

# Green Supply Chain Integration: A Systematic Literature Review

Huahui Li<sup>1</sup>, Haoran Fu<sup>1,2\*</sup>, T Ramayah<sup>1,3,4,5,6,7</sup>, Angran Fu<sup>1,8</sup>

<sup>1</sup>School of Management, Universiti Sains Malaysia, Minden, Penang 11800, Malaysia. <sup>2</sup>School of Economics, Anyang Normal University, Anyang, 455000, China. <sup>3</sup>Department of Information Technology and Management, Daffodil International University, Bangladesh (DIU). <sup>4</sup>Sunway Business School (SBS), Sunway University. <sup>5</sup>University Center for Research and Development (UCRD), Chandigarh University (CU), India. <sup>6</sup>Faculty of Economics and Business, Universitas Indonesia (UI). <sup>7</sup>The University of Jordan (UJ), Jordan. <sup>8</sup>School of Economics and Management, Southwest University of Science and Technology, Mianyang, Sichuan 621010, China. \*Corresponding Author's Email: 01597@aynu.edu.cn

## Abstract

Green Supply Chain Integration (GSCI) can break organizational boundaries, actively seek cooperation with supply chain partners, and acquire complementary resources, which is crucial for sustainable development. This paper aims to conduct an in-depth analysis of the current state of GSCI research, delineating existing findings, avenues for development, and research gaps. Employing a systematic literature review (SLR) as the main methodology, this study meticulously reviews and analyzes 61 papers related to GSCI sourced from the Web of Science (WOS) and Scopus databases. The comprehensive review systematically categorizes and synthesizes the definitions, drivers, impacts, dimensions, inter-dimensional relationships, prevalent theories, data collection methods, source industries, and data analysis techniques related to GSCI. This rigorous literature analysis endeavors to provide a more integrated and comprehensive understanding of GSCI. Furthermore, this paper identifies four main limitations entrenched within the existing research on GSCI: (i) Insufficient research exists regarding the delineation of GSCI dimensions and the nuanced understanding of how distinct dimensions exert varying impacts on the outcome variables. (ii) Consideration of the institutional environment and contextual factors is lacking in antecedent studies; (iii) Existing antecedent research is fragmented and lacks strategic perspective and integration with the digital economy; and (iv) there exists a research gap concerning the exploration of negative impacts associated with outcome variables and the corresponding causes.

**Keywords:** Drivers and sources, Impacts, GSCI, SLR.

## Introduction

The importance of incorporating environmental concerns into supply chain management has received substantial attention since the early 1990s (1). Green supply chain management (GSCM) aims to integrate environmental considerations into decision-making processes across all facets of a company (2). Based on GSCM and supply chain integration (SCI), scholars have proposed the concept of GSCI (3). GSCI reflects the convergence of SCI ideas in environmental management practices (3). GSCI focuses on establishing strategic partnerships between firms and their supply chain partners, facilitating collaborative management of intra-organizational and inter-organizational processes to address environmental issues effectively (3, 4). GSCI helps companies coordinate the resources and capabilities of stakeholders, acquire heterogeneous knowledge, and continually

expand their operational boundaries to develop innovative solutions for environmental protection while maintaining competitiveness. Thus, it can realize the dual objectives—environmental protection and corporate performance improvement (4, 5). GSCI may be a hot topic (6). Existing studies have extensively investigated the antecedents and outcomes of GSCI. However, no study has systematically categorized and compiled the various facets of GSCI, such as its definition, driving factors, actionable outcomes, dimensions and inter-dimensional relationships, commonly employed theories, data collection methods, source industries for data, and data analysis techniques. This paper endeavors to fill this gap by offering a comprehensive and holistic perspective on GSCI. Although the importance of GSCI is constantly emphasized, a notable divergence exists in its practical adoption (7).

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(Received 15<sup>th</sup> November 2023; Accepted 13<sup>th</sup> January 2024; Published 30<sup>th</sup> January 2024)

Existing literature suggests a need for more consensus and clarity regarding the definition and dimensions of GSCI. Therefore, there is a need for a comprehensive review of GSCI research. This study aims to identify the existing findings, pinpoint avenues for further research development, and elucidate the gaps in advancing knowledge in this domain by conducting a rigorous and impartial review of prior research. In order to accomplish this goal, we shall focus our efforts on addressing the following research question (RQ):

RQ1: What are the factors that lead organizations to adopt GSCI?

RQ2: What dimensions of GSCI are recognized in current research?

RQ3: What are the dominant theories that support GSCI research?

RQ4: What can be achieved through GSCI practice?

RQ5: What are the commonly used data collection and data analysis methods for empirical GSCI analysis?

RQ6: What gaps and future research directions can be identified based on existing work?

RQ1 to RQ5 serve as foundational inquiries common to all reviews to identify what has been researched in the GSCI field. The RQ1 - RQ5 answers will be used to respond to RQ6, where we endeavor to illuminate prospective paths and directions for the evolution of the GSCI field.

## Data and methodology

This study employed SLR as it ensures the most efficient and high-quality approach to exploring and evaluating a broad range of literature (8). SLR is used to evaluate and explain a specific research area or phenomenon of interest in all available research, where a literature review can strengthen the research base in the area of interest. SLR is a more authentic and verifiable source that contains more comprehensive and unbiased searches. SLR "provides precise mechanisms and rigorous review protocols to minimize researcher bias and maintain the independence of the research process while allowing for exploration and discovery, thereby helping to deepen understanding (9)." The fundamental difference between traditional narrative and SLR is a comprehensive and unbiased search (8). The most important advantage of the SLR method is that it consists of

