

GREEN SUPPLY CHAIN INTEGRATION: A SYSTEMATIC LITERATURE REVIEW

TÍCH HỢP CHUỖI CUNG ỨNG XANH: TỔNG QUAN TÀI LIỆU CÓ HỆ THỐNG

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Abstract – Green supply chain integration (GSCI) has increasingly played a pivotal role in creating competitive advantage and promoting sustainable development. This study employs a bibliometric analysis approach, supported by VOSviewer, combined with content analysis to identify research trends, knowledge structures, and key themes in the field of GSCI. Based on a Scopus dataset covering the period 2014–2024, the study analyzes citation metrics, keyword co-occurrence, and co-authorship networks to provide a comprehensive overview of GSCI research. The content analysis of 46 systematically selected representative articles reveals that the drivers of GSCI originate from three main groups: external factors, organizational requirements, and firms' internal resources and capabilities. Furthermore, the implementation of GSCI generates positive outcomes for green innovation and firm performance, thereby outlining a comprehensive picture of the formation mechanisms and consequences of GSCI.

Key words – Green supply chain integration; GSCI; antecedents; SLR; drivers

1. Introduction

In light of the increasingly severe impacts of climate change, sustainable development has become a strategic priority for firms [1]. In this context, green supply chain integration (GSCI) has emerged as a strategic approach that enables firms to coordinate effectively with upstream and downstream partners to promote environmental protection practices and pursue sustainable development [2]. GSCI reflects the degree of strategic collaboration among supply chain members through the integrated management of internal and inter-organizational processes aimed at minimizing negative environmental impacts [3], [4]. Through GSCI, firms can exploit and coordinate the resources and capabilities of relevant stakeholders while acquiring diverse knowledge and continuously extending their operational boundaries to develop innovative solutions for environmental protection while maintaining competitive advantage [3], [5]. Therefore, GSCI has become one of the topics that has attracted broad scholarly attention in the field of supply chain management in recent years [6], [7].

However, research on GSCI remains fragmented and lacks systematic consolidation. First, existing studies approach GSCI from various theoretical perspectives, leading to inconsistencies in the conceptualization and measurement of GSCI [8]. Second, there is still no consensus in the empirical literature regarding the effects of GSCI on firm performance, particularly across different

Tóm tắt – Tích hợp chuỗi cung ứng xanh (GSCI) ngày càng đóng vai trò quan trọng trong việc tạo lợi thế cạnh tranh và thúc đẩy phát triển bền vững. Nghiên cứu này dựa trên phương pháp phân tích trắc lượng thư mục với sự hỗ trợ của phần mềm VOSviewer kết hợp với phân tích nội dung để nhận diện xu hướng nghiên cứu, cấu trúc tri thức và các chủ đề trọng tâm trong lĩnh vực GSCI. Dữ liệu Scopus giai đoạn 2014-2024 được phân tích thông qua các chỉ số trích dẫn, đồng xuất hiện từ khóa và mạng lưới đồng tác giả, qua đó cung cấp bức tranh tổng quát về nghiên cứu GSCI. Phân tích nội dung của 46 bài báo tiêu biểu cho thấy các yếu tố tiền đề của GSCI xuất phát từ ba nhóm chính: yếu tố bên ngoài, yêu cầu của doanh nghiệp và nguồn lực, năng lực nội tại. Đồng thời, việc thực thi GSCI mang lại kết quả tích cực đối với đổi mới xanh, hiệu quả hoạt động của doanh nghiệp, qua đó phác họa bức tranh toàn diện về cơ chế hình thành và hệ quả của GSCI.

Từ khóa – Tích hợp chuỗi cung ứng xanh; GSCI; các yếu tố tiền đề; Tổng quan tài liệu có hệ thống; động lực

economic contexts [1], [8]. In addition, the rapid increase in studies linking GSCI with digital transformation and sustainable innovation has been changing the way GSCI is implemented [9], [10]. This highlights the need to synthesize and systematize scholarly knowledge in this field [11]. Therefore, this study employs a bibliometric approach combined with content analysis to: (i) map the development of the field over time and across geographical contexts; (ii) identify thematic research clusters and emerging trends; and (iii) develop an integrated analytical framework of the antecedents and outcomes of GSCI. On this basis, the study proposes future research directions to advance the theoretical and practical development of GSCI in the context of sustainable development.

