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Manufacturing Supply Chain Resilience Amid Global Value Chain Reconfiguration: An Enhanced Bibliometric–Systematic Literature Review

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Abstract

Global Value Chains (GVCs) have driven the worldwide dispersion of manufacturing but remain highly vulnerable to macro-level shocks, including financial crises, geopolitical tensions, and the COVID-19 pandemic. These shocks expose manufacturing supply chains (MSCs) to systemic risks, but limited research has explored how GVC reconfiguration mediates their impact on manufacturing supply chain resilience (MSCR). To address this gap, this study conducts an enhanced bibliometric–systematic literature review (B-SLR) of 120 peer-reviewed articles. The findings reveal that macro-level shocks induce GVC reconfigurations along geographical, value, and governance dimensions, which in turn trigger MSCR through node- and link-level mechanisms. MSCR represents a manufacturer-centered capability that enables MSCs to preserve, realign, and enhance value amid shocks. Building on these insights, this research proposes a multi-tier strategy encompassing firm-level practices, inter-firm collaborations, and policy interventions. This study outlines three key contributions. First, at the theoretical level, it embeds MSCR within a GVC framework, clarifying how GVC reconfiguration mediates SCR under macro-level shocks. Second, at the methodological level, it ensures corpus completeness through snowballing and refines bibliometric mapping with multi-dimensional visualization. Third, at the managerial level, it provides actionable guidance for firms, industry alliances, and policymakers to align MSCR strategies with the dynamics of global production networks.

Keywords: manufacturing; supply chain resilience; global value chain; bibliometric–systematic literature review; CiteSpace co-occurrence analysis

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1. Introduction

Global Value Chains (GVCs) have transformed manufacturing by enabling firms to coordinate production, sourcing, and distribution across multiple countries, thereby optimizing cost, efficiency, and innovation [1,2]. However, the structural fragility of these globally dispersed networks has become increasingly evident under macro-environmental shocks, including financial crises, geopolitical tensions, and the COVID-19 pandemic [3,4]. Manufacturing firms are particularly vulnerable due to high process complexity, capital-intensive operations, tightly coupled production sequences, and multi-tier supplier networks, highlighting the critical importance of supply chain resilience (SCR) in mitigating these vulnerabilities [5–7].

The concept of SCR has emerged as a critical framework to understand how supply chains anticipate, absorb, and recover from shocks while maintaining operational conti-

nuity and competitive advantage [8–10]. Early studies primarily focused on firm-level attributes—flexibility, redundancy, agility, and collaboration—enhancing responsiveness to unforeseen events [11–13]. Subsequent studies have broadened this perspective by incorporating dynamic capabilities, adaptive learning, and managerial practices, thereby allowing resilience to evolve beyond static attributes into a process-oriented and context-sensitive capacity [14–16]. The adoption of Industry 4.0 technologies, together with the implementation of recovery policies, further reflects the growing complexity of supply chain processes and management requirements, highlighting the inherently multi-dimensional nature of resilient supply chains [17–22]. Moreover, complementary bibliometric and systematic reviews have systematically mapped the SCR literature in relation to disruption risks, uncertainties, and supply chain vulnerabilities, providing structured insights into the evolution of key concepts and research trends at both macro- and micro-levels (Appendix A, Table A1) [23–29].

Despite these contributions, three critical gaps remain. First, most studies focus on firm-level practices or network optimization without adequately integrating GVC reconfiguration into SCR analysis. Second, existing reviews often overlook the unique characteristics of manufacturing supply chains (MSCs) embedded within GVCs, such as production complexity, multi-tier dependencies, and the adoption of advanced technologies. These gaps prevent existing studies from fully capturing the impact of macro-environmental shocks on manufacturing supply chain resilience (MSCR). Third, existing systematic reviews on SCR often rely on either narrative synthesis or single-method bibliometric mapping, providing limited methodological integration through bibliometric–systematic literature reviews (B-SLR).

Addressing these gaps is increasingly critical in a volatile global environment where shocks propagate rapidly and MSCs must operate securely and continuously. To explore the interplay between macro-environmental shocks, GVC reconfiguration, and MSCR, this study employs an enhanced B-SLR that systematically integrates the relevant literature. Specifically, the study explores two central research questions:

RQ1: How does GVC reconfiguration mediate the effects of macro-environmental shocks on MSCR?

RQ2: What multi-tier strategic frameworks can strengthen MSCR in the context of GVC reconfiguration?

This study makes three contributions. Theoretically, it embeds MSCR within the GVC framework, highlighting GVC reconfiguration as the mediating mechanism linking macro-level shocks to firm-level adaptive capabilities. Methodologically, it advances systematic review research through an enhanced B-SLR approach that integrates snowballing with multi-dimensional visualization, enabling a more comprehensive corpus and deeper detection of thematic evolution and conceptual interdependencies. Managerially, it develops a multi-tier framework (node–link–policy) that operationalizes MSCR under GVC reconfiguration. This framework aims to guide firms, industry alliances, and policymakers in aligning resilience strategies with the configuration of global production networks.

The remainder of this study is structured as follows: Section 2 develops the conceptual framework; Section 3 outlines the methodology; Section 4 presents the bibliometric analysis results; Section 5 provides a systematic review of the identified research clusters; Section 6 discusses the implications and future research directions; and Section 7 concludes the study.