several generally accepted steps and can be easily validated or replicated by other researchers(10). Following the criteria of (10) and several frequently cited review publications, this study used the SLR approach, including data collection, analysis, and topic exploration (11). Conducting an SLR requires an initial delineation of the research area and the development of a protocol for systematic identification, selection, review, and synthesis of relevant literature (12). This paper strictly adheres to the five-step framework for SLR proposed by Denyer & Tranfield: (i) Formulation of the research question(s); (ii) Identification of studies; (iii) Selection and evaluation of studies; (iv) Analysis and synthesis; and (v) Presentation of results and discussion(10). The procedural details of implementing SLR in this paper are shown in Table 1. The method section concludes with a brief discussion of the limitations, as is the norm for SLR (13).Data collection for this study was conducted following a protocol as administrative review protocols are widely used to explore, discover, and develop any area of research, providing the researcher with the flexibility to make modifications during the research process. At the same time, it also ensures that the review will not be affected by researcher bias (8). The data collection protocol used in this study included a rigorous search strategy and specific criteria for the inclusion and exclusion of articles to achieve the goals of SLR. The search strategy includes appropriate steps such as identifying and selecting relevant keywords and search terms, selecting article databases, modifying the keywords and applying the search strategy (8, 9). Relevant studies were searched from two databases: WOS and Scopus. These databases were selected due to their extensive coverage across various academic disciplines, making them valuable and dependable sources for research. Both databases provide sufficient stability of coverage (14). They both use strict selection criteria and employ a rigorous peer review process. In addition, both databases allow tracking of articles, and author citations proved instrumental in identifying additional relevant studies, enriching our research. Finally, they are widely used by researchers, scholars, and students worldwide and are often available through university libraries and research institutions (15). Select studies or articles from

**Table 1:** SLR phases applied in the paper

	<p><b>Research Questions</b></p> <p>(a)What are the factors that lead organizations to adopt GSCI?  (b)What dimensions and aspects of GSCI are recognized in current research?  (c)What are the dominant theories that support GSCI research?  (d)What can be achieved through GSCI practice?  (e)What are the common data collection methods and data analysis methods used for empirical GSCI analysis?  (f)What gaps and future research directions can be identified based on existing work?</p> <p><b>Literature Databases</b>  WOS and Scopus databases</p> <p><b>Search Period</b>  No time limit</p> <p><b>Inclusion Criteria</b>  (a)Search terms should appear in the title, abstract, or keywords of the papers; (b) were published in English</p> <p><b>Exclusion Criteria</b>  (a) Papers not dealing with the subject of this study; (b) Duplicate items</p> <p><b>Search Strings</b>  “Green Supply Chain Integration”</p> <p><b>Methods for analysis</b>  Descriptive analysis and thematic synthesis.</p> <p><b>Reporting of findings</b>  Findings will be reported in descriptive and analytic (thematic synthesis) components.</p>
<b>Phase 1</b> Question Formulation	
<b>Phases 2 &amp; 3</b> Locating, Selecting, and Evaluating Articles	
<b>Phase 4</b> Analysis	
<b>Phase 5</b> Reporting	

selected databases to identify and select primary studies directly related to research questions and objectives. The study employed a systematic protocol that included selecting selection criteria and extraction methods, sorting duplicate articles in the database, and selecting studies based on title, abstract, and keywords to reduce bias and human error (8, 9).

Both databases were searched using the string "green supply chain integration." The search was conducted in English-language sources. There was no restriction on the time of publication in order to ensure that we captured a broad spectrum of relevant literature. The search was executed on September 16, 2023. 1049 and 647 relevant English documents were retrieved in WOS and Scopus, respectively. To ensure that the selected papers were most relevant to our research, we carefully reviewed titles and abstracts, excluding papers that focused on topics such as SCI, GSCM, and green supply chain performance. There are 63 and 49 papers selected in the two databases, respectively. After deduplicating the selected papers in the two databases, reviewing the full text, and snowballing, the total number of papers

in the two databases was 61, of which 60 were empirical studies, and 1 was a literature review. Although this article has the limitation of searching only two databases, the criteria we employed follow the guidelines for conducting a systematic literature review and ensuring that our work is replicable and trustworthy (13). After finalizing the sample of articles, we embarked on a thorough data analysis. Data analysis is a descriptive and thematic analysis performed by SLR after retrieving data through different evaluation mechanisms (8, 9). A descriptive analysis will be conducted in the first part of the data analysis. According to (8, 9), descriptive research uses some categories and classification schemes in SLR to describe the overview of the selected articles. The classification scheme will be based on published articles, which will classify all articles into different parts, such as the distribution of published articles in other countries, journals, contexts, and periods. The second part of the analysis will attempt to introduce some related topics. In the following section, we present a detailed exposition of the main findings derived from these papers.

## Results

### Descriptive analysis

To manage and analyze the articles in this review, we utilized MS Excel 2019. This software enabled us to sort, compile, and categorize the articles for descriptive and thematic categorical analysis.

### Article sources and publication trends

Figure 2 displays the primary source journals (with more than or equal to 2 articles on related topics) featured in the 61 articles included in this paper. These articles were distributed across 38 different journals. The journal with the highest number of articles is "Business Strategy and the Environment," which published six articles on related topics. Following closely, "Sustainability"

and "Sustainable Development" featured five articles each. These top three journals collectively account for 26% of the publications in this study, highlighting their significant contribution to the field of research in GSCI.

As depicted in Figure 3, the literature on GSCI initially appeared in 2013. The number of publications on this topic has shown a general upward trend, which signifies a growing interest and focus on GSCI within the academic community. However, it is worth noting that the number of studies remains relatively small, indicating that GSCI is an emerging area of research for further exploration and expansion.