2. The concept of GSCI

The concept of GSCI emerged from and extends two streams of research: green supply chain management (GSCM) and supply chain integration (SCI) [12]. In essence, GSCI reflects the convergence of SCI principles and environmental management objectives, as manifested in the degree of collaboration and synchronization between firms and their supply chain partners in pursuing sustainability goals through information sharing, process integration, and the co-development of green strategies [13].

Initially, GSCI primarily focused on environmental orientation and the management of internal and external processes from a behavioral perspective, emphasizing the

coordination of environmental activities across internal functions and external actors [2], [5]. However, recent studies have expanded this approach toward a capability-based perspective, highlighting the role of GSCI as a strategic capability that enables firms to integrate resources, strengthen inter-organizational coordination, and enhance adaptability [4], [14], [15].

Accordingly, GSCI not only helps firms reduce emissions and economic costs but also supports sustainability-oriented green supply chain planning [16]. At the same time, it facilitates green innovation [10], [17] and improves firm performance [13], [18]. These benefits indicate that GSCI is not merely an operational practice but has become an important strategic capability in the context of sustainable development.

However, some studies suggest that previous definitions of GSCI remain static and have not adequately addressed how firms, especially those in emerging economies, can respond to the uncertainty and dynamism of the business environment [8], [19]. This indicates the need to further develop theoretical frameworks to explain how firms implement and adapt GSCI in a volatile business environment.

3. Research methodology

This study was conducted using the systematic literature review (SLR) method, combining bibliometric analysis and content analysis to provide a comprehensive and in-depth understanding of the development of the GSCI field, while also analyzing empirical evidence related to its concept, dimensions, and antecedents.

The entire research process was carried out in accordance with the PRISMA guidelines, which help maximize the transparency, reliability, and quality of systematic reviews [20]. The process is illustrated in Figure 1.

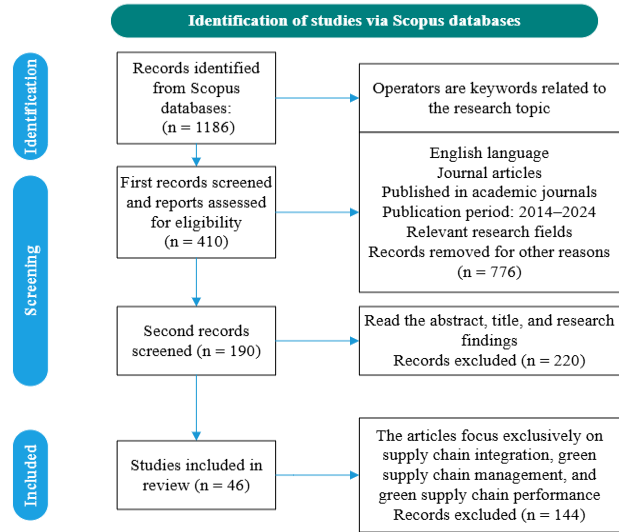


Figure 1. Research process

The research process began with data collection from the Scopus database, one of the most reputable and comprehensive scientific databases [21]. The search strategy was developed around the central research concept, namely GSCI. In the Scopus database, the following search

query was conducted: ("Green" AND "supply" AND "chain" AND "integration") OR "GSCI". This search strategy ensured the retrieval of studies that used the full term “Green Supply Chain Integration” as well as those that used the abbreviation “GSCI”. The search was conducted in January 2025. Initially, 1,186 documents were retrieved from the Scopus database. Subsequently, screening criteria were applied to ensure the relevance and academic quality of the dataset. Specifically, the study focused only on English-language scientific articles published in academic journals between 2014 and 2024 and belonging to the following subject areas: Business, Management and Accounting; Environmental Science; Social Sciences; and Decision Sciences. The selection of the 2014–2024 period was based on the fact that the concept of GSCI is relatively new, and most studies suggest that the first widely recognized concept of GSCI emerged in 2013 [2]. After the initial screening stage, 410 articles meeting the criteria were retained for bibliometric analysis.