2. Conceptual Framework

To provide a solid conceptual foundation, this section develops the framework underpinning the analysis (Figure 1). Macro-environmental shocks act as external drivers that reconfigure GVCs. Since supply chains operationalize the value embedded in GVCs, the

GVC reconfiguration inherently reshapes SCR. Against this backdrop, MSCR transcends the traditional boundaries of SCR and represents a value-oriented capability.

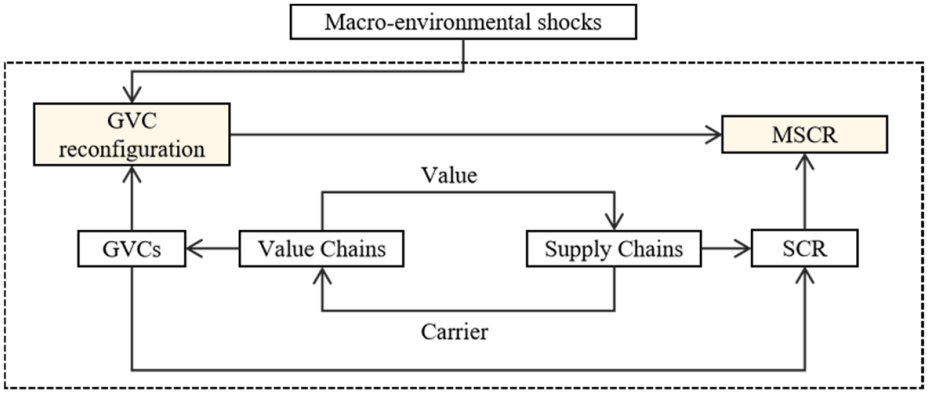


Figure 1. Conceptual framework.

2.1. GVCs

A value chain encompasses all activities undertaken by firms and industries to bring a product from conception to end use [30]. GVCs extend this concept across multiple countries, allowing firms to coordinate production, sourcing, and distribution internationally to optimize cost, efficiency, and innovation [1,2,31]. They represent a complex network of inter- and intra-firm relationships, which, through fragmentation and geographic dispersion, enable the specialization, comparative advantage, and integration of diverse capabilities [32,33]. Recent macro-environmental shocks have accelerated GVC reconfiguration, resulting in more regionalized production layouts, diversified governance structures, and increasingly fragmented value distribution patterns [34–37]. Consequently, GVCs provide a critical lens to understand how global shocks reshape industrial organization and redistribute value across countries and sectors [38,39].

2.2. SCR and MSCR

A supply chain is the interconnected network of firms, resources, activities, and information involved in delivering a product from suppliers to end customers [40,41]. SCR captures a supply chain's capacity to anticipate, absorb, adapt to, and recover from disruptions while maintaining operational continuity and competitive advantage [8–10]. Core attributes include agility, redundancy, flexibility, and visibility [14,42], supported by firm-level strategies and inter-firm coordination mechanisms to mitigate diverse shocks [12,23]. Understanding SCR requires considering the structural and relational complexity of supply chain networks (SCNs), which coordinate flows of goods, information, and resources across multiple tiers [5,43–45].

Manufacturing, as the most complex and mature segment within GVCs, exhibits unique structural and functional characteristics [46,47]. MSCs are distinguished by production complexity, multi-tier dependencies, and the adoption of advanced technologies, which confer efficiency advantages but also generate vulnerabilities during GVC reconfiguration [47,48]. Accordingly, MSCR constitutes a strategic capability that not only mitigates shocks but also sustains long-term competitiveness, preserves value, ensures supply continuity, and fosters innovation across multi-tier manufacturing networks [7,49].

2.3. Linking Value Chains and Supply Chains

Value chains and supply chains are deeply intertwined within global production networks [50]. Value chains emphasize the strategic creation and capture of value, while supply chains serve as operational carriers that realize this value through the flow of

products, information, and resources [35,51]. Their interaction takes shape both within firms (nodes) and within inter-firm connections (links), encompassing logistics channels, information flows, and contractual frameworks [52–54]. GVC reconfiguration mediates how firms recalibrate their SCR strategies under macro-environmental shocks, as they respond to shifting value flows and cascading effects initiated by lead firms [55].

2.4. The MSCR Within the GVC Framework

From a GVC perspective, MSCR is a manufacturer-centered capability, enabling MSCs to preserve, realign, and enhance value amid shocks, ensuring secure and continuous operations [3,56]. This integrative view extends beyond conventional SCR by linking firm-level strategies with systemic GVC reconfiguration. Value preservation safeguards existing flows through redundancy and buffering [6,12]. Value realignment emphasizes the strategic repositioning of production and sourcing across regions to sustain continuity and mitigate disruption risks [16,25]. Value enhancement highlights opportunities embedded in shocks, enabling technological, organizational, or strategic upgrading [57,58]. Integrating these dimensions demonstrates that MSCR extends beyond recovery to strategic advancement within reconfigured GVCs [59,60].

3. Methodology

To address limitations in traditional literature reviews, an enhanced B-SLR was conducted, combining 120 peer-reviewed articles from the Web of Science Core Collection with CiteSpace co-occurrence analysis (Figure 2).