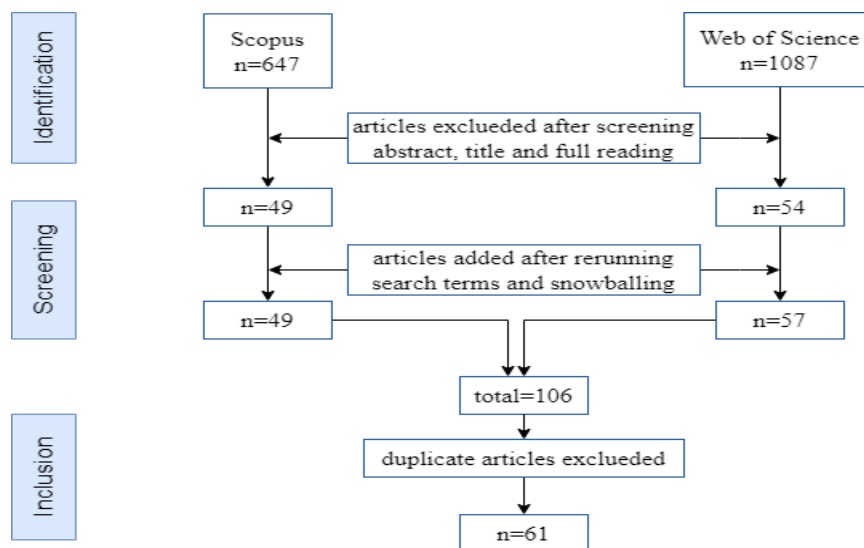


Figure 1: PRISMA framework for SLR

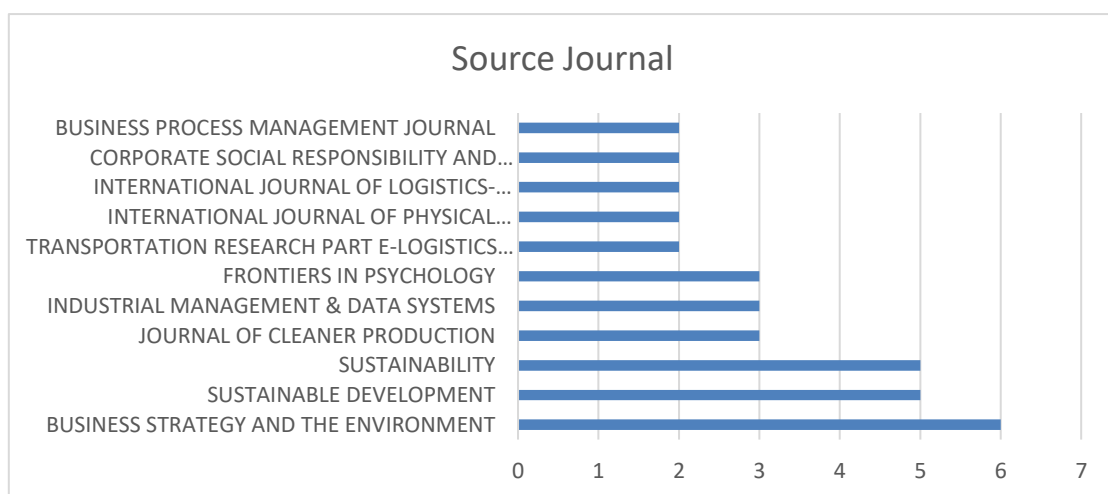


Figure 2: Main source journals

Among the 60 empirical studies included in this research, only Lo *et al.* incorporated data from 10 different countries (16). The rest of the literature relied on data from a single country. It is noteworthy that a substantial portion, 73%, of these single-country data sources are from developing countries. This observation aligns with the concern that developing countries are experiencing a slow depletion of natural resources and exacerbating environmental problems (17). Chinese manufacturing enterprises face tremendous environmental pressure (18). This is reflected in the fact that China has the highest research contribution to GSCI, accounting for 71.7% of the literature on this topic, as illustrated in Figure 4. Furthermore, it is important to note that the existing research focus on developed countries is limited primarily to the United States, South Korea, and Portugal. This suggests a significant gap in understanding GSCI in countries, presenting an opportunity for future research to explore this domain more comprehensively.

The 61 included research papers analysis showed that the research methods used in the GSCI papers included literature review (2%) and empirical research (98%). Empirical studies mainly reviewed data from manufacturing firms (68%) (Figure 5). The data reflects that manufacturing firms are at the forefront of GSCI research. 82% of the literature data draws from multiple mixed industries. In contrast, only 18% of the studies were conducted on specific industries. These include the textile, oil, and gas industries, modern trade stores, information technology (IT) manufacturers, energy suppliers, container shipping firms, and construction and food industries. The choice to examine these specific

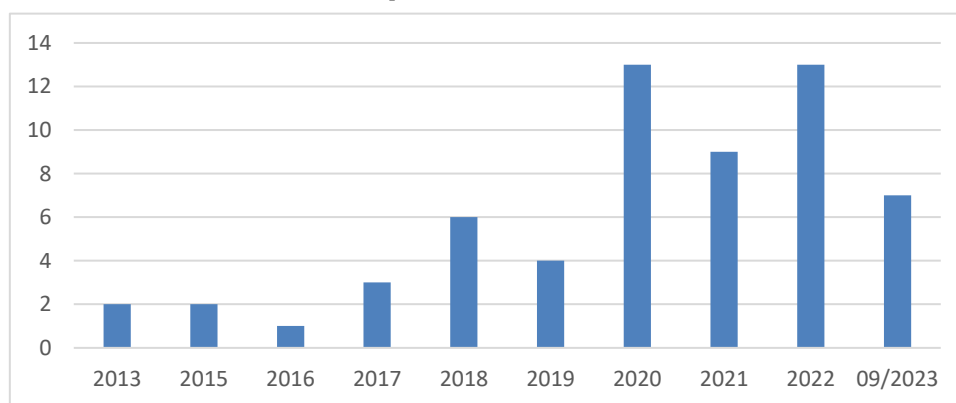
sectors reflects a targeted approach to understanding how GSCI is applied within these industries and how it addresses their unique challenges and opportunities. 8% of the data came from SMEs, highlighting the growing awareness of environmental issues within these smaller businesses (19). 5% of the data is from the food industry. Of the three literatures studying the food industry, one is from Taiwan, and the other two studies are based in Thailand. The Thai food industry encounters challenges and opportunities in realizing their commitments to business practices incorporating eco/social-friendly activities (20).

