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An Empirical Literature-Based Cluster Analysis of Sustainability Practices and Their Performance Impacts in Supply Chains

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Abstract
This study employs cluster analysis to examine how sustainable supply chain (SSC) practices influence performance outcomes addressing the fragmented understanding in prior reviews. Based on 78 peer-reviewed articles published between 2014 and 2021 the analysis investigates how different practices relate to performance dimensions. The two-step cluster analysis yielded two configurations: Cluster 1 linked environmental practices to positive economic outcomes while Cluster 2 linked social practices to positive economic outcomes. Although clustering quality was modest thematic analysis extended these findings by revealing broader but uneven associations. Environmental practices such as eco-design and cleaner production consistently supported both economic and environmental performance while reverse logistics and green procurement produced more variable effects. Social practices produced more fragmented effects: supplier development sometimes enhanced efficiency but labour rights and community initiatives were tied more to legitimacy and reputation than to measurable economic gains. Operational practices also surfaced in Cluster 2 contributing primarily to operational and social outcomes. These results highlight the uneven maturity of SSCM research: environmental practices are more consistently theorized and empirically validated whereas social and operational practices remain less systematic and context-dependent. The study further clarifies how theoretical frameworks map onto these findings with capability-oriented lenses (RBV, NRBV, dynamic capabilities) explaining internal resource advantages and adoption-oriented lenses (Institutional, Stakeholder, Legitimacy) capturing external pressures and legitimacy concerns. By moving beyond descriptive reviews to provide a cluster-based and thematic synthesis this study deepens theoretical understanding and offers actionable insights for scholars, practitioners and policymakers seeking to advance sustainable supply chain management.

Keywords- Sustainable supply chain management (SSCM), Supply chain performance, Triple Bottom Line (TBL), Environmental and social practices, Two-step cluster analysis, Thematic analysis.

1. Introduction

The concepts of sustainability, Triple Bottom Line (TBL) and sustainable supply chain management (SSCM) are highly relevant to this research paper and have been widely discussed in the literature. The concept of sustainability stated in the Brundtland Report (Brundtland, 1987) as "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs" has been widely accepted and quoted in literature. The TBL coined by Elkington (1997) refers to the three dimensions of sustainability: economic, environmental and social. The concept of SSCM developed by Carter & Rogers (2008) and Seuring & Müller (2008) extends supply chain management to encompass the environmental and social dimensions of sustainability. SSCM involves managing material, information and capital flows and promoting cooperation among companies along the supply chain while taking into account economic, environmental and social goals derived from customer and stakeholder requirements. In recent

years the dimensions of sustainability have expanded to include operational, organizational and competitiveness dimensions among others which are explored in this paper.

Sustainability is a critical aspect of supply chains which has been proven to be essential for their continued existence. Achieving economic, social and environmental sustainability targets has become a strategic concern for supply chains. Initially the focus was mainly on the environmental dimension of sustainability with the social dimension gradually gaining attention in the first decade of this century (Carter & Easton, 2011). Although the environmental dimension remains a primary focus the social dimension has increasingly drawn the interest of both academics and practitioners. Organizations need to tackle social sustainability issues not just within their operations but also throughout their wider supply chain networks due to changing business trends and pressures from stakeholders (Meixell & Luoma, 2015; Miemczyk et al., 2012). Although supply chain management studies have begun to investigate sustainability from economic and environmental viewpoints the social aspect is still a relatively unexplored area especially in the Indian context (Mani et al., 2016a, 2016b, 2016c). It is only recently that researchers have shown an interest in examining social sustainability in supply chains (Nakamba et al., 2017).

The primary objective of any commercial organization is to sustain itself economically. However to achieve long-term success organizations must also consider environmental, social and other sustainability dimensions. Researchers have investigated various factors that affect the sustainability performance of supply chains including practices, drivers, capabilities, enablers and more. Overall studies have found that these factors have a positive impact on the performance of sustainable supply chains although there may be some exceptions. By embracing sustainability organizations can enhance their reputation, attract socially conscious customers and foster positive relationships with stakeholders. Additionally sustainable practices can lead to cost savings and improved efficiency which can benefit the organization's bottom line in the long term.

A review by Carter & Washispack (2018) indicates that the literature on SSCM has reached a point of saturation in terms of content, themes and structure. Nonetheless this study demonstrates how a more granular, cluster-based synthesis moves beyond saturation claims by uncovering latent groupings of practices and their performance outcomes and then thematically extending these clusters to clarify overlaps, contradictions and uneven maturity across environmental, social and operational dimensions. In doing so the study positions itself as extending the review-of-reviews tradition by shifting focus from broad theme summaries to empirical structuring of practice–performance clusters, sectoral gaps and methodological biases. By understanding the complex interactions among these factors organizations can develop more effective strategies for improving their sustainability performance.

The emergence of sustainability practices in supply chains has led to a growing body of literature on the factors impacting their performance. While existing studies largely focus on the economic, environmental and social dimensions of sustainability, other possible aspects have also been explored. As such companies need to adopt these practices to remain competitive and achieve their sustainability performance targets. However the current academic literature on reviews of this topic is limited and narrow in scope (Duque-Uribe et al., 2019) and there is a need to provide insights into the various sustainability factors impacting the performance of the supply chains and to identify potential gaps in the current studies. The objective of this paper is to provide a comprehensive view of the sustainability factors impacting the performance of supply chains and to highlight the nature of their impact. Additionally it aims to identify the key methods and theoretical frameworks used in research as well as the dimensions of SSC practices and performances investigated in the literature. Finally this paper attempts to answer the following research questions: (1) What is the trend in the growth of literature on the performance of sustainable supply chains? (2) What are

the key methods deployed in research on the performance of sustainable supply chains? (3) What are the key theoretical frameworks in use in the literature on the performance of sustainable supply chains? (4) What are the factors impacting the performance of sustainable supply chains? (5) What dimensions of SSC practices and performances are investigated in literature? (6) How do SSC practices relate to performance outcomes and what mediating factors have been proposed in prior studies to explain these relationships? (7) What does the frequency of the relationships between SSC practices and sustainable performances convey? (8) What latent clusters of SSC practices and performance outcomes can be identified and how can thematic analysis extend these clusters to reveal broader associations, overlaps and gaps?

To answer these questions the study uses descriptive, frequency-based and cluster analyses followed by thematic interpretation. This combined approach provides insights into how sustainable practices group in relation to performance outcomes and an understanding of their varied and sometimes inconsistent associations. By using a two-step cluster analysis to discover hidden practice-performance patterns which thematic analysis expands to give a more organized understanding of SSCM research than what earlier reviews have achieved. In doing so the study responds to recent calls in the literature (Arda et al., 2023; Carter et al., 2020; Nakamba et al., 2017) for stronger analytical approaches that connect sustainability practices with performance impacts and acknowledge sectoral as well as methodological differences.

The following section explains the research approach. The results section follows with descriptive and frequency-based analyses, the two-step cluster analysis and thematic interpretation of cluster outputs. The discussion section analyses essential research results through five specific sections which examine theoretical contributions and positioning within literature, mediating factors and causal pathways, findings across industry contexts, interpretive comparison of frequency, cluster and thematic results and theoretical frameworks in the literature. The paper ends with a structured summary that presents research findings and contributions, managerial and policy implications, future research directions and limitations to help scholars, practitioners and policymakers enhance SSCM research and implementation.

2. Methodology

To answer the research questions an extensive literature review was conducted to analyse sustainable practices in supply chain management and their reported performance outcomes. Analytical techniques included contingency tables, frequency tables, text tables, line graphs, pie and bar charts, word clouds and heat-map contingency tables. To discover hidden patterns a two-step cluster analysis was applied to the practice–performance relationships. In addition, a thematic interpretation of the cluster outputs was undertaken to examine the internal composition of clusters, identify dominant practice–performance associations and relate them to guiding theoretical frameworks. Together these methods provided both structural and interpretive insights into the literature.

Systematic reviews offer a transparent, replicable process for identifying and synthesizing evidence (Tranfield et al., 2003) minimizing selection bias and delineating knowledge boundaries. Following established guidance (Saunders et al., 2009, as cited in Fahimnia et al., 2015) the review proceeded iteratively from search definition to screening and synthesis.

The overall process adapted the approach of Tranfield et al. (2003) and procedures used in Beske-Janssen et al. (2015) and Nakamba et al. (2017). Study quality was operationalized at the journal level to streamline selection and reduce idiosyncratic paper-level bias. The review period (2014–2021) was chosen to capture the post-2014 surge in SSCM research (see **Figure 2**). Subsequent developments (2022–2025) are noted in future research. The stages were: (1) identification of literature; (2) selection of high-quality studies; (3) relevance screening; (4) data extraction; and (5) synthesis and reporting.

2.1 Identification of Research Literature

A structured search was conducted in Scopus (Title–Abstract–Keywords). Boolean operators and wildcards were used to capture environmental, social and economic aspects of the Triple Bottom Line (TBL):
(*"supply chain"* AND *performance* AND (*green* OR *social* OR *environment** OR *econom** OR *CSR*))
OR
(*"supply chain"* AND (*"TBL"* OR *"Triple Bottom Line"* OR *"Three pillars of sustainability"*))
OR
(*"supply chain"* AND *performance* AND *sustain**).

Searches were limited to peer-reviewed journal articles (2014–2021). Results were exported (RIS) and managed in Zotero for screening. Inclusion/exclusion criteria (**Table 1**) were aligned with prior systematic reviews (Beske-Janssen et al., 2015; Nakamba et al., 2017). Two reviewers independently screened records at abstract and full-text stages; disagreements were resolved through discussion. A PRISMA-style flow diagram summarizes the screening process (**Figure 1**).

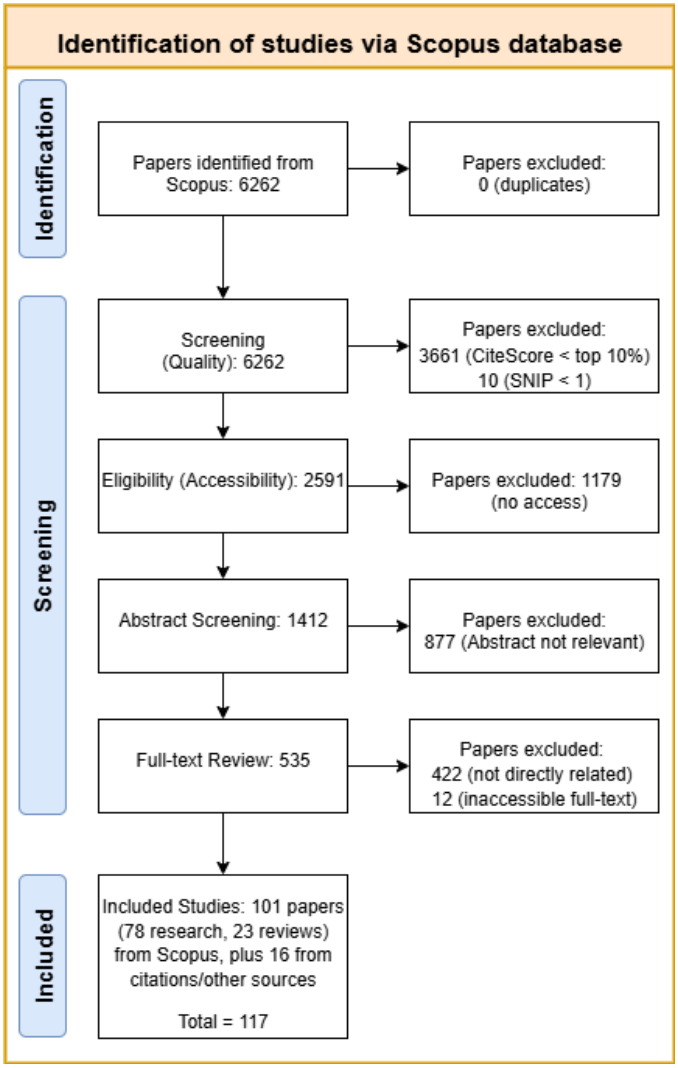

Figure 1. PRISMA-style flow diagram of the screening process.