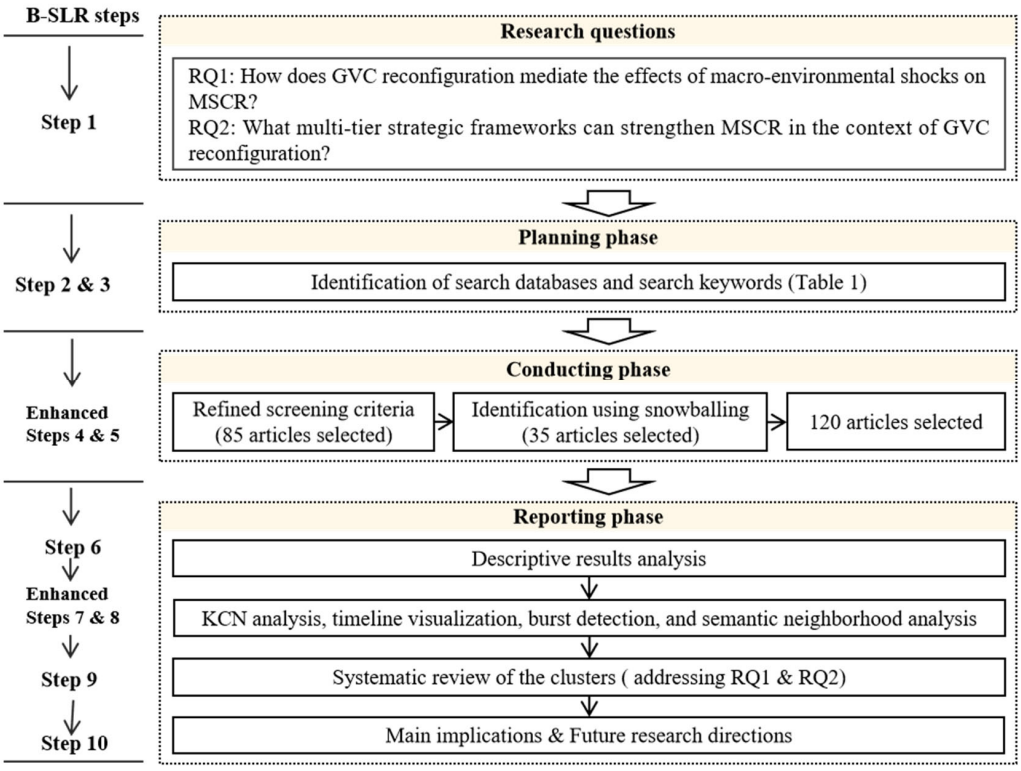


Figure 2. Methodological framework. For a detailed description of the B-SLR methodology, refer to [61,62].

By incorporating triangulation, the B-SLR methodology enhances research rigor, a capability supported by validation in prior studies [61]. Unlike narrative reviews, it ensures transparency, replicability, and bias minimization through structured phases: planning, conducting, and reporting [63,64]. Methodological robustness was further strengthened by

forward and backward snowballing [65] and advanced visualization techniques including keyword co-occurrence network (KCN), timeline analysis, burst detection, and semantic neighborhood mapping. Methodological quality was assessed using the ROBIS tool, with independent evaluations indicating low bias risk. The protocol was registered with PROSPERO (CRD420251128597) on 19 August 2025 and conducted in accordance with PRISMA guidelines. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) Checklist is available for download in the Supplementary Materials.

3.1. Planning Phase

An iterative keyword refinement process was implemented [66]. Initial terms ("global value chain" AND "manufacturing supply chain resilience") were screened and optimized, culminating in the formalized criteria detailed in Table 1. Given that the earliest publication identified in our preliminary search was from 2002, the search parameters were set to commence from that year. To ensure a complete annualized dataset and prevent statistical bias in CiteSpace quantification, the end year was extended through 2024. The Web of Science Core Collection was selected to guarantee source quality and rigor, as peer-reviewed articles provide validated and credible evidence. To achieve comprehensive retrieval and mitigate potential omissions associated with simultaneously using multiple keyword sets, the search strategy was subdivided into discrete conceptual groups of keywords. Each group was executed independently, after which the results were merged and deduplicated.

Table 1. Search criteria.

Search Condition	Description
Boolean operations	OR, AND, NOT
Search scope	Topic: title, abstract, and indexing
Language	English
Time limit	January 2002 to December 2024
Database	Web of Science Core Collection
Keywords	"global value chain" OR "value chain" AND "supply chain resilience" OR "SCR" OR "supply chain uncertainty" OR "supply chain vulnerability" OR "supply chain disruption" OR "robust supply chain" AND "Manufacturing" OR "industry"

3.2. Conducting Phase

According to the above inclusion criteria, 274 articles were initially identified, with 111 remaining after duplicate removal. The application of exclusion criteria eliminated non-English articles and those from the medicine, agriculture, and fisheries domains, retaining 85 articles [61]. To mitigate literature omission risks, forward and reverse snowballing [65] identified 35 additional articles, resulting in a final corpus of 120 articles. Independent screening by authors achieved high inter-coder reliability. Krippendorff's Alpha yielded a value of 0.856, exceeding the 0.800 benchmark [62]. A detailed PRISMA flow diagram is provided (Figure 3).

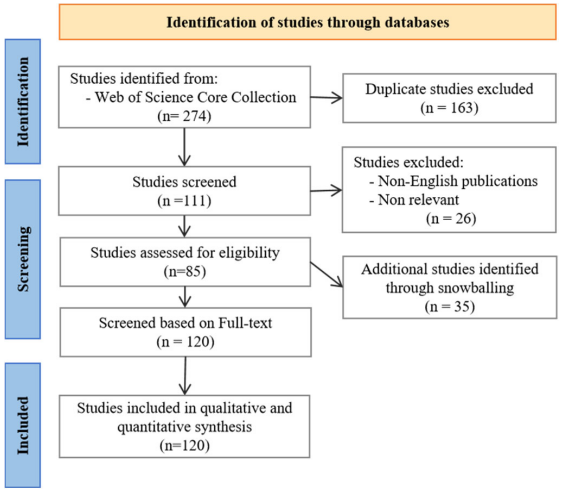


Figure 3. PRISMA flow diagram.