### Thematic synthesis and analysis

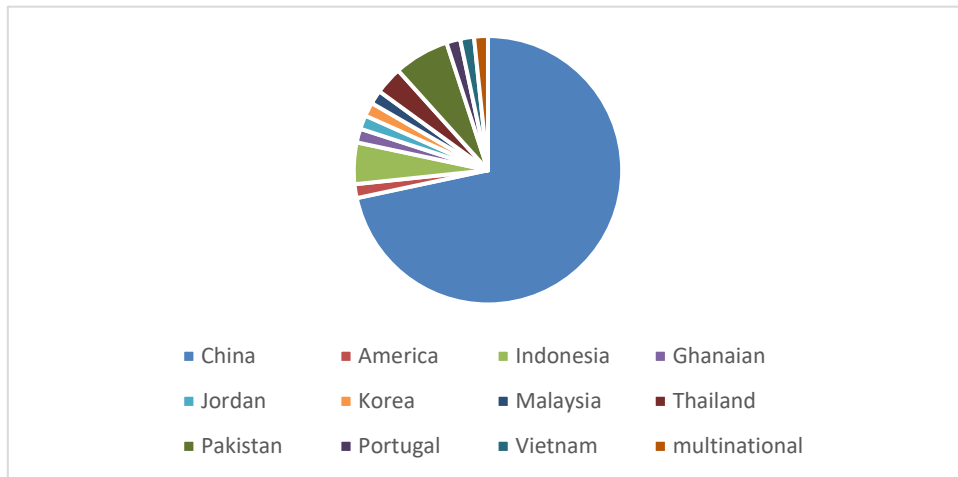
Categorization is foundational for gaining deeper insights into any concept and its practical application. This is a key objective of our literature review. Our paper conducts a thorough analysis of the library of research articles, categorizing them into eight distinct modules, as follows: (a) Definition of GSCI, (b) Division of dimensions, (c) Inter-dimensional relationships; (d) Drivers of GSCI and the mediating role of GSCI; (e) Effects; (f) Theories/Frameworks; (g) Data collection methodology and (h) Data analysis methods.

### Definition of GSCI

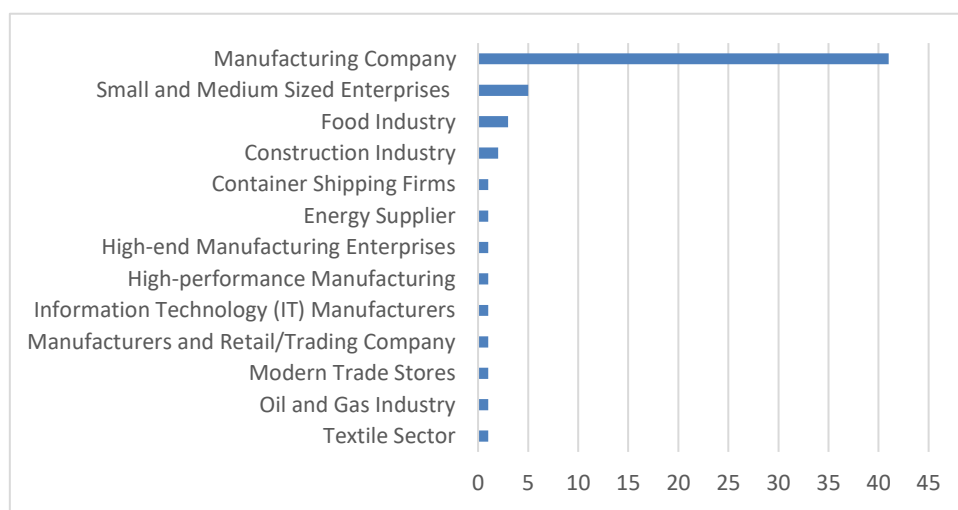
With increased public environmental awareness, GSCI has been proposed based on traditional SCI. Most existing studies on SCI and GSCM have proposed various definitions and dimensions for GSCI from the capability, behavioral, and structural perspectives (21). This lack of consensus highlights the complexity and multifaceted nature of GSCI, a subject of ongoing research and exploration



**Figure 3:** Number of publications per year



**Figure 4:** Countries of data sources



**Figure 5:** Number of publications per application area

From a capability perspective. Based on stakeholder theory, GSCI has been defined as the extent to which manufacturing firms have established strategic relationships with their supply chain partners and have integrated environmental cooperation into intra- and inter-organizational processes (3,16). This is also the definition with the highest acceptance rate (4, 22–24).

From a behavioral perspective. GSCI refers to an inter-organizational environmental integration behavior influenced by the behavior of other actors in the same supply chain network under a green supply chain strategy, emphasizing green collaborative practices in the supply chain (25).

From an organizational structure perspective. Dai *et al.* argued that GSCI is an embedded intra- and inter-organizational integration mechanism that facilitates real-time information sharing across

key functional areas (26).

**GSCI dimension**

GSCI is a multidimensional concept. Song *et al.* highlight the importance of understanding how these dimensions function and operate collectively (27). Examining the dimensions of GSCI can help to systematically understand the differences in influencing factors under different dimensions and help companies take targeted measures to improve their practices. Forty-four of the 61 retrieved literature categorized the dimensions (Table 2). Sixteen empirical research papers primarily concentrated on a single dimension of GSCI. Seven studies are centered solely on green supplier integration (GSI). Three studies exclusively explore green customer integration (GCI). Zhao *et al.* (28) further subcategorized green internal integration (GII)

into green customer process and information integration. Five studies exclusively examine green external integration (GEI). Yin *et al.* (29) and Song, Feng *et al.* (30) categorized GEI into GSI and GCI. Despite the importance of GII, only one paper has specifically analyzed this dimension in

isolation (31). Lyu *et al.* studied Green Supply Chain Information Integration(GSCII) (32). This diverse focus on different GSCI dimensions underscores the concept's complexity and multifaceted nature in the academic research landscape.

**Table 2:** Main variables studied in the literatu

Variable	PCT	No.
GSCI	72%	44
GCI	5%	3
GEI	8%	5
GII	2%	1
GSI	11%	7
GSCII	2%	1

The 44 studies on GSCI categorized GSCI into different dimensions based on different research focuses and subjects (Table 3). There are mainly four dimensions (2%), three dimensions (57%), two dimensions (25%) and one dimension (16%). Existing research generally accepts that GSCI comprises GII, GSI, and GCI (36%). Some scholars

have analyzed GSCI in more detail as a second-order concept, suggesting that the three sub-dimensions can be further reflected in green information sharing, green process coordination, and green strategic alliance (33). This expanded perspective provides a more nuanced understanding of GSCI's multifaceted nature.