Table 1. Inclusion and exclusion criteria used in the first stage.

Criteria	Reason for inclusion/exclusion
Inclusion criteria	
Published research articles from 2014 to 2021	The current scholarly works involving the performance of SSC
Articles in the English language	Most academic journals are published in English
Articles addressing sustainability, environmental, social and economic issues in supply chains	To ensure all dimensions of sustainability including the triple bottom line are included
Articles emphasizing the performance of SSC	To limit the focus to the performance of SSC
Scholarly published articles (research articles and review papers)	To build an authentic scientific knowledge base in the SSCM field
Exclusion criteria	
Articles not addressing all the main areas of inquiry, viz., sustainability, supply chain and performance	The purpose is to review the literature on the performance of SSC and a reference must be made to all the main areas of inquiry
Articles addressing the optimization problems and models, comparative studies, performance measurement, supplier selection and development and trade-off studies.	Optimization models and supplier development studies were excluded because their primary focus is algorithmic modelling or supplier evaluation rather than empirical linkages between practices and performance which form the focus of this study.
Conference papers, working papers, technical papers, books, chapters of books and practical handbooks	To ensure quality and consistency in the analysis all articles must be peer-reviewed

2.2 Selection of High-Quality Studies

Eligibility was restricted to peer-reviewed journals (2014–2021) meeting both: (i) top-decile (≥90th percentile) CiteScore ranking in their field and (ii) SNIP ≥ 1. This journal-level filter is consistent with prior reviews and was used as a pragmatic proxy for study quality. It is acknowledged that journal metrics are imperfect and may bias coverage toward certain outlets; this limitation is noted in the Limitations (Section 5.4). Full-text access constraints at the institutional level led to the exclusion of some journals (documented in Section 3.1.2).

From 6,262 initial records the top-decile CiteScore filter reduced the set to 2,601; applying SNIP ≥ 1 yielded 2,591. Full-text access restrictions reduced the pool to 1,412. Details for subsequent relevance screening appear in Section 2.3 and **Table 2**.

2.3 Identification of Studies Relevant to the Research Questions

Abstract screening of 1,412 records excluded 877 leaving 535 for full-text review. Full-text screening excluded 422 that were not directly aligned with SSC practice–performance linkages; 12 additional papers were not accessible at full text leaving 101 included articles (78 empirical studies, 23 reviews). Sixteen further studies were added from reference chaining yielding a working database of 117 papers. Counts at each stage and reasons for exclusion are summarized in **Table 2**; a PRISMA-style diagram is provided in **Figure 1**.

Table 2. Steps in article inclusion/exclusion at stages two and three.

Inclusion / Exclusion criteria	Step	Count	
		Excluded	Balance
Search String	Total fetched based on Scopus search		6262
Quality	Top 10 CiteScore percentile ranking journals considered	3661	2601
	Journals with SNIP<1[*] excluded	10	2591
Accessibility	Journals not accessible	1179	1412
Relevance	Articles excluded based on Abstract study	877	535
Relevance	Articles excluded based on Full content study	422	113
Accessibility	Full content (PDFs) not accessible	12	101
[*]Journals with SNIPs higher than 1 are better than average for their discipline			
	Total papers included in the study	101[#]	
	Additional papers included from outside	16	
[#]Includes 78 research papers and 23 review papers			

2.4 Extraction of Relevant Data from the Studies

A standardized extraction template captured bibliographic details, research design and methods, theoretical frameworks, industry context, sustainability practices, performance outcomes, type of reported relationship (positive, non-significant, negative, unspecified) and mediators. Procedures followed Denyer and Tranfield (2009) (as cited in Nakamba et al., 2017). Extracted data were organized in Microsoft Excel for subsequent descriptive, frequency, clustering and thematic analyses.

2.5 Synthesis of the Extracted Data and Reporting of the Findings

Data from the selected research papers were analysed and synthesized using SPSS, MS Excel and Python. A mixed-method approach—combining qualitative and quantitative techniques—was adopted to explore trends, patterns and relationships in the SSCM literature.

The first step was a descriptive analysis of the distribution of research articles over time and across publication outlets. To probe content themes categorization analysis rooted in content analysis was applied (Chen et al., 2017; Rowley & Slack, 2004; Seuring & Gold, 2012). Descriptive analytics techniques—including contingency tables, frequency tables, line graphs, pie and bar charts, word clouds and heatmap tables—were used to investigate research methods, theoretical frameworks and SSCM practice–performance relationships.

Practices and performance outcomes were coded into standard dimensions (economic, environmental, social and combined "TBL") with additional categories added inductively where required (e.g., competitiveness, organizational outcomes).

To discover hidden structural patterns a two-step cluster analysis was conducted using SPSS. This method works well for large datasets with mixed data types and can automatically determine the optimal number of clusters. Its usage in recent supply chain research (Dong et al., 2023; Erdem & Erkan, 2019; Yildirim, 2023) support its relevance. The procedure used a hierarchical agglomerative clustering approach progressively merging cases to maximize dissimilarity between cluster centres. Three categorical variables were included: (i) SSC practice dimension, (ii) performance dimension and (iii) type of reported relationship. The log-likelihood distance measure based on the multinomial probability mass function was applied assuming variable independence. Schwarz's Bayesian Criterion (BIC) was used to guide cluster selection with the number of clusters automatically determined and capped at 15.

To complement the cluster analysis a thematic interpretation was also carried out. This helped add depth in areas where numerical separation was limited. The process involved examining how each cluster was composed identifying key links between practices and performance and relating these to relevant theoretical perspectives. By combining frequency, cluster and thematic analyses the study captures both structural patterns and interpretive insights into the diverse and sometimes inconsistent findings reported in earlier research.

In total 78 peer-reviewed articles published between 2014 and 2021 were analysed. The following Results section presents the synthesis, combining frequency-based insights with cluster and thematic analysis to provide a data-driven overview of sustainable supply chain research.

3. Results and Findings

This section summarizes the main findings from the systematic study. The analysis proceeds in three stages: (i) descriptive analysis of publication trends and journal distribution (Section 3.1), (ii) content and dimensional analysis covering industry sectors, research methods, theoretical frameworks and sustainability

practices and performance outcomes (Section 3.2) and (iii) cluster analysis to uncover latent practice–performance configurations supported by thematic interpretation (Section 3.3).

Overall sustainable practices emerged as the most frequently studied factor in the literature with environmental and social dimensions receiving the greatest attention. On the performance side environmental and economic outcomes dominated followed by operational and social outcomes. Frequency analysis further showed that most reported relationships were positive, though non-significant, mixed and negative effects were also documented.

The cluster analysis revealed two latent configurations linking practices and performance. These clusters are later thematically extended to clarify dominant environmental, social and operational themes and to highlight overlaps, contradictions and uneven maturity across sustainability dimensions. A detailed presentation of these results follows in the subsections below.

3.1 Descriptive Analysis

This subsection provides an overview of the temporal and journal-wise distribution of SSC performance research published between 2014 and 2021. The results show a steady post-2017 growth in publications alongside concentration in a small set of high-impact journals highlighting both the expanding interest in SSCM and the narrowness of its publication base. Detailed findings are presented in **Figures 2** and **3** and **Table 3** setting the stage for deeper content and dimensional analysis in Section 3.2.

3.1.1 Distribution of Research Articles Over Time

Figure 2 shows the trend in the number of research articles between 2014 and 2021. The first four years (2014–2017) saw modest activity with 3–8 articles per year. Publications then rose sharply in 2018 (16 articles) and stabilized at 12–13 annually during 2019–2021. This pattern indicates sustained scholarly interest in SSC performance and suggests that research in this area has become an established stream.

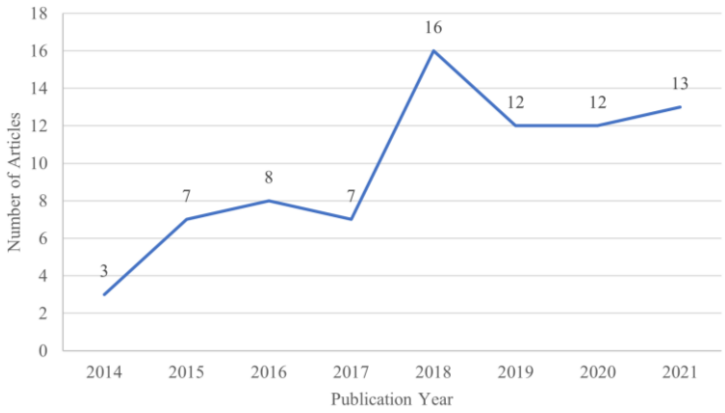

Figure 2. Temporal distribution of research articles on SSC performance (2014-2021).

3.1.2 Publications by Journal

Figure 3 and **Table 3** present the distribution of articles by journal. The *International Journal of Production Economics* is the leading outlet contributing 25 of the 78 articles. *Supply Chain Management* and *Production Planning and Control* follow with 11 each. Together the top three journals account for more than 60% of the dataset reflecting the concentration of SSCM research in a few high-impact outlets. Citation-based indicators (CiteScore, SJR, SNIP) are also reported in **Table 3** for reference.

It is worth noting that some influential journals (e.g., *Journal of Cleaner Production*, *Resources, Conservation and Recycling*) could not be included due to access restrictions, a limitation acknowledged later in Section 5.4.

Together these descriptive patterns provide context for the deeper content and dimensional analysis that follows which examines industry coverage, research methods, theoretical frameworks, practices and performance outcomes (Section 3.2).

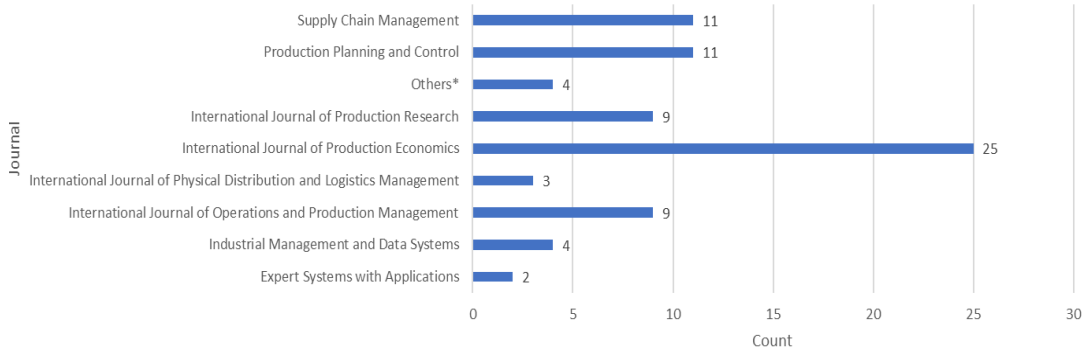

Figure 3. Frequency of articles by journal.

Table 3. Distribution of journals with rankings.