3.3. Reporting Phase

An integrated CiteSpace analytical suite was applied, combining KCN analysis, timeline visualization, burst detection, and semantic neighborhood mapping [67]. Key parameter configurations spanned 2002–2024 (annual slicing), with keyword node selection and g-index extraction (K = 25). A high silhouette value (0.9228) confirmed robust clustering. Crucially, we applied the log-likelihood ratio (LLR) algorithm to KCN analysis. This enables the identification of statistically significant keyword correlations and novel conceptual combinations. Timeline visualization traced chronological co-evolution, burst detection identified terminological surges, and semantic neighborhood analysis mapped conceptual adjacencies, revealing emerging research frontiers and thematic evolution. The results are synthesized in Section 4 to prioritize literature content, facilitating Section 5's systematic review. Insights from both sections are instrumental in addressing the study's central research questions.

4. Results of the Bibliometric Analysis

4.1. Descriptive Results Analysis

This section analyzes publications by year, geography, and journal distribution (Figure 4 and Table 2).

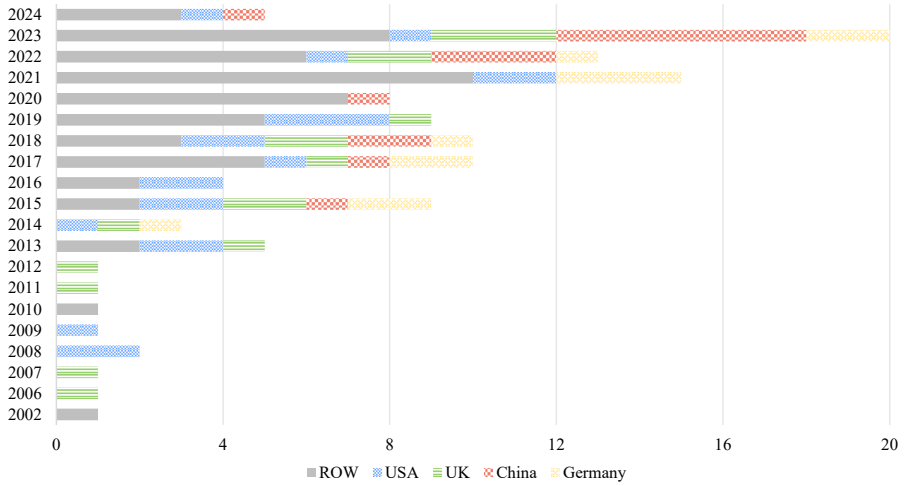


Figure 4. Annual number of publications by country. Countries are classified according to the geographical affiliation of the corresponding or first author. ROW denotes the rest of the world. The United States, the United Kingdom, China, and Germany rank as the top four contributing countries.

Table 2. Overview of most frequent journal sources by the number of articles. The table includes only those journals that have published more than three articles on this topic.

Source	Freq.	References
International Journal of Production Research	14	Dolgui et al. [3]; Ivanov et al. [9]; Tukamuhabwa et al. [11]; Zheng et al. [19]; Xu et al. [24]; Ivanov et al. [43]; Ivanov et al. [46]; Dolgui et al. [68]; Ivanov [69]; Jabbarzadeh et al. [70]; Scheibe & Blackhurst [71]; Yin et al. [72]; Eckstein et al. [73]; Blome et al. [74]
International Journal of Production Economics	11	Aldrighetti et al. [5]; Kamalahmadi & Parast [13]; Brusset & Teller [14]; Chowdhury & Quaddus [15]; Nguyen et al. [18]; Holweg & Helo [51]; Zhao et al. [60]; Dubey et al. [75]; Munir et al. [76]; Frank et al. [77]; Yu et al. [78]
Supply Chain Management: An International Journal	10	Ali et al. [8]; Jüttner & Maklan [44]; Van Hoek & Dobrzykowski [79]; Statsenko et al. [80]; Öberg [81]; Um & Han [82]; Colicchia et al. [83]; Tukamuhabwa et al. [84]; Scholten & Schilder [85]; Woo et al. [86]
International Journal of Physical Distribution & Logistics Management	4	Hohenstein et al. [12]; Ali & Gölgeci [23]; Zhang et al. [87]; Delbufalo [88]
Journal of Cleaner Production	4	Dunant et al. [89]; Costantini et al. [90]; Stindt [91]; Rajesh & Ravi [92]
The International Journal of Logistics Management	3	Aman & Seuring [93]; Ponomarov & Holcomb [94]; Williams et al. [95]
Journal of Operations Management	3	Kim et al. [45]; Barratt & Oke [96]; Ambulkar et al. [97]

Annual publication trends reveal three evolutionary stages in GVC and SCR research (Figure 4). From 2002 to 2012, scholarly output was limited, reflecting the early conceptualization of SCR. From 2013 to 2019, publications increased steadily, with notable peaks in 2015, 2017, and 2018. This surge reflects heightened academic attention following the financial crisis and subsequent supply chain disruptions. Since 2020, the field has witnessed accelerated growth, primarily driven by the COVID-19 pandemic and its unprecedented supply chain shocks.