**Table 3:** Division of GSCI dimensions

	Dimension	No.
Four-Dimensional	GII, GSI, GCI, Community GSCI	1
Three-Dimensional	GII, GSI, GCI	22
	Strategic Integration, Information Integration, and Operational Integration	1
	Internal Integration, Upstream Integration, and Downstream Integration	1
	Technology Integration, GCI, GSI	1
Two-Dimensional	GEI, GII	4
	GSI, GCI	4
	Internal green practices and external green collaboration	1
	GII、GSI	2
One-Dimensional	GSCI	7

### Inter-dimensional relationships

Although the data showed that 72% of the literature dimensioned the GSCI. However, 79.5% of the studies examined the GSCI as a one-dimensional construct. This one-dimensional approach suggests that many researchers in the field view GSCI as an integrated concept, believing that all three dimensions collectively impact and influence the overall construct of GSCI (3, 4, 34, 35). Only nine (14,8%) of the retrieved literature examined the relationship between the dimensions (Table 4). These studies have explored the interplay between GII, GSI, and GCI from different theoretical perspectives. Several of these studies were based on the process perspective, which suggests that GII lays the foundation for green collaboration with external supply chain partners and is the first step towards GSCI (23, 25, 26, 33, 36, 37). In addition, there are also studies based on different theoretical scenarios, such as social contagion theory and power change theory, which suggest that there will be multiple paths of action between the three dimensions (22, 27, 38).

### Drivers of GSCI and the mediating role of GSCI

A total of 13 (21.7%) of the 60 empirical research

papers were aimed at studying the GSCI or its single-dimensional drivers. Of these, one focused on examining the drivers of GCI. One examined the drivers of GEI, two explored the drivers of GSI, and one examined the drivers of upstream GSCI. 8 articles study the drivers of GSCI as a holistic concept. An essential finding is that the effects of these drivers are often moderated by other factors in most cases, totaling 84.6%. This suggests that various contextual and moderating variables can influence and shape the relationship between GSCI drivers and the overall outcomes. The specific literature and related drivers are detailed in Table 5.

Nineteen research papers, representing 31.6% of the studies, have focused on analyzing the mediating role of GSCI and its dimensions in various relationships, as outlined in Table 6. These studies delve into how GSCI and its dimensions mediate or intermediate the effects of different independent variables, many of which also correspond to the drivers of GSCI or its dimensions. This mediation analysis contributes to a deeper understanding of the intricate relationships and pathways through which GSCI impacts various outcomes and variables within the supply chain context.

**Table 4:** Relationship between GSCI dimensions

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#### Inter-dimensional relationships (Source)

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Internal integration of corporate green product development is positively related to customer integration of corporate green product development (26).

Internal Integration Moderates the Relationship between GCI and Green Innovation Performance, but Not GSI and Green Innovation Performance (38).

GII is the basis of GSI and GCI. In this study, GII positively correlates with GSI and GCI (33).

GSI directly contributes to GII, GCI, and information sharing with suppliers. GII has a positive impact on GCI and financial performance (22).

GII activities contribute to the upstream GSI (36).

Organizations that ignore the critical role of GII may be unable to promote GSI and GCI through BDAC. Organizations that want to improve GEI through BDAC can start by improving GII (25).

GII only indirectly affects green performance through GSI. GII is a driver of GSI (37).

The interaction between GCI and GSI is positively related to financial performance. In contrast, the interaction between GCI and Green GSI negatively affects financial performance (27).

GII may support GSI and GCI by increasing the information capacity. This also means that the three dimensions of GSCI work together somehow (23).

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**Table 5:** Drivers of the GSCI

Drivers	Moderator Variable	Research Variables
Governance Mechanisms	Power and Environmental Uncertainty	GCI
Coercive and Non-coercive powers	Relationship Closeness	GEI
Leader Sustainability Orientation	Organizational Learning Capability	
Big Data Analytics Capability (BDAC)	Data-driven Decision Culture	
Blockchain Technology	Organizational Culture	
Environmental Management	N/A	GSCI
Competitive Pressure		
BDAC	Flexibility- and Control-oriented Culture	
Green Entrepreneurial Orientation	Environmental Leadership	
Supply Chain Ethical Leadership	Perceived Institutional Force	
Green Intellectual Capital	N/A	
Dependence on Supplier	Contract Management Difficulty	GSI
Organisational Conflict	Governance Mechanisms	
Relationship Quality	Green Drivers	upstream GSCI

To summarize, the drivers of GSCI can be categorized into six main areas:

**Stakeholders (18.8%):** Based on the stakeholder theory, stakeholder pressures from customers' environmental demands, government environmental laws and regulations, NGOs' environmental demands, competitors' environmental management pressures, and sustainable supply chain finance can significantly influence GSCI.

**Corporate strategy (15.6%):** Corporate strategic decisions such as green innovation strategy, forward-looking environmental strategy, corporate sustainability strategy, corporate social responsibility, and corporate environmental responsibility significantly impact GSCI.

**Managerial attitudes and motivation (15.6%):** Top management often significantly influences corporate strategy development and the planned implementation of business activities. Leadership cues such as environmental values, environmental orientation, environmental commitment, and sustainability orientation help to shape corporate

behavior by increasing internal knowledge and understanding of corporate environmental sustainability policies, procedures, and practices.

**Knowledge and ability (34.3%):** Environmental knowledge and BDAC are key antecedent variables facilitating GSCI. Four papers have investigated the role of BDAC in facilitating GSCI.

**Relational governance (12.5%):** Firms with good relationship quality are likelier to share information, exchange resources, utilize technology with their partners, and contribute to joint programs to address environmental issues. Relationship norms motivate firms to engage in environmental behavior through self-reinforcement and ethical control.