S. No.	Journal	Scopus percentile 2018	CiteScore 2018	SJR 2018	SNIP 2018	Frequency	Percent
1.	International Journal of Production Economics	98	7.13	2.475	2.486	25	32.1%
2.	Production Planning and Control	90	4.38	1.427	1.514	11	14.1%
3.	Supply Chain Management	94	5.91	2.103	2.018	11	14.1%
4.	International Journal of Operations and Production Management	95	6.05	2.095	2.275	9	11.5%
5.	International Journal of Production Research	90	4.34	1.585	1.720	9	11.5%
6.	Industrial Management and Data Systems	99	4.95	1.137	1.706	4	5.1%
7.	Others*	N.A.	N.A.	N.A.	N.A.	4	5.1%
8.	International Journal of Physical Distribution and Logistics Management	96	6.60	2.407	2.109	3	3.8%
9.	Expert Systems with Applications	98	6.36	1.190	2.696	2	2.6%

** Technological and Economic Development of Economy, Ecological Indicators, Corporate Governance (Bingley), Business Process Management Journal*
N.A. - Not Applicable

3.2 Content and Dimensional Analysis

This subsection examines SSCM research across substantive dimensions: industry coverage, research methods, theoretical frameworks, sustainable practices and performance outcomes. The results reveal concentration in manufacturing-focused studies, heavy reliance on SEM-based methods, dominance of environmental practices and uneven attention to performance dimensions. Detailed findings appear in **Tables 4** to **7** and **Figures 4** to **8** with interpretive implications discussed in Section 3.2.7 and extended through cluster and thematic analysis (Section 3.3) and the Discussion.

3.2.1 Distribution of Articles by Industry Sector

Table 4 summarizes industry coverage. Manufacturing and multi-industry studies account for just over 60% of the sample while sector-specific work in automotive, apparel, food, construction, logistics and

electronics remains comparatively limited. This concentration suggests opportunities for deeper sectoral investigations tailored to distinct sustainability challenges and supply-chain structures.

Table 4. Industry distribution of reviewed articles.

Industry	Count
Manufacturing	37
Multi-industry	11
Others*	8
Automobile	7
Food	4
Electrical & electronic equipment	3
Manufacturing & service industries	2
Construction	2
Apparel manufacturing	2
3PLs	2
** Aerospace, Cement, Mining, Wood Furniture, Supplying firms, SMEs, Non-financial, Haulier*	

3.2.2 Distribution of Methods Employed in Articles

Table 5 (cross-tab heatmap) shows that SEM family methods—SEM, PLS-SEM, CFA/EFA—dominate the evidence base. This pattern aligns with variance-based modelling preferences in SSCM and provides context for later observations about methodological concentration (see Section 5.4).

Table 5. Distribution of research methods in analysed studies (cross-tabulation heatmap).

Method	Publication year								Total	
	2014	2015	2016	2017	2018	2019	2020	2021		
Structural Equation Modelling (SEM)	3	1	3	3	6	6	5	5	**32**	**24.6%**
Structural Equation Modelling using Partial Least Squares (PLS-SEM)	0	2	3	0	7	3	2	4	**21**	**16.2%**
Confirmatory Factor Analysis (CFA)	3	4	2	0	2	0	5	5	**21**	**16.2%**
Exploratory Factor Analysis	2	3	2	0	1	1	1	4	**14**	**10.8%**
Regression Analysis	0	0	0	0	0	1	2	0	**3**	**2.3%**
Hierarchical Regression Analyses	0	1	1	0	1	0	0	0	**3**	**2.3%**
Cluster Analysis	0	1	0	0	1	0	1	0	**3**	**2.3%**
Structural Equation Modelling (Covariance-based)	0	0	0	0	1	0	1	0	**2**	**1.5%**
Principal Component Analysis	0	1	0	0	0	0	0	1	**2**	**1.5%**
Ordinary Least Square Regression Analysis	0	0	0	0	1	0	0	1	**2**	**1.5%**
Linear Regression Analysis	0	0	0	0	0	0	0	2	**2**	**1.5%**
Factor Analysis	1	0	1	0	0	0	0	0	**2**	**1.5%**
Thematic Analysis	0	0	0	1	0	0	0	0	**1**	**0.8%**
Sensitivity Analysis	0	0	0	1	0	0	0	0	**1**	**0.8%**
Ordinary Least Squares Moderated Hierarchical Regression	0	0	0	0	0	1	0	0	**1**	**0.8%**
One-way ANOVA	0	0	0	0	1	0	0	0	**1**	**0.8%**
Multivariate Linear Regression Model	0	0	0	0	0	0	1	0	**1**	**0.8%**
Multivariate Analysis of Variance (MANOVA)	0	0	0	0	0	0	1	0	**1**	**0.8%**
Multiple Regression Analysis	0	0	0	0	0	1	0	0	**1**	**0.8%**
MICMAC	0	0	0	0	0	0	0	1	**1**	**0.8%**
Meta-analysis Process	0	0	0	1	0	0	0	0	**1**	**0.8%**
Intuitionistic Fuzzy DEMATEL	0	1	0	0	0	0	0	0	**1**	**0.8%**
Grey-DEMATEL	0	0	0	0	1	0	0	0	**1**	**0.8%**
Fuzzy Set Theory	0	1	0	0	0	0	0	0	**1**	**0.8%**
Fuzzy Set Qualitative Comparative Analysis	0	0	0	0	0	0	0	1	**1**	**0.8%**
Fuzzy DEMATEL	0	0	1	0	0	0	0	0	**1**	**0.8%**
Fuzzy AHP	0	0	0	0	0	1	0	0	**1**	**0.8%**
DEMATEL	0	1	0	0	0	0	0	0	**1**	**0.8%**
Data Envelopment Analysis (DEA)	0	0	0	0	0	0	1	0	**1**	**0.8%**

Table 5 Continued…

Correlation Analysis	0	0	1	0	0	0	0	0	**1**	**0.8%**
Artificial Neural Network Analysis (ANN)	0	0	0	0	1	0	0	0	**1**	**0.8%**
Analytic Network Process (ANP)	0	0	1	0	0	0	0	0	**1**	**0.8%**
Analytic Hierarchy Process (AHP)	0	0	0	0	1	0	0	0	**1**	**0.8%**
Analysis of Variance (ANOVA)	0	0	0	0	0	0	0	1	**1**	**0.8%**
Analysis of Covariance (ANCOVA)	0	1	0	0	0	0	0	0	**1**	**0.8%**
Total	**9**	**17**	**15**	**6**	**24**	**14**	**20**	**25**	**130**	**100.0%**
High									**Low**	
			Frequency							

3.2.3 Distribution of Theoretical Frameworks Used in Articles

A wide range of frameworks is employed (**Table 6**). The Resource-Based View (RBV) is most prevalent with the Natural Resource-Based View (NRBV), Institutional Theory and Stakeholder Theory also widely used.

Table 6. Guiding theoretical lenses used in SSCM studies (heatmap by year).

Theoretical lens	**Publication year**								
	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Total**
Resource-based View Theory	0	1	3	0	2	3	0	1	**10**
Natural Resource-based View	0	0	0	0	1	2	1	4	**8**
Institutional Theory	0	2	1	1	2	1	1	0	**8**
Stakeholder Theory	0	0	1	0	1	3	1	1	**7**
Transaction Cost Economics Theory	0	1	0	0	2	0	1	1	**5**
Dynamic Capability Theory	0	0	0	0	0	0	1	3	**4**
Agency Theory	0	0	0	1	1	1	0	1	**4**
Systems Theory	0	0	0	0	0	2	0	1	**3**
Relational View	1	0	1	0	0	0	0	1	**3**
Stakeholder's Resource-based View	0	0	0	0	0	0	1	1	**2**
Social Network Theory	0	0	0	0	0	1	1	0	**2**
Self-Determination Theory	0	0	0	1	1	0	0	0	**2**
Complementarity Theory	0	0	0	0	1	1	0	0	**2**
Triple Bottom Line Theory	0	0	0	0	0	0	0	1	**1**
Strategic Choice Theory	0	0	1	0	0	0	0	0	**1**
Stewardship Theory	0	0	0	1	0	0	0	0	**1**
Social Capital Theory	0	1	0	0	0	0	0	0	**1**
Resource Dependence Theory	0	1	0	0	0	0	0	0	**1**
Practice-based View	0	0	0	0	0	0	0	1	**1**
Legitimacy Theory	0	0	0	0	1	0	0	0	**1**
Knowledge-based View	1	0	0	0	0	0	0	0	**1**
Intuitionistic Fuzzy Set Theory	0	1	0	0	0	0	0	0	**1**
Critical Success Factor Theory	0	0	0	0	1	0	0	0	**1**
Total	**2**	**7**	**7**	**4**	**13**	**14**	**7**	**16**	**70**
High									**Low**
			Frequency						

Adoption of explicit theoretical lenses increases over the review period. Beyond prevalence later sections clarify how these lenses are applied to different parts of the SSCM causal chain (see Section 4.1) which helps explain observed differences in reported outcomes.

3.2.4 Factors Impacting the Performance of Sustainable Supply Chains

The literature identifies several factor types—practices, drivers, capabilities, enablers and barriers. Given this review's focus subsequent analyses concentrate on sustainable practices (and any reported mediators)

and their associations with performance outcomes. Other factor types are noted as avenues for future integrative reviews (see Section 5.3).

3.2.5 Components of Sustainable SCM Practices

Across the 78 articles approximately 200 practices are referenced. Frequently occurring practices include GSCM practices, lean practices, environmental management practices, supplier selection and supplier development. **Figure 4** (word cloud) provides a visual orientation to the most commonly mentioned practices while Appendix 1 lists all practices and their sources in detail.

Figure 4. Word cloud of sustainable practices.

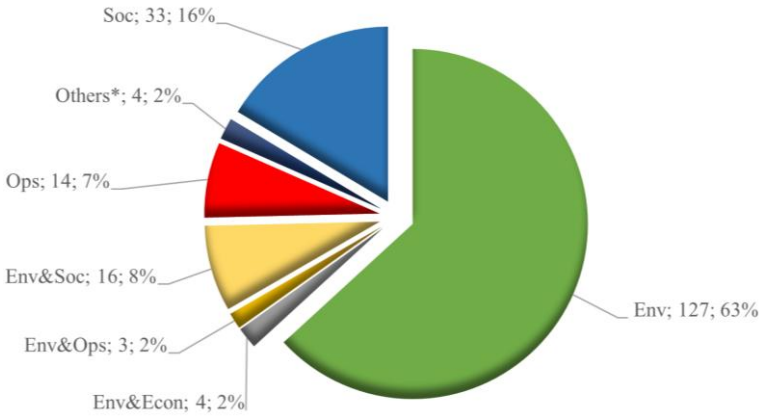

Figure 5. Dimensions of SSCM practices studied.

For consistency with the methodological framework (see Section 2.5) practices were grouped into economic, environmental, social and TBL dimensions with additional categories added inductively as required. Practice dimensions are dominated by environmental followed by social and combined environmental–social categories (**Figure 5**). Together these account for the majority of classifications indicating the sustained emphasis on environmental practices in SSCM and the growing though less mature attention to social practices.

3.2.6 Distribution of SSC Performance Dimensions

Across the 78 articles approximately 60 performance outcomes are examined. Frequently occurring outcomes include environmental performance, economic performance, social performance and financial performance. **Figure 6** (word cloud) provides a visual orientation to the most commonly mentioned performance outcomes.

Figure 6. Word cloud of performance outcomes.