Geographically, the United States leads with 21 articles (17.5%), indicating its academic dominance as well as its concentration of global production networks and advanced manufacturing. The United Kingdom and Germany also served as early contributors, with publications between 2013 and 2015 reflecting their exposure to European industrial disruptions and the early adoption of Industry 4.0 technologies. China, a latecomer to the field, expanded rapidly after 2018, coinciding with its increasing participation in global manufacturing networks.

Two key insights emerge from this analysis. First, surges in publications correspond closely with major shocks, suggesting a disruption-driven research agenda. Countries directly affected by these events tend to exhibit faster and more substantial scholarly responses. Second, academic contributions are shaped by industrial structures and the geography of shocks, with the US, the UK, Germany, and China functioning as critical manufacturing nodes that both experience disturbances and produce influential research.

In terms of journals, output is concentrated in core supply chain and operations outlets, with the International Journal of Production Research, the International Journal of

Production Economics, and Supply Chain Management: An International Journal accounting for nearly 30%. Journals such as The International Journal of Logistics Management, Journal of Operations Management, and International Journal of Physical Distribution & Logistics Management highlight managerial practice links. Additional contributions from journals like Journal of Cleaner Production, Journal of Business Research, Regional Studies, and Transport Reviews reflect the increasing integration of SCR with international business, regional economics, sustainability, and logistics research. Such diversification signals the diffusion of supply chain and value chain scholarship across adjacent disciplines, highlighting the integration of insights derived from multiple research agendas.

4.2. Trend Analysis

KCN analysis delineated nine thematic clusters (Figure 5 and Appendix B). Timeline visualization and burst detection were then used to identify emerging terminology, signaling the evolution of the research domain (Figures 6 and 7). To map the evolutionary trajectories of GVC and SCR research, we subsequently employ CiteSpace's semantic neighborhood analysis to generate timeline visualizations (Figures 8 and 9).

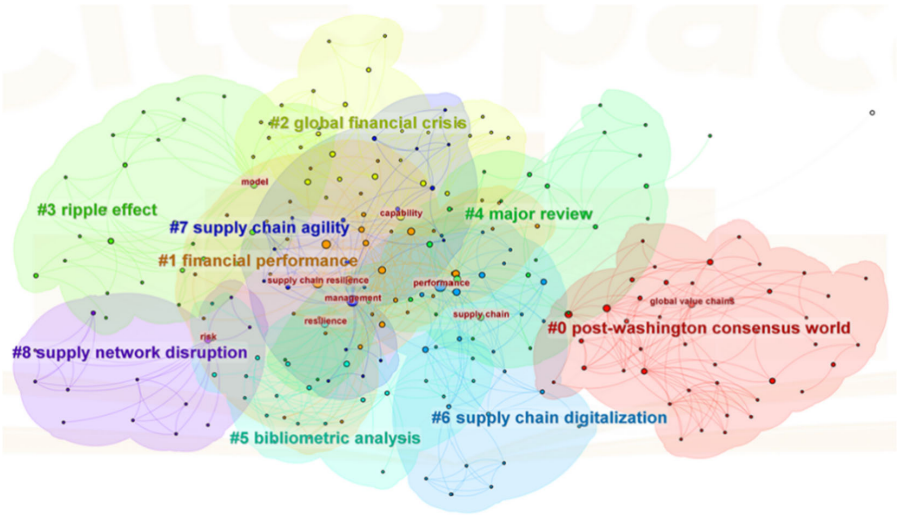


Figure 5. Keyword clustering diagram. # Numbers represent cluster IDs, and each cluster is labeled using the keyword with the highest log-likelihood ratio (LLR) score. Words with higher LLR scores within each cluster are shown in Appendix B Table A2, and the main articles in each cluster are listed in Appendix B Table A3.

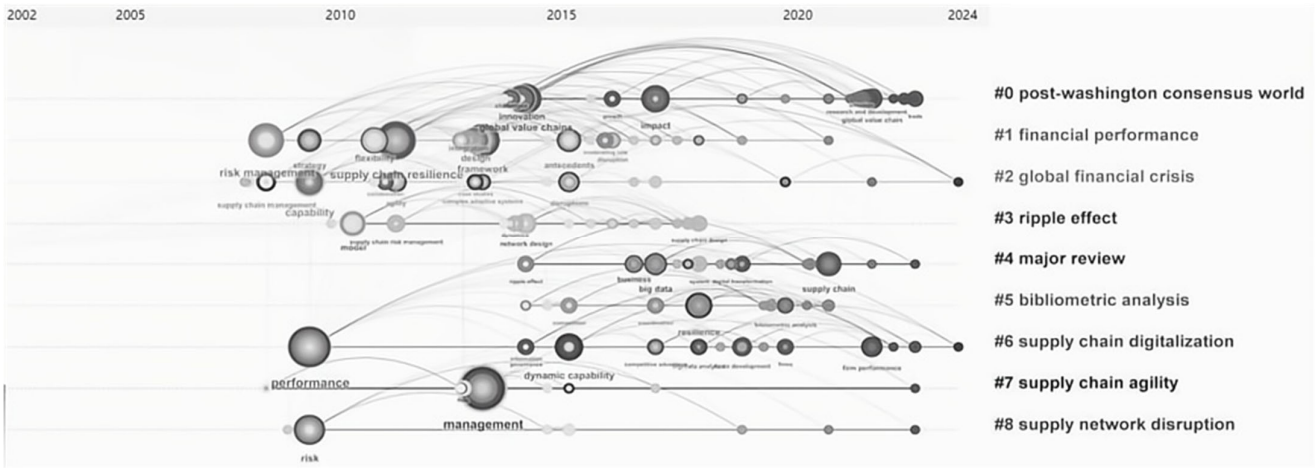


Figure 6. Timeline view of the KCN.