Based on the 410 articles retrieved from the Scopus database, the study conducted a bibliometric analysis to assess the development of GSCI through publication and citation indicators, keyword co-occurrence, and research collaboration networks. This analysis provided an overall picture of the research field, identify core themes, prominent research streams, and development trends over time [22], with the support of VOSviewer software. A key advantage of this method is its ability to process large volumes of scholarly data in a systematic and objective manner while requiring fewer resources for data collection [23], [24].

After the bibliometric analysis, the study further conducted an in-depth screening by reading the titles and abstracts of the articles to determine their direct relevance to the GSCI topic. The retained studies had to simultaneously meet the following conditions: (i) focusing directly on GSCI; (ii) examining the dimensions, antecedents, or outcomes of GSCI; and (iii) using a clear theoretical model or research method. Conversely, studies that focused only on SCI, green supply chain management, or green supply chain performance without directly analyzing GSCI were excluded from the dataset. After two rounds of screening, a total of 46 articles that fully met the criteria were selected for in-depth content analysis. The use of explicit inclusion and exclusion criteria helped reduce selection bias in the literature synthesis process.

For the 46 articles selected for content analysis, the study coded and extracted data using a standardized form to ensure a systematic data synthesis process. The coded information included: authors, article title, year of publication, journal, research questions/objectives, theories/research models used, research methods, key research variables, research findings, limitations, and future research directions (see Appendix).

After coding, the studies were classified into three main themes of GSCI, including: (i) the concept and dimensions of GSCI; (ii) the antecedents of GSCI; and (iii) the effects of GSCI on firms. This coding and classification process ensured that the synthesized framework of the antecedents

Table 1. List of articles published in journals

Journal	Number of publications	Article
Sustainability (Switzerland)	06	[26] - [31]
Business Strategy and the Environment	05	[4], [32] - [35]
Sustainable Development	05	[13], [36] -[39]
Journal of Cleaner Production	04	[15], [40], [41], [42]
Cogent Business and Management	02	[43], [44]
Industrial Management and Data Systems	02	[45], [46]
Corporate Social Responsibility and Environmental Management	02	[17], [47]
Australian Journal of Management	01	[48]
Business Process Management Journal	01	[49]
Frontiers in Environmental Science	01	[50]
European Journal of Innovation Management	01	[11]
International Journal of Conflict Management	01	[51]
International Journal of Construction Supply Chain Management	01	[52]
International Journal of Logistics Research and Applications	01	[53]
International Journal of Physical Distribution & Logistics Management	01	[5]
International Journal of Production Research	01	[19]
Journal of Asian Finance, Economics and Business	01	[54]
Journal of Business and Industrial Marketing	01	[55]
Journal of Intellectual Capital	01	[56]
Journal of International Logistics and Trade	01	[8]
Journal of Knowledge Management	01	[10]
Journal of Legal, Ethical and Regulatory Issues	01	[57]
Journal of Manufacturing Technology Management	01	[58]
Logforum	01	[59]
Management Decision	01	[60]
Management of Environmental Quality: An International Journal	01	[18]
Systems	01	[61]

Based on the content analysis of the aforementioned reputable articles, the studies were found to focus on the following main themes.

Definitions and dimensions of GSCI

GSCI is defined and analyzed mainly from three perspectives: capability, behavior, and organizational structure [59]. From the capability perspective, GSCI is

considered the extent to which a firm strategically collaborates with suppliers, customers, and internal departments to meet environmental requirements [4], [19], [36], [53], [57]. From the behavioral perspective, GSCI is understood as environmental integration behavior among organizations in the supply chain network, which involves mutual influence and emphasizes green collaborative practices [5], [46]. From the organizational structure perspective, GSCI includes green integration between organizations, namely customers and suppliers, and within the organization through the integration of products/services, information, capital, and decisions to maximize value for stakeholders [29].

Among the 46 studies, 39 studies classified the dimensions of GSCI, accounting for 85%; four studies focused only on green customer integration (GCI), one study explored only green internal integration (GII), and two studies examined only green supplier integration (GSI). Table 2 below classifies the dimensions of GSCI in the 39 studies on the GSCI variable. Existing studies show that the classification of GSCI dimensions is based on two main approaches: (1) based on integration content, classified into strategic integration, information integration, and operational integration; and (2) based on integration actors, classified into green internal integration (GII), green supplier integration (GSI), and green customer integration (GCI). Currently, most studies on GSCI adopt the second classification and examine GSCI through three dimensions: green internal integration, green customer integration, and green supplier integration [5], [36], [53], [57].