**Risk factors (3.2%):** GSCI requires close communication and interaction with partners, but due to the rapid changes in the external environment, the high degree of uncertainty makes companies face different risks in implementing GSCM, and these risks can be important factors that can facilitate or hinder companies.

**Table 6:** Mediating role of GSCI

<b>Independent Variable</b>	<b>Moderator Variable</b>	<b>Mediating Variable</b>	<b>Dependent Variable</b>
Communication Capability		GEI	Green and Financial Performance
Internal Green Practices	N/A		Firm Competitiveness
Information Technology Resources		GII	Environmental Performance
Proactive Environmental Strategy		GII, GSI	Environmental Performance
Competitors' Green Success	Organizational Ambidexterity	GSI	Firm Performance
IT Capabilities			Organizational Performance
Green Manufacturing Practice			Sustainable Performance
BDAC			Green Innovation
Main Competitor's Green Success			Environmental Innovation
Perceived Institutional Force, Green Human Resource Management, and BDAC	N/A		Firm Performance
Government Support, Market Greenness			Green Product Innovation
Environmental Knowledge		GSCI	Green Performance
Key Supply Chain Drivers			Supply Chain Sustainability
Green Innovation Strategy			Green Innovation
Human Resource Strategy	Information Systems and Mutual Trust		Economic Performance
Green Intellectual Capital	Relationship Learning Ability, Green Absorptive Ability		Green Innovation
Sustainable Supply Chain Finance	Environmental Leadership		Firm Performance
IoT Capabilities	Energy Consumption Behavior, Green Training		Green Supply Chain Performance
Environmental Orientation	Technology Turbulence		Firm Performance

As research in the field of GSCI has evolved, scholars have begun to realize that the influencing factors discussed earlier do not simply play a direct role in GSCI. Existing literature analyzes the mechanism of influencing factors from two aspects: the discussion of the interaction of key influencing factors and the moderating effect of influencing factors by contextual factors. First,

there is an interaction effect between different influences. Interaction can occur between different antecedents within the same category of influences. For example, Government Support and Market Greenness positively affect green internal and GEI (39). Some scholars have also focused on the interaction effects between influences belonging to different categories. For example,

GSCI depends on the interaction between perceived institutional strength, green human resource management (GHRM), and big data analytic capacity (BDAC) (40). Understanding these interaction effects is fundamental to developing comprehensive and effective strategies for GSCI implementation. Secondly, there is a boundary condition for improving enterprises' GSCI level. In the process

of influencing factors to promote GSCI, environmental factors moderate them. These boundary conditions can determine whether key influencing factors enhance or hinder GSCI; their impact can exhibit heterogeneity in practice. For example, firms can utilize big data technologies and management capabilities to enhance information processing to achieve a higher degree of GSCI.

**Table 7:** Effects of GSCI

<b>Research Variables</b>	<b>Outcome Variables</b>
GCI	Financial Performance
	Opportunistic Behavior
	Green Product Innovation
GEI	Green New Product Development
	Firm Performance
GSCII	Supply Chain Process Ambidexterity
	Performance
	Green Performance
	Green Innovation Performance
	Technology Innovation Performance
	Green New Product Development and Performance
	Sustainable Performance
	Green Innovation
	Financial Performance
	Sustainable Performance
Sustainable Performance	
GSCI	Firm Performance
	Economic Performance
	Sustainable Performance
	Environmental and Cost Performance
	Green Innovation
	Firm Performance
	Green Innovation Performance
	Environmental Innovation
	Environmental Performance
	Environmental Innovation

Furthermore, the critical role of data-driven decision-making culture in influencing the link between BDAC and GSCI must be addressed (26). Therefore, when exploring the antecedent conditions of GSCI, it is necessary to consider both control mechanisms and moderating effects that contextual factors may cause.

**Outcome**

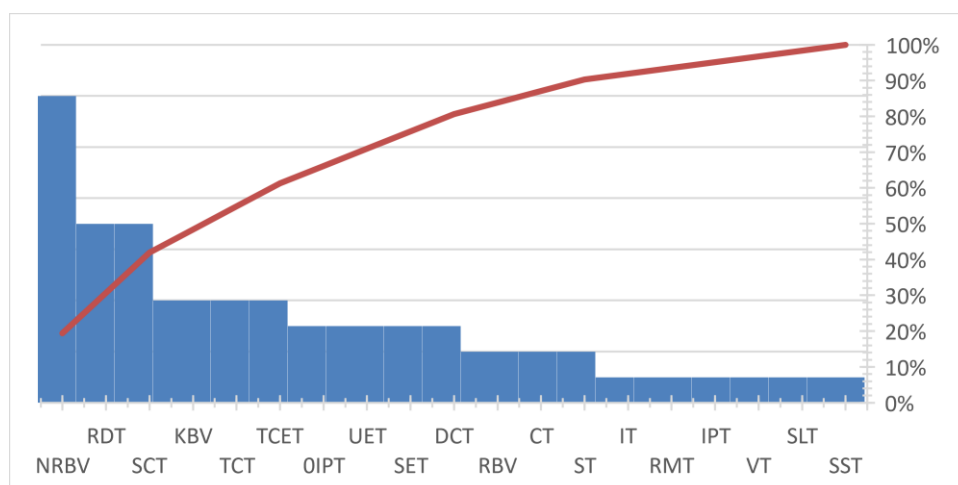
From Table 7, 28 papers aimed to study the effect of GSCI. The breakdown of these studies is as follows: three articles specifically investigate the effect of GCI, three articles are dedicated to examining the role of GEI, one article focuses on understanding the role of GSCII, eighteen articles examine the role of GSCI, three studies on the role of GSI. In addition to examining the direct effects and roles of GSCI, it is noteworthy that GSCI also frequently acts as a mediating variable, as highlighted in Table 8. The role of GSCI is mainly focused on the impact on Performance (51.9%) and Innovation (36%). The top three studies in performance are firm performance (29.6%), sustainable performance (18.5%), and financial performance (22.2%). Setyadi states that sustainable performance contains only economic and environmental performance (41). In comparison, sustainable performance in other literature contains three aspects: economic performance, social performance, and environmental performance. There is no consensus on the impact of GSCI on financial performance (27, 33). The next major concerns in literature are green and organizational performance. The top three different types of

innovation are green innovation (55.6%), environmental innovation (27.8%), and green product innovation (11.1%). The literature mainly analyzes the impact of GSCI on innovation from an organizational learning perspective (3), resource sharing and creation perspective (34), knowledge resource base view (35), and competitive perspective (26).