Keywords	Year	Strength	Begin	End	2002 – 2024
supply chain management	2008	2.16	2008	2013	
risk management	2008	0.99	2008	2011	
framework	2014	0.87	2014	2015	
antecedents	2015	2.14	2015	2017	
dynamic capability	2015	0.83	2015	2017	
network design	2017	2.14	2017	2018	
agility	2011	0.56	2017	2018	
integration	2018	2.63	2018	2019	
risk	2009	0.87	2018	2019	
big data	2017	1.86	2019	2021	
additive manufacturing	2019	0.71	2019	2022	
supply chain resilience	2011	0.69	2019	2020	
resilience	2018	2.14	2020	2021	
supply chain	2021	2.67	2021	2024	
capability	2009	1.15	2021	2022	
impact	2017	2.58	2022	2024	
global value chain	2022	2.2	2022	2024	
innovation	2015	2.12	2022	2024	

Figure 7. Top 18 keywords with the most robust citation bursts. The red line denotes the active duration of burst terms; the light blue line indicates terms that have not yet emerged; and the dark blue line represents terms that are present but not in a burst state.

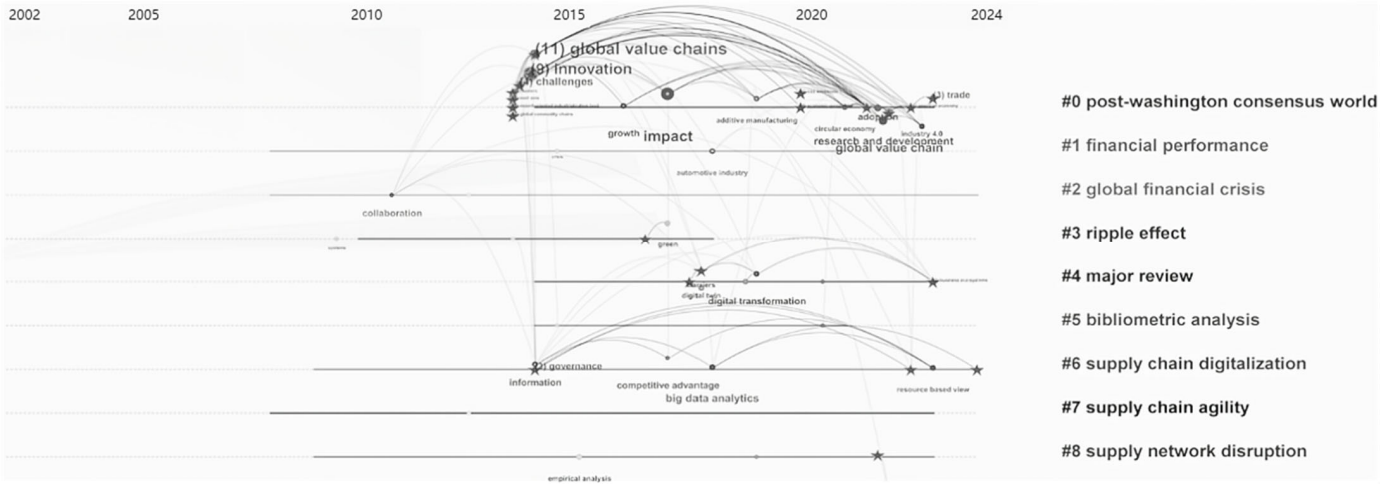


Figure 8. Timeline view of the GVC keyword network. The stars in the figure represent neighboring nodes of the GVC. The numbers in parentheses indicate the keyword frequency.

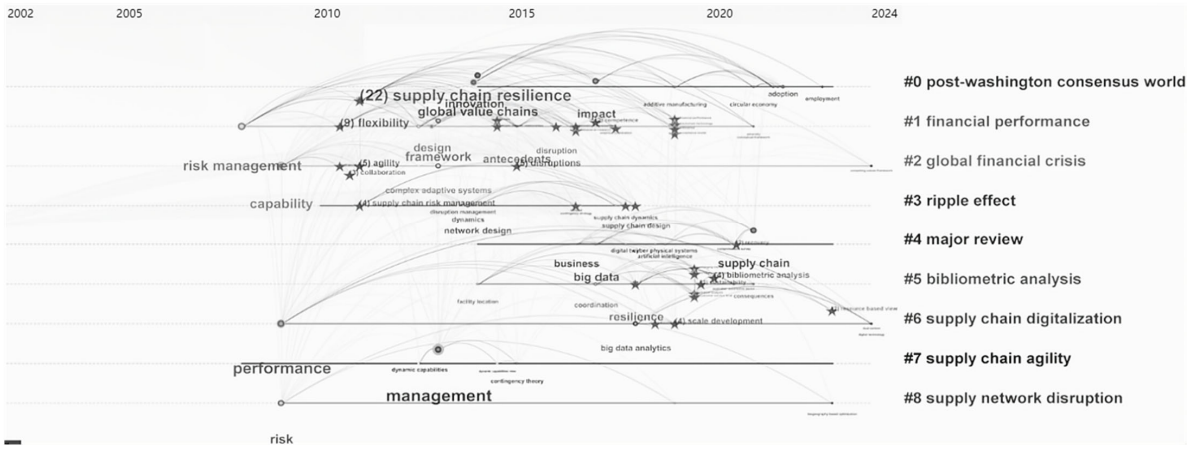


Figure 9. Timeline view of the SCR keyword network. The stars in the figure represent neighboring nodes of the SCR. The numbers in parentheses indicate the keyword frequency.