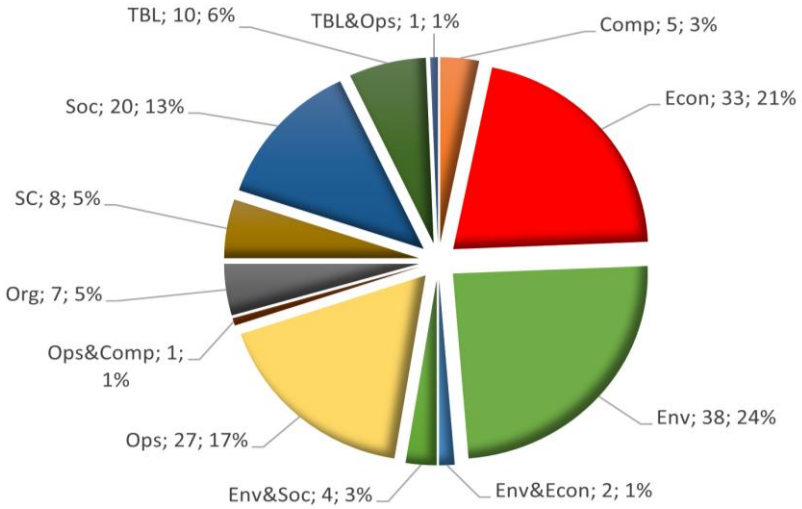

Figure 7. Dimensions of SSC performance.

For consistency with the methodological framework (see Section 2.5) performance outcomes were classified deductively into economic, environmental, social and TBL dimensions with inductive additions (e.g., operational, supply-chain level, organizational, competitiveness). The most frequently examined performance dimensions are environmental, economic, operational and social (**Figure 7**). This distribution reflects longstanding attention to environmental and economic measures alongside growing interest in operational and social dimensions.

3.2.7 Frequency-Based Analysis of Practices and Performance Outcomes

This subsection provides a comprehensive overview of sustainable supply chain practices and their reported performance impacts. **Table 7** synthesizes these relationships through a cross-tabulated heatmap highlighting the frequency and direction of associations across practice and performance dimensions.

Environmental practices dominate the evidence base (315 out of 508 relationships) followed by social (76), operational (54) and environmental–social combinations (47). Economic performance is the most frequently studied outcome (157) followed by environmental (118), operational (64), social (54) and TBL performance (32). The strongest associations are between environmental practices and both economic (102) and environmental outcomes (97) with further links to operational (33) and social outcomes. Social and operational practices though less frequently examined show notable connections to economic, social and operational outcomes.

Overall, most relationships are positive (266 out of 508) though a substantial number are non-significant (127) and a small minority negative (13). Mixed results are particularly evident for environmental practices affecting economic, operational and competitiveness outcomes as well as for social practices influencing economic and supply chain performance. These inconsistencies point to contextual dependencies and measurement challenges.

To move beyond descriptive tabulation the relationships reported in **Table 7** were synthesized into a conceptual map (**Figure 8**). This map illustrates where linkages between practices and performance are strong, moderate, weak or underexplored. Environmental practices show consistent positive links with environmental, economic and operational performance showing their empirical maturity. Operational practices show modest economic and operational links. In contrast social practices yield weaker and more variable outcomes reflecting challenges in measurement and context dependence. The map also highlights research gaps in cross-dimensional practices (environmental + social) and in underexplored performance outcomes such as competitiveness and organizational-level performance. Collectively these patterns suggest that each practice dimension exerts multi-dimensional performance effects reinforcing the interconnected nature of economic, social and environmental sustainability in supply chains.

While this dimensional mapping clarifies where research efforts have been concentrated it does not explain how practices and outcomes systematically group together. To address this Section 3.3 applies two-step cluster analysis complemented with thematic analysis to uncover latent configurations of SSCM practices and performance outcomes.

Table 7. Frequency heatmap of relationships between sustainable practices and performance outcomes.

Practice dimension	Relationship	Performance dimension												
		Econ	Env	Ops	Soc	TBL	SC	Comp	Org	Env&Soc	Env&Econ	TBL&Ops	Ops&Comp	All Dims
Env	+	37	56	27	7	9	5	6	11	1	5	1	1	**166**
	o	30	25	3	7	3	1	4	1	0	0	0	0	**74**
	(+)	23	10	1	2	0	0	2	0	0	0	0	0	**38**
	u	9	6	1	4	6	0	0	2	0	2	0	0	**30**
	-	3	0	1	0	1	0	1	1	0	0	0	0	**7**
	Total	**102**	**97**	**33**	**20**	**19**	**6**	**13**	**15**	**1**	**7**	**1**	**1**	**315**
Soc	+	5	4	6	17	1	3	1	0	0	0	0	0	**37**
	o	7	0	3	2	1	0	3	1	0	0	0	0	**17**

Table 7 continued…

	(+)	8	0	0	1	0	1	0	1	0	0	0	0	**11**
	u	0	0	0	0	0	6	0	0	0	0	0	0	**6**
	-	1	0	0	0	0	1	1	0	0	0	0	0	**3**
	(-)	2	0	0	0	0	0	0	0	0	0	0	0	**2**
	Total	**23**	**4**	**9**	**20**	**2**	**11**	**5**	**2**	**G**	**G**	**G**	**G**	**76**
Ops	+	7	7	11	3	2	4	1	0	0	0	0	0	**35**
	o	0	2	8	2	0	2	3	0	0	0	0	0	**17**
	(+)	0	0	1	0	0	0	0	0	0	0	0	0	**1**
	-	0	0	0	0	0	0	0	0	1	0	0	0	**1**
	Total	**7**	**9**	**20**	**5**	**2**	**6**	**4**	**G**	**1**	**G**	**G**	**G**	**54**
Env&Soc	+	6	2	2	2	5	0	0	0	3	0	0	0	**20**
	o	7	1	0	5	0	0	0	1	0	0	0	0	**14**
	(+)	7	0	0	1	0	0	0	1	2	0	0	0	**11**
	-	0	0	0	0	0	0	0	0	1	0	0	0	**1**
	(-)	0	0	0	0	0	0	0	0	1	0	0	0	**1**
	Total	**20**	**3**	**2**	**8**	**5**	**G**	**G**	**2**	**7**	**G**	**G**	**G**	**47**
Env&Econ	+	0	0	0	0	2	0	0	0	0	0	0	0	**2**
	o	2	1	0	0	0	0	0	0	0	0	0	0	**3**
	-	0	1	0	0	0	0	0	0	0	0	0	0	**1**
	Total	**2**	**2**	**G**	**G**	**2**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**6**
Env&Ops	+	1	1	0	0	0	1	0	0	0	0	0	0	**3**
	o	1	1	0	0	0	0	0	0	0	0	0	0	**2**
	Total	**2**	**2**	**G**	**G**	**G**	**1**	**G**	**G**	**G**	**G**	**G**	**G**	**5**
Ops&Econ	(+)	1	1	0	0	0	0	0	0	0	0	0	0	**2**
	Total	**1**	**1**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**2**
TBL&Ops	+	0	0	0	0	1	0	0	0	0	0	0	0	**1**
	Total	**G**	**G**	**G**	**G**	**1**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**1**
TBL	+	0	0	0	0	1	0	0	0	0	0	0	0	**1**
	Total	**G**	**G**	**G**	**G**	**1**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**1**
Org	+	0	0	0	1	0	0	0	0	0	0	0	0	**1**
	Total	**G**	**G**	**G**	**1**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**1**
All Dims	**+**	**56**	**70**	**46**	**30**	**21**	**13**	**8**	**11**	**4**	**5**	**1**	**1**	**266**
	o	**47**	**30**	**14**	**16**	**4**	**3**	**10**	**3**	**0**	**0**	**0**	**0**	**127**
	(+)	**39**	**11**	**2**	**4**	**0**	**1**	**2**	**2**	**2**	**0**	**0**	**0**	**63**
	u	**9**	**6**	**1**	**4**	**6**	**6**	**0**	**2**	**0**	**2**	**0**	**0**	**36**
	-	**4**	**1**	**1**	**0**	**1**	**1**	**2**	**1**	**2**	**0**	**0**	**0**	**13**
	(-)	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**3**
	Total	**157**	**118**	**64**	**54**	**32**	**24**	**22**	**19**	**9**	**7**	**1**	**1**	**508**

Impact Notations: + Positive, (+) Positive but significance unspecified, - Negative, (-) Negative but significance unspecified, o - No Significant Impact, u - Unspecified

Econ=Economic, Env=Environmental, Soc=Social, Ops=Operational, Org=Organizational, TBL=Triple Bottom Line, Comp=Competitiveness, SC=Supply Chain, G=Potential Gap

High													**Low**
					Frequency								

Note: Entries where either the practice or performance dimension was unspecified were excluded from the analysis. "G" indicates unexplored or missing relationships.

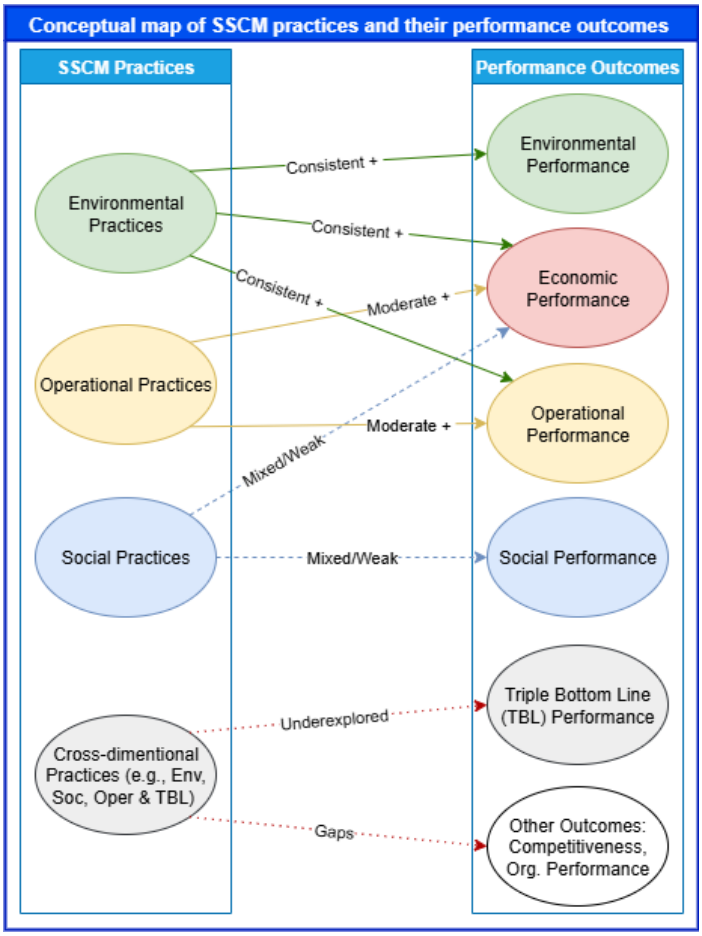

Figure 8. Conceptual map of SSC practices and performance outcomes (frequency-based analysis).

Note: Arrows indicate strength and consistency of reported linkages; dotted arrows highlight underexplored areas and gaps.

3.3 Two-Step Cluster Analysis: Unveiling the Impact of Sustainable Practices on Supply Chain Performance

Building on the frequency-based insights from Section 3.2.7 this section applies two-step cluster analysis to uncover latent groupings of sustainable practices and their associated performance outcomes. Whereas frequency analysis highlighted dimensional linkages, clustering provides a structural synthesis that reveals how practices align into distinct thematic configurations. Thematic interpretation (Section 3.3.3) further clarifies the internal composition of these clusters linking them to broader theoretical perspectives.

3.3.1 Methodology and Variable Selection

The analysis employed two-step cluster analysis in SPSS using log-likelihood distance and Schwarz's Bayesian Criterion (BIC). Three categorical variables were included: (i) practice dimension (environmental, social, operational and combinations), (ii) performance dimension (economic, environmental, social, operational, competitiveness, etc.) and (iii) reported relationship (positive, negative, non-significant, unspecified).