Table 2. Classification of GSCI dimensions

Classification of GSCI	Number of studies
Four-dimensional GSCI: GII, GCI, GSI, and community integration	01
Three-dimensional GSCI by content: strategic, information, and operational integration	1
Three-dimensional GSCI by actor: GII, GSI, and GCI	15
Two-dimensional GSCI: GII and external integration	2
Two-dimensional GSCI: GSI and GCI	6
Two-dimensional GSCI: GII and GSI	1
One-dimensional GSCI: aggregate GSCI	13

Source: Authors’ synthesis, 2025

The above results show that most current studies consider GSCI a multidimensional construct, but the degree of separation among dimensions remains uneven. The fact that many studies still measure GSCI as an aggregate variable may obscure the different impact mechanisms of each dimension. Therefore, future studies need to analyze more clearly the distinct roles of GII, GSI, and GCI.

Foundational theories used

In studies on GSCI, scholars have applied various theoretical foundations to define the concept, identify its components, and develop research models to measure the role of GSCI in firms. A synthesis of 46 related studies reveals considerable diversity in the theories used in this field. Although most studies use these theories to support

GSCI research, there are many different interpretations and applications of the components of GSCI. Among them, the most frequently used theories are the Natural Resource-Based View, Dynamic Capabilities Theory, and Resource Dependence Theory.

For studies aiming to explain the antecedents of GSCI, the synthesis results show that the theoretical system used is relatively diverse, with a stronger tendency to focus on behavioral factors and relationships among stakeholders. Specifically, theories such as Social Exchange Theory and Stakeholder Theory are commonly applied to explain the role of trust, collaboration, and pressure from supply chain partners in the formation of GSCI. Meanwhile, theoretical foundations that emphasize internal organizational capabilities, such as Dynamic Capabilities Theory and the Resource-Based View, are mentioned less frequently in this group of studies. This may suggest an imbalance in approaches to GSCI between the perspective of inter-organizational relationships and firms' internal capabilities.

Studies in the group examining the effects of GSCI on firms show that the theoretical system used is quite diverse and consistent with the complex nature of the relationship between GSCI and firm performance. Notably, the theoretical trend has shifted from traditional foundations such as the Resource-Based View to more modern theoretical frameworks such as Dynamic Capabilities Theory, the Natural Resource-Based View, and Institutional Theory. This shift reflects scholars' efforts to provide a deeper explanation of the drivers of change and the role of environmental context in shaping and amplifying the effects of GSCI on firm performance.

Antecedents of GSCI

First, the dimensions of GSCI can be driven by external factors, such as government, market conditions [58], competitors' success [34], and relationships with suppliers [31]. Individuals or groups of stakeholders may use various forms of influence, such as exerting pressure or providing incentives, to achieve environmental protection goals, thereby affecting firms' GSCI. In addition, there are also obstructive factors that negatively affect environmental collaboration. Accordingly, when relationship conflict occurs between customers and firms, the ability to achieve green customer integration decreases [51], and firms need a high level of commitment to mitigate this negative effect. However, most current studies have focused only on individual factors from the external environment or relationship quality to explain the formation of GSCI, without comprehensively considering the combined mechanism between external pressures and relational attributes in promoting firms' green actions. In addition, stakeholder pressure may also originate from customer pressure and social pressure, in which the public and non-governmental organizations (NGOs) play an important role in firms' environmental strategies [62] and a key role in decision-making related to firms' environmental social responsibility [63]. These aspects have not yet received sufficient research attention.

The second group of antecedents arises from firms'

internal requirements including environmental awareness attitudes, and strategies. From the perspective of leadership awareness, scholars have shown that when leaders have a stronger sustainability orientation, they tend to adopt a strategic collaborative approach to address environmental issues through integration mechanisms [47], [55]. When firms have a clear green strategic orientation, supply chain members can be deeply integrated into environmental initiatives, thereby providing key resources and capabilities for both exploitative and exploratory innovation [27], [28]. Supply chain partners tend to learn from focal firms when these firms demonstrate integrity, set high standards, and actively participate in green supply chain activities [53]. The implementation of environmental strategies is also promoted through green strategic alliances in the supply chain [17], and green human resource strategies that empower employees and promote teamwork contribute to strengthening green supplier and customer integration [45]. In addition, when manufacturing firms adopt supply chain finance solutions to provide financial resources to supply chain partners, these partners, in return, cooperate in implementing GSCI [13]. Thus, studies have confirmed that GSCI is not only the result of green awareness and attitudes but also a key mediating mechanism connecting strategic, financial, and organizational factors in the sustainable development process.