The literature on GSCI also acknowledges that there can be negative impacts associated with its implementation. Shi *et al.* argue that a paradox exists between GCI and opportunistic behavior (42). On the one hand, based on the TCET, it is argued that GCI may cause opportunistic problems such as concealment of information, evasion of responsibility, and forced modification of contracts. On the other hand, based on SET, it is believed that GCI helps to build trust and commitment between the two parties.

**Theories/Frameworks**

Nineteen theories appear in the 60 empirical research papers (Figure 6). Although most papers use these theories to support GSCI, there is a wide variety of interpretations and applications of the various GSCI elements. The three most commonly used theories are NRBV (20%), RDT (11.7%), and SCT (11.7%). Table 8 explains the acronyms in Figure 4.5. Several pieces of literature utilize the research framework. The main ones include the motivation-opportunity-ability (MOA) framework (39) 、 strategy-structure-environment (SSE) framework (43), and strategy-structure-performance (SSP) framework (36).



**Figure 6:** Commonly used theories in the literature

**Table 8:** Explanation of abbreviations

Abbreviations	Theory
NRBV	Natural Resource-Based View
SCT	Social Capital Theory
RDT	Resource Dependence Theory
TCT	Transaction Cost Theory
TCET	Transaction Cost Economics Theory
KBV	Knowledge-Based View
UET	Upper Echelons Theory
SET	Social Exchange Theory
OIPT	Organizational Information Processing Theory
ST	Stakeholder Theory
RBV	Resource Base View
DCT	Dynamic Capability Theory
CT	Contingency Theory
VCT	Value-Creation Theory
SST	Socio-technical System Theory
SLT	Social Learning Theory
RMT	Resource Mobilization Theory
IT	Institutional Theory
IPT	Information Processing Theory

Figure 7 reveals the number of theories used in the literature. Zhao *et al.* used three theories RDT, SCT, and TCT. 50% of the literature used two theories (44). In contrast, the other 47.6% rely on

a single theoretical foundation. This single-theory approach is common but may need to be improved in providing a holistic and comprehensive understanding of GSCI.

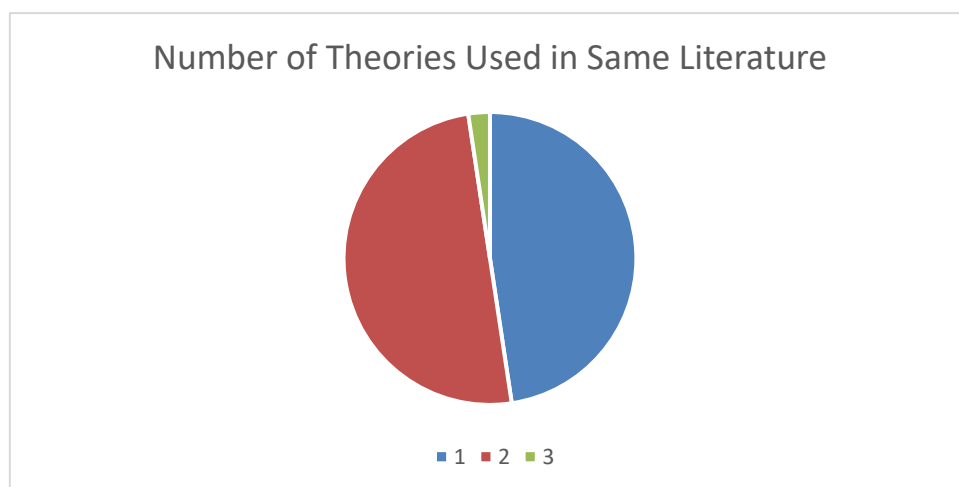
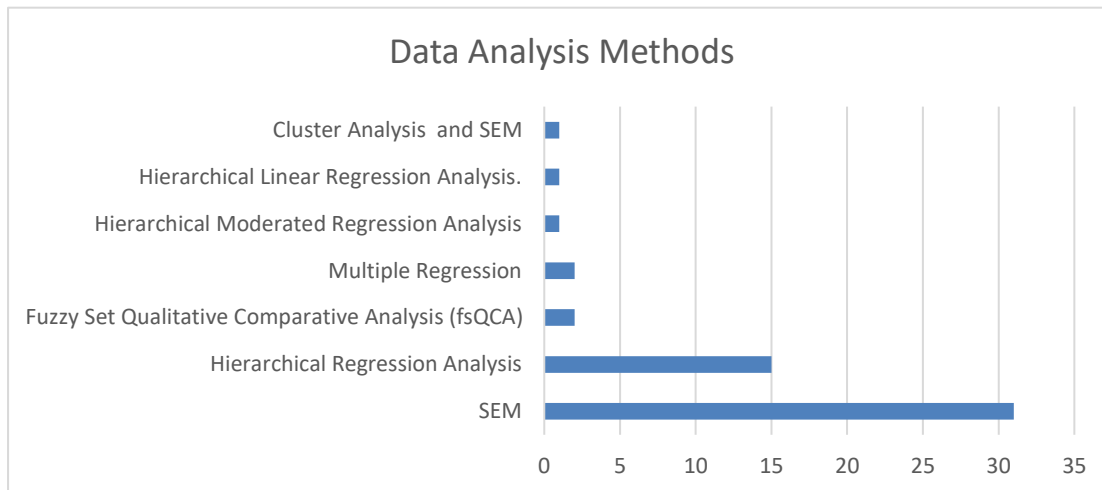


Figure 7: Number of theories used in the same literature



**Figure 8:** Data analysis methods

### Data collection methodology

Of the 60 empirical studies included in this review, only Yang *et al.* used longitudinal data (4). The rest of the literature uses cross-sectional data. Cross-sectional data can limit the explanatory power of causality. While cross-sectional data can provide valuable insights into relationships and associations, it has limitations in establishing causality and capturing dynamic changes over time.