3.3.2 Cluster Identification and Characteristics

The two-step cluster analysis yielded two clusters. Cluster 1 accounted for 326 cases (64%) while Cluster 2 comprised 182 cases (36%). The silhouette coefficient was 0.2 indicating weak separation and considerable overlap.

Based on the three input variables—practice dimension, performance dimension and relationship—the SPSS output characterized Cluster 1 as associations between environmental practices and positive economic outcomes and Cluster 2 as associations between social practices and positive economic outcomes. These direct results highlight the prominence of economic performance as the most frequently reported outcome across the reviewed studies.

However, the modest silhouette suggests that environmental and social practice–performance associations overlap considerably reflecting the multi-dimensional nature of SSCM research. While the statistical quality of separation is limited even weak clustering helps reveal underlying structural tendencies in how practices relate to outcomes. **Figures 9** and **10** summarize the model fit and cluster sizes while **Tables 8** to **10** provide the frequency distributions across practice and performance dimensions for the two clusters.

3.3.3 Interpretative and Thematic Analysis of the Clusters

Because the raw cluster outputs were narrow (environmental practices with positive economic outcomes; social practices with positive economic outcomes) and the silhouette coefficient indicated only modest separation it was necessary to move beyond numerical categorization. A thematic analysis was therefore undertaken to examine the practice–performance associations within each cluster, identify dominant themes, link them to theoretical perspectives and generate actionable insights.

Cluster 1 is dominated by environmental associations. Practices such as eco-design, cleaner production, reverse logistics and green procurement are predominantly linked to economic and environmental outcomes with operational spillovers also present. Eco-design shows consistently positive effects (with some no-impact findings) while cleaner production albeit on a smaller evidence base is likewise largely positive. Green procurement is mostly positive but accompanied by non-significant and unspecified results and occasional negatives. By contrast reverse logistics exhibits mixed evidence with substantial no-impact findings and a few negatives alongside positives. Overall, this cluster reflects the empirical maturity of environmental practices which are more consistently theorized and validated as drivers of business value than other sustainability dimensions.

In contrast Cluster 2 brings together social and operational associations. On the social side links most often point to economic and social outcomes with additional ties to supply-chain performance. Within supplier-related social practices positive associations (including cases with unspecified significance) are common alongside a meaningful share of no-impact results and occasional negatives. Themes such as labour & human rights and community/philanthropy likewise show mixed evidence—predominantly positive but with instances of no impact and in the case of community/philanthropy some negatives. On the operational side associations are strongest with operational and environmental outcomes while direct economic effects are limited. In particular supplier integration & development shows clear benefits for operational (and some social and environmental) outcomes but no direct economic linkages within this cluster. Overall Cluster 2 underscores the relative immaturity of social sustainability research with outcomes that remain uneven and context-specific.

These thematic patterns are synthesized visually in **Figure 11** while **Tables 8** to **10** provide supporting details on the frequency distributions across practice and performance dimensions.

These contrasting cluster profiles not only highlight uneven maturity across sustainability dimensions but also provide a foundation for drawing practical and strategic insights which are developed in the following subsection.

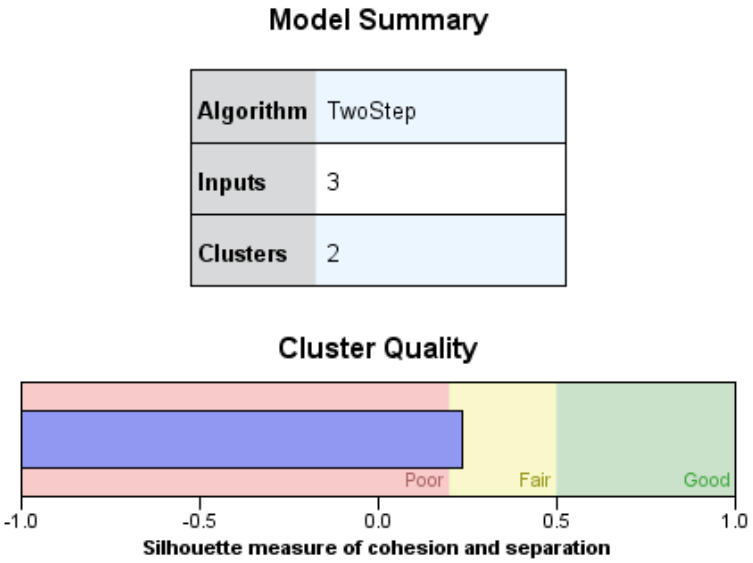

Figure 9. Two-step cluster analysis – model summary.

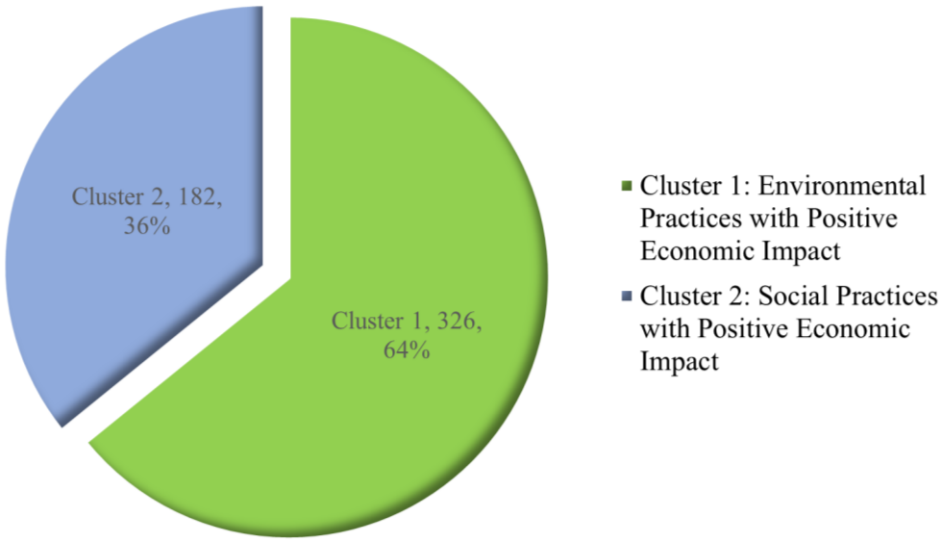

Figure 10. Two-step cluster analysis – cluster sizes.

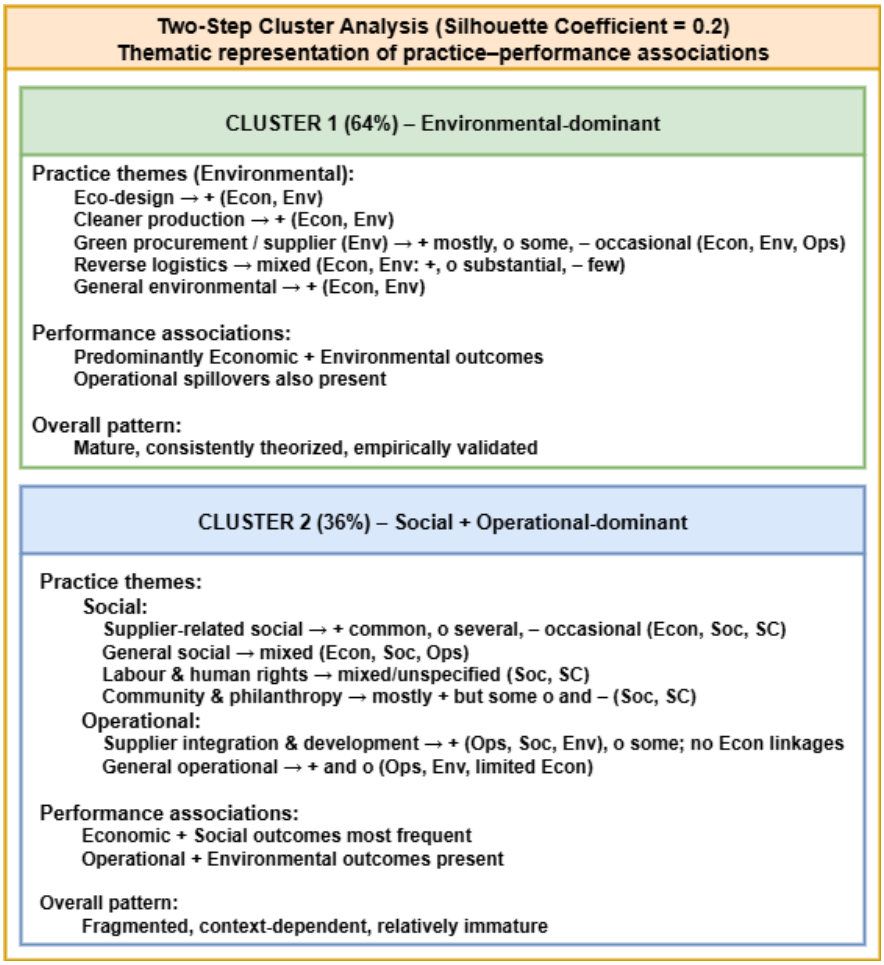

Figure 11. Thematic analysis of practice–performance associations within clusters.

Note: Cluster 1 (Environmental-dominant) links environmental practices such as eco-design, cleaner production, reverse logistics, and green procurement to predominantly economic and environmental outcomes, with operational spillovers also present. Cluster 2 (Social/Operational-dominant) links social and operational practices—including supplier-related initiatives, labour and human rights, community engagement, and supplier integration—to economic, social, and operational outcomes, with fragmented and context-dependent effects. Relationship patterns are denoted as: + positive, o no significant impact, – negative. Dimension abbreviations used: Econ=Economic, Env=Environmental, Soc=Social, Ops=Operational, SC=Supply Chain.

Table 8. Cluster-wise frequency of practice dimensions.

		Practice dimension										
		Env	**Soc**	**Ops**	**Env&Soc**	**Env&Econ**	**Env&Ops**	**Ops&Econ**	**TBL&Ops**	**TBL**	**Org**	**Total**
Cluster	1	315		2	5	2			1	1		**326**
	2		76	52	42	4	5	2			1	**182**
	All	**315**	**76**	**54**	**47**	**6**	**5**	**2**	**1**	**1**	**1**	**508**
Econ=Economic, Env=Environmental, Soc=Social, Ops=Operational, Org=Organizational, TBL=Triple Bottom Line												

Table 9. Cluster-wise frequency of performance dimensions.

		Performance dimension												
		Econ	**Env**	**Ops**	**Soc**	**TBL**	**SC**	**Comp**	**Org**	**Env&Soc**	**Env&Econ**	**TBL&Ops**	**Ops&Comp**	**Total**
Cluster	1	102	97	33	20	30	6	13	15	1	7	1	1	**326**
	2	55	21	31	34	2	18	9	4	8				**182**
	All	**157**	**118**	**64**	**54**	**32**	**24**	**22**	**19**	**9**	**7**	**1**	**1**	**508**
Econ=Economic, Env=Environmental, Soc=Social, Ops=Operational, Org=Organizational, TBL=Triple Bottom Line, Comp=Competitiveness, SC=Supply Chain														

Table 10. Cluster-wise frequency of reported relationships.