The third group affecting GSCI originates from firms' internal resources and capabilities. In the global context of moving toward sustainable development, recent studies have emphasized the critical role of technological, data, and knowledge capabilities in promoting GSCI. Specifically, big data analytics capability (BDAC) has been shown to be an important foundation that helps firms enhance visibility and collaboration, thereby improving the level of green integration [11], [49]. In addition, information technology (IT) capability, including both traditional IT and emerging technologies such as blockchain, contributes to enhancing transparency, traceability, trust, and long-term collaboration among supply chain partners, thereby promoting green integration and environmental performance [32], [41], [59]. Moreover, green intellectual capital, especially green structural capital and green relational capital, together with transformational capability, has been identified as an important intangible asset that determines the ability to achieve sustainable integration in the supply chain [38], [56]. Green operations management capability and cultural management capability have also been shown to have significant effects on GSCI [40], [52]. However, Feng and Sheng [35] proposed that firms should combine big data capability, green human resource management, and balanced institutional pressure to achieve a higher level of GSCI. Overall, studies in this group show that GSCI is formed and reinforced through the development of data, technological, and green knowledge capabilities, as well as governance and collaboration mechanisms among actors in the supply chain.

The coding results of 46 studies show that the antecedents of GSCI can be grouped into three main categories: external factors originating from stakeholders, firms' internal requirements, and organizational

resources/capabilities (Table 3). Most antecedents appear only once, except for big data analytics capability [11], [46], [49].

Table 3. Groups of GSCI antecedents

Antecedent group	Representative variables
Stakeholder pressure	Government support, market greenness [58], competitors' success [34], relationship quality [15], relationship conflict [51] ...
Firms' internal requirements, including cognition and attitudes	Lean practices [38], strategic alliance [17], ethical leadership [53] ...
Organizational resources and capabilities	Blockchain technology [32], big data analytics capability [11], green intellectual capital [56] ...

Source: Authors' synthesis, 2025

The synthesis results show that early studies on GSCI often approached the topic from the perspective of external pressure. However, recent studies have tended to shift toward cognitive and capability-based perspectives, emphasizing that GSCI is not only a response to environmental pressure but also a strategic capability that enables firms to integrate knowledge, technology, and inter-organizational resources.

Effects of GSCI on Firms

Current research on the effects of GSCI focuses on two core aspects: promoting innovation activities and enhancing firms' overall performance. However, the impact mechanisms, the role of each GSCI dimension, and contextual conditions vary considerably across studies.

First, regarding the relationship between GSCI and green innovation, most studies agree that GSCI plays a central role in promoting activities related to improving existing products or processes to reduce negative environmental impacts, as well as creating new environmentally friendly products, services, or processes [37], [43]. Early approaches emphasized learning and knowledge exchange mechanisms, arguing that GSCI helps firms internalize knowledge from suppliers and customers and combine it with internal knowledge to create green products and processes [37]. Subsequent studies expanded this perspective to environmental strategy, suggesting that GSCI becomes a capability that promotes stronger exploratory innovation when firms have a clear green strategic orientation or are influenced by external factors [56], [58].

In parallel, recent studies have emphasized the role of strategic collaboration, technology, and institutions in the relationship between GSCI and green innovation. Accordingly, green strategic alliances have been shown to be an important antecedent that promotes GSCI and thereby helps improve and advance green products and green processes [17]. Digital technologies such as blockchain and BDAC not only support operations but also enhance knowledge integration and resource reconfiguration capabilities, thereby strengthening the effect of GSCI on green innovation [10], [11]. At the micro level, the effects of green supplier integration and green customer integration on different types of innovation also depend on information-sharing mechanisms and quality

[48]. Nevertheless, current studies mainly examine green innovation at an overall level or distinguish between exploratory and incremental innovation, while green product innovation has not yet been analyzed in depth as a distinct type of innovation.