4.2.1. General Trend Analysis

In terms of cluster analysis (Figure 5), Cluster 0 centers on GVC governance, emphasizing institutional frameworks, inter-firm coordination, and sustainability imperatives. Cluster 1 focuses on supply chain risk management, highlighting approaches to identifying, assessing, and mitigating operational and environmental vulnerabilities. Cluster 2 addresses supply chain integration, investigating mechanisms for aligning information, resources, and processes across organizational and geographical boundaries. Cluster 3 concentrates on resilience capabilities, stressing adaptive responses and the maintenance of performance stability under the ripple effect of disruptions. Cluster 4 examines digital transformation and Industry 4.0, with particular attention to big data, IoT, and advanced analytics as enablers of agility and visibility. Cluster 5 captures firm-level innovation and capability development, analyzing how technological upgrading and strategic renewal foster resilience. Cluster 6 investigates sustainability transitions, linking digitalization with green innovation, circular economy practices, and resilience-building strategies. Cluster 7 highlights SCR attributes, underscoring flexibility, redundancy, agility, and collaboration that underpin long-term resilience. Cluster 8 considers supply chain design and configuration, focusing on network structures that balance efficiency with robustness.

KCN's timeline visualization reinforces a three-stage evolution (Figure 6). Stage 1 (2008–2013), catalyzed by the global financial crisis, revealed that scholarship moved from predominantly static risk-management and coordination concerns (Clusters 1–2) toward emergent resilience thinking that emphasizes disruption response and performance stabilization (Clusters 3, 6–8). Stage 2 (2014–2019) coincided with the diffusion of Industry 4.0 technologies and increased production network complexity. Research in this interval extended risk awareness into digitalization, multi-tier governance, innovation diffusion, and sustainability agendas (Clusters 0–6). Stage 3 (2020–2024), precipitated by the COVID-19 shock, highlighted macro–micro linkages. Scholars increasingly integrate political, economic, trade, and geopolitical factors when theorizing firm-level resilience strategies (notably Clusters 0, 4, and 6).

Burst detection identifies shifting terminological focus that mirror these stages (Figure 7). The early phase (2008–2013) is dominated by foundational terms such as supply chain management and risk management. The middle phase (2014–2018) displays bursts in framework, antecedents, dynamic capability, network design, and agility, indicating a turn toward capability building and network adaptability. The recent phase (2018–2024) is characterized by strong bursts in integration, risk, big data, additive manufacturing, resilience, capability, impact, global value chain, and innovation, signaling a consolidation

of multi-dimensional frameworks that couple technological transformation with strategic and policy-level reconfiguration.

Taken together (Figures 5–7), the evidence indicates a clear intellectual trajectory from firm-level risk mitigation toward multi-level, system-oriented resilience perspectives that integrate technological and organizational dimensions. Current research hotspots emphasize four interrelated themes: (1) the role of digitalization in enhancing visibility, agility, and predictive capacity across global networks; (2) the incorporation of sustainability imperatives—such as green innovation, circularity, and low-carbon transitions—into resilience strategies; (3) the integration of geopolitical, trade, and institutional factors into the analyses of GVC reconfiguration and governance; and (4) methodologically, advancing the field requires more longitudinal and cross-scale studies, combining digital data, simulation, and comparative approaches to capture the dynamic and multi-layered nature of resilience building.

4.2.2. Research Trends on GVC and SCR

GVC research has progressed through three distinct phases (Figure 8). In the foundational phase (pre-2016), research focused on institutional barriers and innovations as key constraints to value chain integration, examining power relations, contract design, and coordination among actors. The second phase (2017–2020) expanded the theoretical scope to include sustainability pressures, green transition imperatives, and digital transformation, reflecting an increased awareness of environmental and social responsibilities. Since 2021, under the impacts of COVID-19, trade tensions, and climate crises, research has converged on five emerging frontiers: circular economy-driven closed-loop design, Industry 4.0 deployment, collaborative R&D networks, multi-stakeholder ecosystem governance, and geopolitically driven trade restructuring. Importantly, technological innovation and circularity principles now act as synergistic drivers linking GVC and SCR scholarship, facilitating a shift from efficiency-oriented models toward governance structures that are resilient, sustainable, and inclusive.

SCR research has evolved through distinct paradigm shifts (Figure 9). Stage 1 (post-2008 financial crisis) emphasized reactive strategies, including redundant inventory and multiple sourcing, to enhance system recoverability, establishing the foundational framework for crisis management. Stage 2 (2014–2018) marked a maturation phase in which agility, collaboration, and supply chain visibility were recognized as core capabilities, consistent with dynamic capabilities theory. Research extended beyond operational optimization to include supply–demand diagnostics and multi-tier network coordination, reflecting a shift from risk mitigation to capability building. Stage 3 (post-2019) witnessed a transformation toward proactive enablement and anticipatory design, highlighting digital governance, green innovation, and heterogeneity-based capability development grounded in a resource-based view (RBV). This evolution indicates a theoretical pivot from discrete, reactive risk absorption toward systemic capability orchestration, where technological innovation, big data analytics, and RBV-driven frameworks collectively optimize network design, managerial capabilities, and organizational value capture.