The questionnaires collected in the articles by Long *et al.* (45), Wang & Feng (21), and Feng *et al.* (46) were filled out by two or more individuals in the company to control CMV at the source. However, the author used a common methodology; biases may still affect the accuracy of the findings. In contrast, the questionnaires in the other literature included in this paper were completed by a single person from the respondent's organization. It is recommended that future studies utilize a multi-informant approach to improve validity and reliability.

### Data analysis methods

Figure 8 illustrates the data analysis methods used in 60 empirical research papers. The data analysis method with the highest number is SEM (51.7%). This was followed by hierarchical regression analysis (25%). Five of them used both bootstrapping methods. Two documents used both SEM and hierarchical regression analysis. One used with cluster analysis.

### Discussion

Although existing research is generally based on different research bases, such as GSCM and SCI,

and combines different theoretical perspectives, such as NRBV, RDT, and SCT, the development of GSCI still needs to be improved. However, there still needs to be a more in-depth and comprehensive investigation into the mechanism and process of GSCI. At the same time, there is no consensus on whether the division of dimensions and the relationship between dimensions will have the same impact on enterprises. This has led to conflicting and confusing research results. Further studies can explore how different dimensions of GSCI interact with each other and examine their varying impacts on enterprises.

Some important influencing factors and specific influencing mechanisms still need to be emphasized. For example, the influence of different institutional contexts in different countries. Internal, supply-driven, and demand-driven risks firms face in complex market environments. Under the wave of the digital economy, it is particularly important to explore the relevant impacts of digitalization, digital technology, and digital transformation. It can be seen from the thematic analysis above that research in this area still needs to be improved. GSCI is a complex process driven by different factors and influenced by the synergy of different resources. It requires a multifaceted and holistic perspective. Our understanding of the key drivers still needs to be improved. What factors may harm GSCI need further exploration, and what governance mechanisms can be adopted to mitigate these negative impacts?

This paper also found that different influencing factors may not be independent but synergize

their effects through linkage and matching. Most studies still focus on the net effect of the influencing factors in a compartmentalized manner, ignoring the synergistic effect of multiple factors, which may lead to a certain degree of powerlessness and ineffectiveness of the existing theories in explaining, predicting, and guiding the enterprises to carry out GSCI. Although some studies have focused on the complementary effects of different factors or capabilities, they remain in the methodology of analyzing interaction terms, which is a limitation to exploring the synergistic effects of multiple factors.

There still needs to be greater understanding of how control mechanisms and contextual factors influence the implementation of GSCI. The effects of key influencing factors on GSCI may change depending on the contextual conditions in different practice settings. Only a few contextual factors have been analyzed in the current study, and many important contextual conditions still need to be mentioned. It concludes that the influence of external environmental factors, supply chain relationships, organizational culture, and institutional contexts must be considered to improve GSCI effectively.

The research perspectives on the effect of GSCI are scattered, and there needs to be more strategic perspectives to explore its impact on the long-term development of enterprises. Moreover, existing research on GSCI needs to explore the impact of GSCI on stakeholder value, synergistic advantage, and competitive advantage. Today, with the global wave of sustainable development, social and environmental performance have become key dimensions of corporate value. However, the literature review results show that less literature pays attention to the social aspect of GSCI. Although more literature has paid attention to green innovation, these indicators are only one aspect of corporate environmental performance and cannot reflect the overall environmental quality of the company. The best indicator of corporate environmental performance is pollutant emissions; unfortunately, few companies directly disclose pollutant emission information, or different companies disclose different types of pollutants, resulting in dimensional problems in the analysis.

Existing research suggests that GSCI affects

performance directly or indirectly. However, there may still be some inconsistent results in the practice of GSCI. The negative impact paths should be addressed. The negative effects of GSCI have not received enough attention, and few studies have analyzed the final performance results by combining both positive and negative paths. From the above analysis, the research field on GSCI is mainly concentrated in the manufacturing industry. Due to the different behavioral characteristics of different industry backgrounds, it is difficult to obtain homogeneous data, leading to biased results. Future research can consider the GSCI behavior of a single industry and provide more targeted practical guidance. For example, the pharmaceutical industry and agricultural enterprises.

Current empirical research on GSCI. Its data collection and data processing methods are relatively single. These will have an impact on the results. Future research is necessary to conduct longitudinal studies further to provide more precise evidence of relationships in the literature. It is suggested that future studies use multiple data sources and multiple methods to provide more rigorous findings. Also, a multi-informant approach should be used to increase validity and reliability.

### **Contributions and Limitations**

This paper systematically analyzes the current GSCI literature, focusing on identifying the drivers of GSCI, dimensionality, role results, common theories, data collection, and data analysis methods. A comprehensive list of relevant variables is also presented. This study provides a theoretical foundation for a deeper understanding of the complex antecedents of GSCI. This study also comprehensively analyzes the positive and negative pathways of GSCI. This study provides a dialectical perspective for the discussion of the effectiveness of GSCI in achieving the outcome goals. It inspires supply chain management practitioners to act in an environmentally friendly manner.

The paper also has some limitations. First, our study only documents from two databases, WOS and Scopus. Future studies may include more literature and sources. Second, although the GSCI shows good results in the existing literature, 71.7% of the literature data originates from China.

Therefore, the findings and enablers discussed in the literature may be different in the context of other countries' institutional economies. Third, the ideas presented here are based on existing studies whose perspectives may vary from industry to industry and thus require attention in future research.

## Abbreviations

Nil

## Acknowledgement

Nil

## Authors contributions

All authors have equally contributed.

## Conflict of interest

The authors declare no conflict of interest.

## Ethics approval

Not applicable.

## Funding for the study

No

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