Second, regarding the relationship between GSCI and firm performance, empirical evidence generally confirms that GSCI is an important foundation for improving firms' financial performance, environmental performance, and sustainable performance, although the impact mechanisms are not uniform. Many studies show that GSCI plays a mediating role in transforming antecedents such as environmental orientation, sustainable supply chain finance, and IT capability into firm performance outcomes [13], [36], [41]. However, the roles of each GSCI dimension differ. While green customer integration and green supplier integration often create direct and evident effects on financial and environmental performance, green internal integration mainly plays an indirect role through innovation and information sharing [4], [26].

In addition, the effects of GSCI on firms depend strongly on contextual conditions such as firm size [29], institutional pressure [35], and market competition [34]. Studies based on the resource and dynamic capability perspectives indicate that GSCI can only be truly effective when supported by IT infrastructure, relational capability [41], innovation culture, and organizational trust [54]. In the context of emerging economies, some evidence suggests that the role of green supplier integration may be more prominent than that of green customer integration in improving environmental and sustainable performance [40].

The effects of GSCI examined in existing studies are quite diverse but can be grouped into two main categories: innovation and performance. Figure 5 shows the frequency of GSCI outcome variables. These outcomes include innovation, environmental, economic, operational, and social aspects, reflecting the multifaceted nature of GSCI's impact on firms.

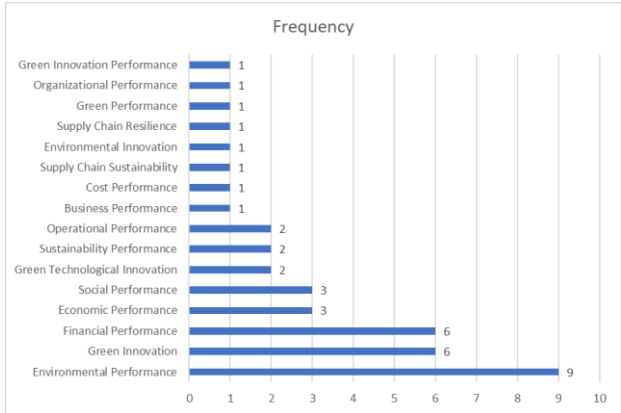


Figure 5. Frequency of GSCI outcome variables

Source: Authors' synthesis, 2025

Comparison among GSCI dimensions

An important finding drawn from the 46 studies is that the three GSCI dimensions do not create value through the same mechanism. GII serves as the foundation for

firms’ internal coordination and is a prerequisite for the effective implementation of external integration activities, namely GSI and GCI [19]. GSI has been studied mainly from the perspective of collaboration with upstream partners to improve environmental performance [1], whereas GCI reflects the ability to connect with customers’ green needs [48].

Regarding the effects of GSCI on green innovation, all three GSCI dimensions promote innovation, but the mechanisms and types of innovation they affect differ. GII promotes innovation through both internal knowledge exchange and knowledge combination; GSI mainly affects innovation through knowledge combination with supply partners; whereas GCI is stronger in information exchange with the market [37]. GCI tends to promote radical environmental innovation more strongly than GSI due to its direct capture of changes in customer needs [48]. By contrast, GSI plays an important role in improving process innovation by leveraging new technologies and materials from suppliers [39].

Regarding the effects of GSCI on firm performance, the impacts of GSCI dimensions on financial and environmental performance differ significantly. GCI and GSI often have more direct and evident impacts on profitability than GII [26]. GSI is a key dimension that helps control ecological impacts from the supply side and strengthen supply chain resilience against environmental uncertainty [39]. GII, in contrast, plays an important mediating role in transforming infrastructure resources, such as IT, into actual environmental outcomes [59]. An important difference is that while the combination of GII and GCI generates positive financial performance, the interaction between GII and GSI may sometimes lead to negative effects on financial performance due to increased management costs and resource conflicts [30].

The above results show that GII, GSI, and GCI should not be regarded as dimensions with homogeneous effects. Measuring GSCI as an aggregate variable may obscure important differences among impact mechanisms. This may be one reason why current empirical studies have not reached full consensus on the effects of GSCI on firm performance.