		Relationship						
		+	o	(+)	u	-	(-)	**Total**
Cluster	1	177	74	38	30	7		**326**
	2	89	53	25	6	6	3	**182**
	All	**266**	**127**	**63**	**36**	**13**	**3**	**508**
Impact Notations: + Positive, (+) Positive but significance unspecified, - Negative, (-) Negative but significance unspecified, o - No Significant Impact, u - Unspecified								

3.3.4 Interim Insights from Cluster Analysis

The clustering results highlight the strategic significance of specific thematic patterns. Within Cluster 1 eco-design and cleaner production emerge as consistently beneficial offering managers relatively reliable pathways to both economic and environmental performance. Green procurement also contributes positively but with some non-significant and occasional negative outcomes suggesting that its effectiveness depends on how criteria are implemented across supply chains. Reverse logistics while present in many studies shows a more mixed profile with positives balanced by substantial no-impact findings and a few negatives—indicating that performance benefits may be highly sensitive to context.

Cluster 2 shows that social and operational practices have developed unevenly. Their outcomes are often fragmented and shaped by the sectoral context. Supplier-focused social initiatives as well as labour and human rights practices show mixed results with some positive, others insignificant or even negative. Community and philanthropic actions also vary in their impact raising doubts about how well they are built into core supply chain strategies. On the operational side supplier integration and development practices generally improve operational, social and environmental performance. However, they do not show a clear link to economic gains suggesting that their benefits lie in long-term capability building rather than short-term financial results.

Taken together these thematic insights show that while environmental practices offer clearer, performance-enhancing capabilities, social and operational practices remain less systematically integrated and produce more variable results. These contrasts provide a foundation for the broader interpretation of overlaps, contradictions and sectoral differences together with their theoretical implications which are elaborated in the Discussion section.

Finally, Cluster 1 accounted for a larger share of cases (64%) compared to Cluster 2 (36%). This imbalance mirrors the empirical dominance of environmental practices in the SSCM literature which are more frequently examined and more consistently linked to positive economic outcomes. By contrast social and operational practices although important have been studied less often and with more variable results

resulting in a smaller and more heterogeneous Cluster 2. The unequal cluster sizes therefore reflect not a methodological artefact but the uneven maturity of research streams across sustainability dimensions.

4. Discussion

Building on the results in Section 3 this section interprets the findings to draw broader insights into sustainable supply chain management (SSCM). Subsections 4.1–4.5 examine theoretical contributions, mediating mechanisms, sectoral patterns, interpretive comparisons and the role of guiding frameworks.

The analysis shows that sustainability practices significantly influence supply chain performance but with uneven maturity across dimensions. Environmental practices dominate both research attention and positive outcomes while social practices have gained visibility but remain fragmented and context-dependent. Environmental and economic performance continues to be the most frequently studied outcomes as in prior reviews (e.g., Bai et al., 2015; Beske-Janssen et al., 2015), though other dimensions—particularly TBL, competitiveness and supply chain-level—are receiving gradual attention. Compared to earlier reviews (e.g., Carter et al., 2020; Fahimnia et al., 2015; Nakamba et al., 2017) this study highlights a stronger recent emphasis on environmental and social practices alongside persistent neglect of certain sectors and outcome dimensions.

Publication and sectoral patterns. Publication activity in SSCM performance studies increased markedly after 2014 with most contributions concentrated in a small number of management and engineering journals. Research is dominated by manufacturing and multi-industry contexts with more limited coverage of sectors such as automotive, apparel, construction and logistics. This uneven distribution suggests clear opportunities for future sector-specific exploration.

Methodological patterns. SEM and PLS-SEM remain the dominant analytical techniques accounting for more than 40% of the reviewed studies. While effective for modelling linear, variance-based relationships, their predominance may underrepresent configurational, longitudinal or dynamic perspectives—potentially explaining why mixed or non-significant results are less frequently captured. Greater methodological diversity including fuzzy-set QCA, system dynamics and longitudinal designs would enrich the evidence base.

The conceptual map (**Figure 8**) synthesizes frequency-based patterns showing the relative maturity of environmental practices and the more fragmented outcomes of social practices. The two-step cluster analysis adds a structural perspective by grouping practice–performance associations into two dominant configurations: one environmental-dominant and the other social-dominant (**Figures 9** and **10**). Building on these results thematic analysis (**Figure 11**) reveals the internal composition of each cluster. Cluster 1 is anchored in eco-design, cleaner production, reverse logistics and green procurement which are predominantly linked to economic and environmental outcomes. Cluster 2 is defined by supplier-related social initiatives, labour and human rights, community engagement and supplier integration which are linked to economic, social, environmental and operational outcomes though with more variable and sometimes contradictory effects including several non-significant and occasional negative findings as well as supply chain-level impacts.

In sum these results show both empirical maturity (environmental practices as well-theorized drivers of business value) and uneven development (social and operational practices as fragmented, context-dependent themes). They also expose overlaps, contradictions and gaps. The following subsections (4.1–4.5) develop these insights further in relation to theory, causal pathways, sectoral contexts, comparative interpretations and guiding frameworks.

4.1 Theoretical Contributions and Positioning within Literature

The extant literature has employed a variety of theoretical frameworks to investigate SSC performance with the RBV being the most widely used followed by the NRBV, Institutional Theory, Stakeholder Theory and Transaction Cost Economics. Together these five account for more than half of the theoretical lenses applied in SSCM studies (**Table 6**). The growing reliance on explicit frameworks over time reflects an increasing emphasis on conceptual grounding within the field. Whereas Section 4.5 reviews theories in general this subsection links them directly to the study's findings showing how specific practice–performance patterns align with and extend existing theoretical perspectives.

This study advances theory-building by applying two-step cluster analysis to uncover latent practice–performance configurations an approach not used in earlier reviews (e.g., Carter & Washispack, 2018; Chen et al., 2017). By linking clusters and themes to theoretical lenses the analysis provides a structural complement to narrative and bibliometric syntheses.

The findings reinforce and extend established frameworks. Cluster 1 (environmental practices linked to economic outcomes) supports RBV and NRBV arguments that sustainability initiatives can evolve into performance-enhancing capabilities. Cluster 2 (social practices linked to economic outcomes) aligns with Institutional and Stakeholder perspectives where regulatory pressures, customer expectations and legitimacy concerns drive adoption particularly in emerging economy contexts (Mani et al., 2016c; Nakamba et al., 2017). Thematic analysis further showed how operational practices (e.g., supplier integration) intersect with relational and governance lenses, emphasizing monitoring, coordination and collaboration.

Importantly the evidence shows that theoretical lenses have been applied to different stages of the SSCM causal chain rather than as interchangeable explanations. Capability-oriented lenses (e.g., RBV, NRBV, dynamic capabilities) are typically applied to environmental themes such as eco-design, cleaner production, reverse logistics and green procurement (Cluster 1) explaining how firm-internal resources translate into economic and environmental performance. Adoption-oriented lenses (e.g., Institutional, Stakeholder, Legitimacy) are more often linked to social themes such as supplier-related initiatives, labour and human rights and community engagement (Cluster 2) where external regulation, customer/OEM expectations and legitimacy concerns drive adoption. Governance lenses (e.g., Transaction Cost Economics, Agency) operationalize supplier auditing, compliance and monitoring while relational lenses (e.g., Social Capital, Resource Dependence) highlight collaboration and information sharing particularly in operational practices such as supplier integration and development. In several studies multiple frameworks are combined (e.g., Institutional + RBV) to connect external pressures with capability development and ultimately performance. In sum theories are applied to different links of the SSCM causal chain—adoption drivers, capability building, governance mechanisms and relational pathways—rather than offering identical explanations of the same phenomenon.

Relative to recent reviews this study confirms the dominance of environmental themes (Arda et al., 2023; Han & Huo, 2020) while also documenting the rising role of social practices in performance improvement—an emerging trend that earlier reviews (Chen et al., 2017; Gopal & Thakkar, 2016) left underexplored. By grouping consistent impacts through clustering, the analysis also addresses prior concerns about fragmented outcome reporting.

By bridging empirical insights with theory this study demonstrates that sustainability practices are not isolated initiatives but operate as interdependent constructs within broader supply chain systems. The clustering approach to identifying systemic groupings further encourages exploration of integrated, multi-

theoretic models in future SSCM research. This forward-looking integration sets the stage for Section 4.5 which provides a broader comparative review of theoretical frameworks and their limitations complementing the practice-linked analysis developed here.

4.2 Mediating Factors and Causal Pathways

Beyond identifying direct relationships between sustainability practices and performance outcomes this study reviewed evidence for mediation effects reported across the literature. Of the 78 primary studies analysed 49 tested mediation models with 36 reporting significant effects (9 full, 11 partial and 16 unspecified) while 13 found no mediation.

For example, Kitsis & Chen (2023) tested four mediation paths involving green operations as an intermediary between environmental proactivity and collaboration on one hand and environmental and economic performance on the other. All four paths demonstrated full mediation underscoring the central role of operational processes in translating sustainability intent into performance outcomes.

Common mediators included green operations, environmental performance and process innovation pointing to recurring operational pathways. By contrast mediators tied to social sustainability or operational outcomes were seldom significant reflecting the uneven maturity of social themes observed in the cluster and thematic analysis.

Overall these findings highlight the need to look beyond simple direct-effect models in SSCM research. Future studies should look into the causal pathways especially for social and operational practices by using mediation and moderation analyses to understand how and under what conditions SSC practices lead to the intended outcomes.

4.3 Findings Across Industry Contexts

The analysis of industry-specific patterns revealed notable differences in how sustainability practices influence supply chain performance across sectors. Manufacturing accounted for the largest share of entries (n = 189) reflecting the concentration of SSCM research in this domain. Findings here were heterogeneous with strong positive impacts (123) alongside a substantial number of non-significant outcomes (51) and some negative or unspecified effects indicating variability in both practices and performance reporting within the sector.

In contrast the automotive sector showed more consistent evidence of positive outcomes: 40 of 41 entries reported benefits with only one neutral and no negative findings. This suggests that sectors with high stakeholder visibility and strong regulatory pressures may be further advanced in embedding sustainability into operational and strategic practices. At the same time the near-unanimous positive reporting raises the possibility of selective emphasis or publication bias highlighting the need for more critical and comparative studies.

Multi-industry studies (n = 33) showed a balanced pattern with 17 positive and 15 non-significant results possibly due to averaging effects across sectors. Other industries such as electrical and electronics though studied less often also revealed encouraging trends dominated by positive and neutral outcomes.

From a practical perspective these findings underscore the importance of sector-specific strategies. While cross-industry learning can be valuable the effectiveness of sustainability practices depends on contextual factors such as supply chain complexity, regulatory environments and consumer expectations. Notably underrepresented sectors including construction, apparel, logistics and services face distinct challenges:

construction is marked by carbon intensity and waste management; apparel raises persistent labour rights and working-condition concerns; and logistics and services encounter environmental and operational pressures. Linking these sector-specific themes to measurable performance outcomes remains a key research gap reinforcing the uneven maturity identified in the thematic analysis.

4.4 Interpretive Comparison of Frequency, Cluster, and Thematic Results

The frequency-based analyses (**Tables 7** to **10**) show that environmental practices lead the SSCM literature particularly in relation to economic and environmental performance. This prominence reflects clearer regulatory benchmarks, established measurement frameworks and the relative ease of quantifying environmental outcomes. By contrast social practices appear less frequently and yield more inconsistent or unspecified results underscoring persistent challenges in operationalizing social constructs and a lingering bias toward environmental and economic outcomes in manufacturing-oriented research.

The cluster analysis provides a structural view of these imbalances. Cluster 1 groups environmental practices with predominantly positive economic outcomes while Cluster 2 groups social practices with predominantly positive economic outcomes. These narrow configurations reflect the literature's strong orientation toward linking both environmental and social practices to economic value.

However, the silhouette coefficient of 0.2 suggests only modest separation between clusters indicating that environmental and social practices overlap to a considerable extent. This limited distinction highlights the multi-dimensional nature of SSCM practices and the challenge of fitting them neatly into separate categories.