Research methods used

Among the 46 synthesized studies, 43 used quantitative empirical research methods, two used qualitative methods, and one used a mixed-methods approach. Survey data were collected from manufacturing firms or logistics firms. Commonly used analytical techniques included SEM [4], [19], [26], [32], PLS-SEM [11], [18], [61], and configurational analysis methods. Most studies used firm-level data collected from middle or senior managers, which helped increase data reliability because the respondents had direct knowledge of the firms’ environmental strategies, supply chain activities, and business performance.

However, the synthesis shows that most studies used cross-sectional data. The use of cross-sectional data may limit the ability to explain causal relationships. In addition, the studies mainly focused on manufacturing firms in

China, with 31 out of 46 studies, while studies in other contexts such as India [10], Jordan [11], Indonesia [54], or other developing countries remain relatively limited. According to Institutional Theory, firm behavior and strategy are significantly influenced by the institutional environment in which firms operate, including regulatory systems, social norms, and stakeholder pressures [64]. Due to differences across countries in economic development levels, industry structures, technological capabilities, and environmental policy frameworks, the influence of antecedents as well as the effectiveness of GSCI may not be entirely the same. Therefore, findings mainly developed from the Chinese context need to be further tested in other emerging economies, including Vietnam, to assess the stability and generalizability of the relationships established in the existing literature.

Integrated framework of the antecedents and outcomes of GSCI

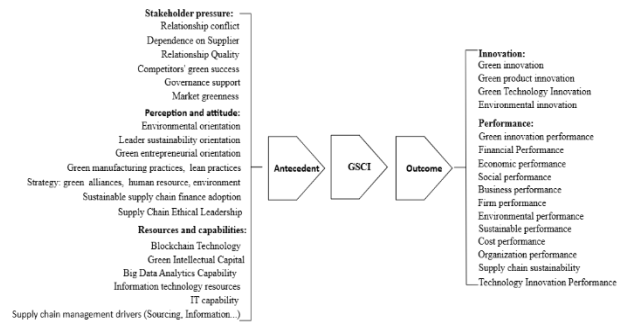


Figure 6. Antecedents and outcomes of GSCI

Source: Authors’ synthesis, 2025

The coding and content analysis results of the 46 selected studies provide the direct basis for developing the integrated framework in Figure 6. By comparing research variables, directions of influence, and empirical findings across studies, the antecedents of GSCI can be classified into three main groups: (i) stakeholder pressure; (ii) firms’ internal factors, such as cognition and attitudes related to the environment and sustainable development; and (iii) organizational resources and capabilities. Conversely, the outcomes of GSCI fall into two main groups: innovation and firm performance. Accordingly, the proposed framework not only systematizes the factors that have been studied but also reflects the empirical relationships identified through the systematic synthesis and comparison of 46 studies, thereby clarifying the connection between the literature review results and the structure of the research framework.

5. Conclusion

This study reviewed and analyzed the development of the GSCI field through a bibliometric approach. Based on data collected from Scopus for the period 2014–2024, the results show that GSCI has become an increasingly prominent research topic, particularly in the context of sustainable development and growing pressure to reduce environmental impacts in global supply chains. The substantial increase in the number of publications, the expansion of research across multiple countries, and the

increasingly close academic collaboration network reflect the high level of interest among the scientific community in the strategic role of GSCI in sustainable development. The results of science mapping analysis show that research on GSCI is shifting from traditional approaches toward integrated models that combine digital transformation, sustainable innovation, and financial performance, thereby reflecting the strategic role of GSCI in modern supply chain management.

The analyses identified influential authors, institutions, and countries in the field, while also highlighting the foundational theories used and the main research thematic clusters, including the definition and components of GSCI, the antecedents of GSCI, and the effects of GSCI on environmental performance, economic performance, and green innovation capability. These findings indicate that the theoretical foundation of GSCI has been relatively firmly established.

This study contributes to the academic literature by providing a comprehensive picture of the knowledge structure of GSCI, thereby helping to systematize existing research directions and identify important research gaps. These findings not only support researchers in positioning the topic but also provide a foundation for developing more integrated theoretical models in the future. The study also identifies several notable gaps.

First, although the role of stakeholder pressure has been confirmed, current studies mainly examine such pressures separately and have not fully analyzed the simultaneous effects and synergistic effects among pressure groups, even though these pressures may coexist and generate synergy [65]. At the same time, studies often approach GSCI as a single construct rather than analyzing the differential effects of each type of pressure on each dimension of integration.