To explore this further a thematic analysis (**Figure 11**) was carried out to examine the internal makeup of the clusters. In Cluster 1 the main themes include eco-design, cleaner production, green procurement and reverse logistics. Eco-design and cleaner production consistently show positive relationships while green procurement is mostly positive but includes some neutral or unclear outcomes. Reverse logistics on the other hand presents mixed evidence with many no-impact results and a few negatives alongside positives highlighting that environmental practices cannot always be assumed to produce uniform benefits.

Cluster 2 is characterized by supplier-related social initiatives, labour and human rights, community engagement and supplier integration. Supplier-related initiatives and labour practices yield both positive and non-significant outcomes while community engagement sometimes produces negative or symbolic effects. Supplier integration enhances operational, social and environmental outcomes but shows no direct economic linkages. These fragmented and sometimes contradictory findings demonstrate that social and operational practices are less systematically embedded than environmental practices with results shaped by sectoral and contextual contingencies.

This interpretive extension clarifies the uneven maturity of sustainability research: environmental practices form a more robust, empirically grounded stream whereas social practices remain fragmented, context-dependent and theoretically underdeveloped.

Contradictions are clearly visible across the findings. In Cluster 1 although many studies report positive economic outcomes from environmental practices some themes show exceptions. For instance, reverse logistics often leads to no measurable improvement and occasionally even negative effects pointing to implementation challenges and efficiency trade-offs. Green procurement though mostly positive also shows non-significant or unclear results in some cases suggesting inconsistency in how supplier criteria are applied. In Cluster 2 these contradictions become even more apparent. Supplier-focused social initiatives

and labour standards tend to enhance legitimacy and reputation but their economic impact remains uncertain. Community engagement efforts sometimes deliver symbolic value with little real performance improvement and in rare cases even negative outcomes. Together these inconsistencies show that SSCM performance linkages depend strongly on how practices are designed, the context of the industry and the methods used to measure outcomes.

Taken together the frequency patterns, cluster structures and thematic insights point to an uneven level of maturity in SSCM research. Environmental practices particularly eco-design and cleaner production consistently show positive effects. However, others such as green procurement and reverse logistics display more varied results including non-significant and sometimes negative outcomes. Social practices especially those related to suppliers, labour standards and community engagement are even more fragmented with positive impacts often accompanied by symbolic or contradictory effects. These findings highlight that sustainability practices cannot be assumed to deliver uniform benefits: their impacts depend on practice design, sectoral context and measurement approach. This synthesis underscores the need for more precise operationalization of social constructs, stronger cross-industry comparative research and methodological diversity to capture the complex pathways linking SSCM practices to performance.

These findings demonstrate that contrary to earlier claims of saturation in SSCM reviews (e.g., Carter & Washispack, 2018) meaningful gaps remain in the operationalization of social practices, the integration of sectoral contexts and the theorization of mixed or contradictory outcomes. The cluster- and theme-based synthesis thus extends prior descriptive works by uncovering latent structures and underexplored dimensions.

4.5 Theoretical Frameworks in the Literature

Whereas Section 4.1 linked theoretical frameworks directly to the cluster and thematic findings this section broadens the perspective by reviewing the main theories used in SSCM research more generally comparing their applications, gaps and limitations.

To contextualize the theoretical underpinnings of the reviewed literature a comparative summary of key frameworks used in SSCM research is presented in Appendix 2. This table highlights how major theories such as the RBV, NRBV, Stakeholder Theory, Dynamic Capability View (DCV) and Agency Theory have been applied to explain sustainability-related performance outcomes.

RBV and NRBV continue to dominate applications framing environmental practices such as eco-design and green procurement as internal resources and capabilities that deliver sustained economic and environmental advantages. Stakeholder Theory by contrast emphasizes external salience and legitimacy frequently applied to social practices but often criticized for weak empirical operationalization.

More recently the Dynamic Capability View has gained traction (**Table 6**) particularly in linking digital and analytics-based competencies to sustainable supply chain performance. It highlights how firms' sense, seize and reconfigure resources to sustain advantage under changing environmental and social pressures. Yet empirical testing remains limited with most applications being conceptual or cross-sectional rather than longitudinal.

Agency Theory has also been widely employed focusing on monitoring and control of supplier environmental and social practices. However, this framework is often critiqued for overemphasizing opportunism while neglecting relational governance and trust-based mechanisms.

Taken together these frameworks illustrate both the conceptual richness and the fragmentation of SSCM research. By aligning each theory with its specific applications and limitations Appendix 2 complements the empirical synthesis and underscores the need for more integrative, multi-theoretic approaches that connect internal resources, external pressures, dynamic reconfiguration and governance relationships.

5. Conclusion

5.1 Summary of Findings and Contributions

This study advances SSCM literature by moving beyond descriptive reviews to provide a cluster-based synthesis of practice–performance linkages. Through a systematic review of 78 papers the analysis discovered how environmental, social and operational practices relate to different performance outcomes.

The two-step cluster analysis produced two underlying patterns. Cluster 1 comprised environmental practices that were mainly associated with positive economic outcomes while Cluster 2 grouped social practices showing similar economic links. The low silhouette coefficient (0.2) suggests weak separation between clusters indicating a strong overlap among sustainability dimensions and the difficulty of placing practices into distinct categories. To look beyond these broad groupings a thematic analysis was conducted. It showed that Cluster 1 is comprised of eco-design, cleaner production, green procurement and reverse logistics — practices linked not only to economic gains but also to environmental and operational improvements. Cluster 2 on the other hand is defined by supplier-focused social initiatives, labour and human rights actions, community engagement and supplier integration. These tend to produce mixed results across economic, social, operational and supply chain outcomes. Taken together the findings highlight the relative maturity of environmental practices and the still-evolving nature of social sustainability research.

The review also identified methodological and sectoral imbalances in the evidence base. A dominance of SEM-based approaches privileges linear cause–effect models while underrepresenting configurational or longitudinal perspectives. Similarly, the literature remains heavily manufacturing-focused with limited insights from sectors such as apparel, construction, logistics and services. These biases underscore the need for more diverse methodological approaches and broader industry coverage.

The study further contributes to theory-building by clarifying how different frameworks map onto distinct parts of the SSCM causal chain. Capability-oriented lenses (e.g., RBV, NRBV, dynamic capabilities) explain how internal resources drive performance consistent with Cluster 1. Adoption-oriented lenses (e.g., Institutional, Stakeholder, Legitimacy) account for external pressures and legitimacy concerns reflected in Cluster 2's social practices. Governance and relational lenses (e.g., Transaction Cost, Agency, Resource Dependence, Social Capital) illuminate supplier–buyer coordination. Together, these insights extend prior reviews and syntheses (e.g., Carter & Washispack, 2018; Carter et al., 2020; Nakamba et al., 2017; Sodhi & Tang, 2018) by showing not just which theories are used but how they structure explanations across adoption, capability, governance and performance.

5.2 Managerial and Policy Implications

The findings offer valuable insights for supply chain managers and policymakers aiming to drive sustainability-led performance.

The cluster analysis showed that both environmental and social practices are most often linked to positive economic outcomes reflecting the strong emphasis in SSCM research on business value. The thematic analysis however added two important insights. First it showed that environmental practices also influence environmental and operational outcomes though not always consistently—for example reverse logistics often yields no clear benefits. Second it revealed that Cluster 2 includes not only social but also operational

practices which produce additional yet more fragmented effects across social, operational and supply chain performance dimensions.

For managers this implies differentiated strategies. Environmental practices such as eco-design and cleaner production represent mature, reliable levers for cost reduction, compliance and competitiveness. Green procurement and reverse logistics while widely adopted yield more variable returns indicating that performance gains depend on careful implementation and monitoring. Managers should prioritize mature environmental themes for immediate performance improvements while managing risks in those with more mixed evidence.

Social practices—including supplier development programs, labour standards, human rights and community initiatives—show mixed associations with economic performance. Supplier-related initiatives sometimes contribute to efficiencies and stronger buyer–supplier relationships but labour and community-oriented practices more often deliver reputational or legitimacy benefits without consistent economic returns and in some cases produce symbolic or even negative outcomes. These practices are therefore best pursued with a long-term, stakeholder-oriented perspective, systematically measured and embedded into core operations rather than treated as peripheral CSR activities. Operational practices such as supplier integration and general operational improvements also contribute meaningfully—strengthening operational, social and environmental outcomes even if direct economic effects are limited. Managers should therefore recognize that both social and operational practices deliver value in multiple ways: economic benefits in some contexts, reputational or relational advantages in others and capability-building effects over time.

From a policy standpoint the underrepresentation of social and supply chain–level outcomes underscore the need for frameworks that incentivize balanced adoption. Policymakers and industry bodies can support this by developing sector-specific guidelines, benchmarking tools and standardized disclosure requirements that ensure equal attention to environmental, social and operational dimensions. Cross-industry collaborations and knowledge platforms can also accelerate diffusion by facilitating learning across firms and value chains particularly in underexplored sectors such as apparel, logistics, services and construction.

Overall, the results show that sustainability cannot be treated as a generic strategy. Practice-performance linkages are subtle and sector-specific. Managers should base their choice of environmental, social and operational practices on their industry context, supply chain complexity and stakeholder expectations while policymakers should foster reporting and learning mechanisms that encourage systematic integration of social and operational sustainability alongside environmental practices.

5.3 Future Research Directions

Building on the findings of this literature-based empirical analysis, several avenues for future research emerge.

The clusters identified in this study highlight a narrow orientation of SSCM research toward economic performance with environmental and social practices most often linked to positive economic outcomes. Thematic analysis however revealed broader but uneven associations: environmental practices such as eco-design and cleaner production consistently support economic and environmental outcomes whereas reverse logistics and green procurement yield more variable effects; social practices such as supplier development sometimes enhance efficiency while labour rights and community initiatives are more often tied to legitimacy and reputation than to measurable economic gains. Future research should refine the

measurement of these constructs particularly for social and operational practices to improve consistency and comparability across studies.

Methodological innovation is required to capture more nuanced patterns. Beyond the two-step cluster approach techniques such as fuzzy clustering, latent class analysis or hybrid machine learning could reveal finer sub-structures (e.g., differentiating eco-design from green procurement or labour standards from community initiatives). Similarly moving beyond the dominance of SEM future studies could employ configurational methods (e.g., fuzzy-set QCA), longitudinal designs, simulation or system dynamics to capture complex, delayed or non-linear practice–performance linkages.

More consideration is needed to mediating and moderating mechanisms. Contextual factors such as industry, supply chain structure and institutional environment may condition how practices influence outcomes. Advanced modelling can clarify these contingencies and explain inconsistent or non-significant effects reported in prior studies.

The industry setting is heavily focused on manufacturing while others such as construction, apparel, logistics and services face unique sustainability challenges ranging from carbon intensity to labour rights. Industry-specific studies are required to provide practicable insights and to test the generalizability of SSCM concepts across various industry contexts.

The performance outcomes studied to date are skewed toward economic and environmental measures. Future research should include focus on competitiveness, social, operational, organizational and supply chain-level outcomes which remain less explored but are critical for a complete understanding of sustainability.

Finally, this work was limited to studies published between 2014 and 2021 a period of rapid expansion in SSCM research. Future studies should incorporate insights emerging after 2021 to capture evolving practices, new data sources and shifting sustainability priorities.

5.4 Limitations

While this study offers valuable insights several limitations must be acknowledged.

The database and access-related exclusions shaped the sample. Certain high-impact journals (e.g., *Journal of Cleaner Production*, *Resources, Conservation and Recycling*, *Business Strategy and the Environment*, *Transportation Research Part E: Logistics and Transportation Review*, *International Journal of Life Cycle Assessment*) could not be included which may limit comprehensiveness. In addition, the reliance on journal metrics (CiteScore percentile, SNIP) as quality filters introduces bias by privileging certain outlets. Future reviews may adopt complementary quality checks to broaden coverage.

The study period was restricted to 2014–2021 selected to capture the surge of SSCM research during that timeframe. Although studies published after 2021 were excluded these are referenced in the Future Research section to reflect subsequent developments.

The synthesis is shaped by biases in the underlying literature base. Because many of the selected studies employed SEM or PLS-SEM the findings largely reflect linear, variance-based cause–effect relationships while configurational or longitudinal dynamics remain underexplored. Likewise, the predominance of manufacturing-focused studies means that findings are more representative of that sector with sustainability challenges in apparel, construction, logistics and services receiving comparatively less attention.

The study focused exclusively on sustainable practices and did not examine other influential factors such as drivers, enablers, capabilities or barriers. Including these dimensions in future research could provide a more holistic understanding of SSC performance.

Finally, the cluster analysis produced only two clusters both linking practices to economic outcomes (environmental→ economic; social→ economic) with a modest silhouette coefficient (0.2) indicating weak statistical separation. While this limits robustness the thematic analysis (**Figure 11**) added explanatory value by showing that environmental practices also connect to environmental outcomes and that social/operational practices have fragmented ties across economic, social, operational and supply chain outcomes. Thus, even when numerical clustering quality was weak the thematic approach provided useful structural insights into the uneven maturity of SSCM research.

Appendix 1. Sustainable supply chain practices studied in literature.

S. No.	Author	Practices
1.	Abdallah & Al-Ghwayeen (2020)	GSCM practices
2.	Agarwal et al. (2018)	GSCM adoption
3.	Agyabeng-Mensah et al. (2020)	Supply chain environmental cooperation, Green human resource management, Internal green supply chain practices
4.	Aray et al. (2021)	Supply chain integration and coordination
5.	Arda et al. (2023)	Environmental management practices
6.	Balasubramanian & Shukla (2017a)	Core green practices, Facilitating green practices
7.	Balasubramanian & Shukla (2017b)	Core green practices, Facilitating green practices
8.	Banasik et al. (2017)	Closing loop
9.	Belhadi et al. (2022)	Digital business transformation, Organizational ambidexterity
10.	Bhatia & Srivastava (2019)	Product recovery, Environmental concerns, Production planning, Demand and inventory management, Product design and collection, Organisational leadership, Sustainable production, Raw material prices
11.	Blome et al. (2014)	Sustainable production
12.	Cherrafi et al. (2018)	Lean management, Green practices, Process innovation
13.	Cousins et al. (2019)	GSCM practices
14.	Croom et al. (2018)	Basic social sustainability practices, Advanced social sustainability practices
15.	Das (2018)	Environmental management practices, Social practices for employees, Social practices for community, Operations practices, Supply chain integration
16.	De et al. (2020)	Lean and sustainability oriented innovation
17.	Dubey et al. (2015)	Supplier relationship management, Total quality management
18.	Edwin Cheng et al. (2022)	Sustainable supply chain flexibility, Circular economy practices
19.	Foo et al. (2018)	Internal environmental management, Cooperation with customers, Investment recovery, Eco-design, Supplier selection, Environmental collaboration, Supplier evaluation
20.	Geng et al. (2017)	GSCM practices, Intra-organizational management, Supplier integration, Eco-design, Customer cooperation, Reverse logistics
21.	Geyi et al. (2020)	Agile practices, Sustainable supply chain practices
22.	Gopal & Thakkar (2016)	Sustainable supply chain practices
23.	Govindan et al. (2015)	Internal management support, Green purchasing, ISO 14001 certification, Reverse logistics
24.	Graham et al. (2018)	Downstream environmental logistics practices
25.	Green et al. (2019)	Agile production practices, GSCM practices
26.	Gualandris & Kalchschmidt (2016)	Sustainable process management, Sustainable supply management
27.	Han & Huo (2020)	Green supplier integration, Green customer integration, Green internal integration, Green Internal Integration
28.	Huang et al. (2017)	Green supply chain initiatives
29.	Inman & Green (2018)	GSCM practices, Lean manufacturing practices
30.	Jadhav et al. (2019)	Internal sustainability practices
31.	Jiang et al. (2020)	Green strategy alignment, Green process coordination
32.	Kang et al. (2018)	Intra-organizational sustainability management practices, Inter-organizational sustainability management practices
33.	Katiyar et al. (2018)	Planning performance, Sourcing performance, Delivery performance, Manufacturing performance
34.	Khaksar et al. (2016)	Green innovation, Green supplier

Appendix 1 continued…

35.	Khor et al. (2016)	Reverse logistics product disposition options - repair (under regulatory pressure), Reverse logistics product disposition options - recondition (under regulatory pressure), Reverse logistics product disposition options - remanufacture (under regulatory pressure), Reverse logistics product disposition options - recycle (under regulatory pressure), Reverse logistics product disposition options - disposal (under regulatory pressure), Reverse logistics product disposition options - repair (under ownership pressure), Reverse logistics product disposition options - recondition (under ownership pressure), Reverse logistics product disposition options - remanufacture (under ownership pressure), Reverse logistics product disposition options - recycle (under ownership pressure), Reverse logistics product disposition options - disposal (under ownership pressure)
36.	Kirchoff et al. (2016)	GSCM practices
37.	Kitsis & Chen (2020)	SSCM practices
38.	Kitsis & Chen (2023)	Green operations, Environmental proactivity, Collaboration with suppliers and customers
39.	Kusi-Sarpong et al. (2016)	Green information technology and systems, Strategic suppliers partnership, Operations and logistics integration, Internal environmental management, Eco-Innovation practices, End-of-Life practices
40.	Laguir et al. (2021)	Eco-efficiency orientations, Eco-branding orientations
41.	Laosirihongthong et al. (2020)	Sustainable design, Sustainable procurement, Sustainable manufacturing, Sustainable distribution, Reverse logistics
42.	Lee (2015)	Green SCM
43.	Lee et al. (2015)	Greening the supplier
44.	Liu et al. (2020)	3PL-initiated low-carbon supply chain integration
45.	Longoni & Cagliano (2018)	Primary stakeholder disclosure practices, Extended stakeholder disclosure practices
46.	Lopes de Sousa Jabbour et al. (2021)	Low-carbon products, Low-carbon processes, Low-carbon logistics
47.	Luthra et al. (2018)	Ecological considerations in organisations' policies and missions, Supply chain members' collaborations, Sustainability training, Green design and purchasing, Reverse logistics and waste minimisation, Ethical and safe practices, Community welfare and development
48.	Mahapatra et al. (2021)	Identification of climate risk and opportunity, Percentage of operational spend on energy, Emission trading, Disclosure score, Carbon emissions reduction efforts (Scope 1), Carbon emissions reduction efforts (Scope 2), Carbon emissions reduction efforts (Scope 3)
49.	Mani & Gunasekaran (2018)	Supply chain social sustainability adoption
50.	Mani et al. (2016b)	Equity, Safety, Health and Welfare, Philanthropy, Ethics, Human Rights
51.	Mani et al. (2018)	Supplier social sustainability
52.	Mani et al. (2020)	Supply chain social sustainability in emerging economies
53.	Mathiyazhagan et al. (2023)	Customer management, Information sharing, Corporate sustainability reporting, Standardisation and monitoring
54.	Mitra & Datta (2014)	Environmentally sustainable product design & logistics, Collaboration with suppliers
55.	Nath & Agrawal (2020)	Basic social sustainability practices, Advanced social sustainability practices, Lean practices
56.	Pan et al. (2020)	Internal environmental management, Cooperation with suppliers, Cooperation with customers
57.	Petljak et al. (2018)	Water and energy management, Waste management, Cooperation with suppliers, Green purchasing, Green logistics
58.	Ramanathan et al. (2021)	Supply chain partners selection, Green activities of supply chain partners
59.	Roehrich et al. (2017)	Green supplier selection, Value internalisation
60.	Roy et al. (2020)	Environmental product design, Source reduction, Environmental management systems
61.	Shafiq et al. (2017)	Monitoring of supplier environmental practices, Monitoring of supplier social practices
62.	Shafiq et al. (2019)	Purchasing teams, Human rights, Labour practices, Emerging economy sourcing
63.	Shafiq et al. (2020)	Supply chain transparency, Employee-focused social practices
64.	Shashi et al. (2019)	Lean practices
65.	Stekelorum & Laguir (2023)	Sustainable customer orientation
66.	Subramaniam et al. (2020)	Supplier monitoring, Supplier development, Incentives for supplier, Supplier collaboration
67.	Susanty et al. (2020)	Circular economy practices, Environmental-oriented supply chain cooperation practices
68.	Tachizawa et al. (2015)	Monitoring GSCM practices, Collaborative GSCM practices
69.	Wong et al. (2021)	Supply chain integration
70.	Wang & Dai (2018)	Internal environmental management, Internal social responsible management, External supplier monitor and assessment, External supplier collaboration
71.	Wiengarten & Longoni (2015)	Coordinative outward-facing integration with supplier and customer, Collaborative outward-facing integration with supplier and customer
72.	Wu et al. (2015)	Recovering and recycling used products
73.	Yadlapalli et al. (2018)	Supplier development, Supplier selection
74.	Yang et al. (2019)	Complementarity between eco-design and reverse activities

Appendix 1 continued…

75.	Yang et al. (2020)	Supplier CSR, Buyer CSR
76.	Yu et al. (2014)	Internal GSCM, GSCM with customers, GSCM with suppliers
77.	Yu et al. (2021)	Supplier green management, Internal green management, Customer green management
78.	Zhu et al. (2016)	Organizational governance, Human rights, Labour practices, The environment, Community involvement and development, Supply chain management, Political responsibility

Appendix 2. Comparative summary of theoretical frameworks in SSCM.

Theory	Application in SSCM	Gaps / Limitations	Representative studies
Resource-based view	Uses RBV to explain how firms' internal resources and capabilities can generate sustained performance advantages in the context of sustainability initiatives.	Often overlooks external influences (e.g., regulatory or institutional pressures).	Arda et al. (2023)
Natural resource-based view	Adopts NRBV to position carbon reduction initiatives as environmentally sustainable strategies that contribute to pollution prevention, product stewardship, sustainable development and competitive advantage.	Tends to focus narrowly on environmental outcomes; underrepresents social dimensions and cross-tier integration.	Mahapatra et al. (2021)
Stakeholder theory	Investigates how sourcing strategies and internal purchasing structures influence enforcement of supplier social practices and firm performance, drawing on stakeholder theory.	Commonly applied at a conceptual level; lacks robust operationalization and performance-linked empirical models.	Shafiq et al. (2019)
Dynamic capability view	Conceptualizes Big Data Analytics capabilities as dynamic organizational competencies that enable strategic responses to achieve sustainable supply chain performance.	Limited empirical testing in SSCM contexts; often lacks longitudinal validation of dynamic reconfiguration.	Edwin Cheng et al. (2022)
Agency theory	Applies agency theory to examine how behaviour-based governance mechanisms such as monitoring supplier environmental and social practices affect firm sustainability performance.	Overemphasis on control and opportunism; lacks integration with trust-based and relational governance models.	Shafiq et al. (2017)

Conflict of Interest

The authors confirm that there is no conflict of interest to declare for this publication.

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During the preparation of this work the authors used ChatGPT an AI-based language model developed by OpenAI to improve the language and readability of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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