Second, studies on the antecedents of GSCI have largely focused on external drivers and “hard” resources such as capital and technology, while the role of “soft” resources and capabilities, such as organizational culture, learning capability, inter-organizational coordination capability, and environmental leadership capability, has not been fully explored. This limits the ability to explain differences in the level of GSCI among firms within the same research context.

Third, from the outcome perspective, most studies have only established the direct relationship between GSCI and innovation outcomes or firm performance, whereas mediating mechanisms, especially the role of green product innovation, have received limited attention. Compared with process innovation, green product innovation requires a higher level of integration in information sharing and technological coordination [58]. In addition, the role of moderating factors such as industry competition, environmental policies, and technological level in the relationship between GSCI and firm performance has not been sufficiently examined.

Fourth, existing studies also show that GSCI may directly or indirectly affect firm performance. Firms expect that through GSCI, they can address pollution and energy

consumption issues, thereby improving environmental, financial, and social performance. This positive effect has been demonstrated in many manufacturing industries [42], [59]. However, the negative effects of GSCI have not received adequate attention. Some scholars have recognized that, under specific circumstances, environmental leadership weakens the positive impact of sustainable supply chain finance on GSCI [13], or that technological turbulence negatively moderates the relationship between internal environmental orientation and GSCI [36]. Therefore, future studies need to clarify the positive and negative pathways in the mechanism through which GSCI affects firm performance, thereby guiding firms to strengthen positive mechanisms and mitigate negative effects, thereby enhancing GSCI's contribution to sustainable development.

Fifth, most current empirical evidence is concentrated in China, which limits the generalizability of findings to other emerging economies where supply chain structures, levels of stakeholder pressure, and environmental policy frameworks differ considerably [27]. In Vietnam, although the pressure for green transformation is increasing, studies on GSCI remain limited and have not clarified the links among stakeholder pressures, GSCI, green product innovation, and firm performance.

Finally, in terms of methodology, 43 out of 46 studies used quantitative research methods based on cross-sectional data, while longitudinal studies, mixed-methods approaches, and qualitative research remain limited. The strong reliance on cross-sectional data may constrain the ability to infer causal relationships and may not fully reflect the dynamic nature of changes over time.

Overall, this study has systematized existing research on GSCI and clarified several characteristics of the knowledge structure in this field. The synthesis results show that previous studies have mainly focused on the overall impact of GSCI, while differences in the roles and impact mechanisms among GSCI dimensions have not been fully analyzed. At the same time, research on GSCI is shifting from an approach based on environmental pressure to one that emphasizes the role of dynamic capabilities, digital technologies, and green innovation. In addition, the synthesis results also show that most current empirical evidence has been developed in the Chinese context, highlighting the need to re-examine these relationships in other emerging economies, including Vietnam.

6. Limitations and future research directions

This study has systematized and analyzed related studies from three perspectives: the concept and content of GSCI, its influencing factors, and its impacts. On this basis, the study developed a research framework and proposed research gaps. A comprehensive list of relevant variables is also presented, providing a dialectical perspective for discussing the effects of GSCI on firms.

This study also has several limitations. First, this study included only English language articles retrieved from the Scopus database. Although Scopus has broad coverage of academic journals, limiting the data source may have led to

the omission of some relevant studies published in other databases, such as Web of Science, as well as studies published in other languages, especially theoretical works or in-depth industry-specific studies. Therefore, the scope of the synthesized evidence may not fully represent the entire body of knowledge on GSCI, thereby limiting the comprehensiveness and generalizability of the research findings. Future review studies may expand the scope of data collection and incorporate multilingual sources to provide a more comprehensive understanding of the development of GSCI research.

Second, although GSCI shows positive effects on firm performance, nearly 70% of the existing literature originates from China. Therefore, the findings and supporting factors discussed in the literature may vary across the institutional contexts and economic conditions of different countries. This limits the generalizability of the research findings to developed economies or emerging economies outside China.

Finally, due to the nature of review research, the findings are mainly derived from synthesizing and interpreting results from existing studies, most of which use cross-sectional data and quantitative methods. This means that the current literature remains limited in reflecting the dynamic nature of GSCI and the evolution of integration mechanisms over time. Future review studies may further classify existing works according to research design and data type, thereby clarifying methodological approaches and trends in the field of GSCI.

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