Overall, GVC and SCR studies have followed converging evolutionary trajectories, highlighting a shift from efficiency- and risk-centered frameworks toward integrated, resilient, and sustainable supply chain systems. Both domains increasingly emphasize multi-level integration, digital governance, green innovation, and collaborative networks, reflecting the interplay between systemic capability building and value chain transformation. Future research is expected to focus on how supply chains can simultaneously enhance resilience, facilitate value co-creation, and strategically respond to environmental,

economic, and geopolitical uncertainties, thereby bridging micro-level firm behavior with macro-level governance and network dynamics.

5. Systematic Review of the Clusters

The nine co-occurrence clusters (0–8) are synthesized and reorganized into three analytical dimensions through thematic integration.

5.1. Macro-Environmental Shocks Driving GVC Reconfiguration (Clusters 0 and 2)

This section is based on research from Cluster 0 (Post-Washington Consensus world) and Cluster 2 (Global Financial Crisis), which reveals the interactive relationship between macro-environmental shocks and GVC reconfiguration.

The distribution of value in GVCs follows the logic of "who governs, benefits", where lead firms set standards, coordinate suppliers, and capture disproportionate shares of value, thereby shaping the configuration and evolution of entire chains [87,98]. The Post-Washington Consensus era facilitated fairer international cooperation and policy innovation [32]. This shift accelerated regional supply chain integration and power redistribution, significantly strengthening the bargaining position of suppliers from emerging economies [81]. However, deepening production globalization exposed systemic GVC vulnerabilities, including fragmented geographical structures, the cross-node contagion of risks [84], and an over-reliance on highly globalized networks [99,100]. These macro-environmental pressures drove GVC reconfiguration along three key dimensions:

First, geopolitical and institutional shocks have promoted regionalization and diversification. The 2008 financial crisis elevated resilience to a global strategic priority, exposing the systemic vulnerabilities of GVCs [44]. Geopolitical events such as the United Kingdom's exit from the European Union (Brexit) and the US–China trade tensions intensified trade barriers and policy uncertainty [47]. Wuttke [38] further demonstrated that successful GVC integration under institutional shocks does not guarantee optimal local economic linkages.

Second, technological revolutions have shifted GVCs from low-cost dependence toward efficiency and digitalization. Innovations such as containerization reduced transport costs and accelerated globalization [101]. Emerging technologies, including Industry 4.0 and additive manufacturing, reshape value distribution within existing GVCs and even foster episodic supply chain models [57,81]. Big data, AI, and digital twins enhance visibility, predictive capacity, and the management of complex, dispersed networks [18].

Third, global shocks and sustainability pressures are transforming governance from centralized control to adaptive and symbiotic models. GVCs are increasingly recognized as complex adaptive systems requiring continuous adjustment to external shocks [36]. The COVID-19 pandemic highlighted risk contagion across nodes in global production networks [17,100]. Sustainability mechanisms such as the Carbon Border Adjustment Mechanism (CBAM) internalize environmental costs, prompting firms to reassess supplier selection and logistics routes [99]. Consequently, governance is shifting from controlling GVCs to orchestrating them dynamically [4].

5.2. The Impact of GVC Reconfiguration on SCR (Clusters 1, 3, and 8)

Drawing on the literature from Cluster 1 (financial performance), Cluster 3 (ripple effects), and Cluster 8 (supply network disruptions), this section synthesizes key insights on SCR and analyzes them through the theoretical lens of GVC reconfiguration.

SCR research emphasizes capability building at both firm and relational levels, grounded in diverse theoretical perspectives (Table 3). Complex Adaptive Systems (CAS) theory highlights supply chain nonlinearity, adaptive behaviors, and ripple effects in response to disruptions, though it offers limited managerial guidance [79,84]. Dynamic

Capabilities Theory focuses on sensing, seizing, and transforming resources to maintain performance under turbulence, but underplays contextual constraints [73,74,78]. The RBV identifies valuable, rare, inimitable, and non-substitutable (VRIN) resources, such as strategic inventory, backup suppliers, and redundant capacity, as resilience enablers, yet often overlooks systemic network effects [96,102]. Complementarily, social network theory conceptualizes supply chains as interdependent networks, where disruptions propagate as ripple effects through nodes, magnifying selective vulnerabilities [3,43,45]. Firms mitigate these risks via structural, relational, and cognitive social capital, supported by logistics stability, while hybrid strategies integrating flexible network design and sustainability practices enhance robustness, adaptability, and profitability [94,103]. Collectively, these frameworks elucidate micro- and meso-level adaptation and resource allocation but require integration with GVC theory to fully capture SCR dynamics under global uncertainties.

Table 3. Classical theories and their focus within SCR.

Theory	Focus Within SCR Research	Limitations	References
CAS	Ripple effects, systemic contagion, adaptive behaviors	Limited managerial guidance	Statsenko & Jayasinghe [79]; Tukamuhabwa et al. [84]
Dynamic Capabilities	Sensing, seizing, and transforming capabilities for turbulence adaptation	Underemphasis on initial resources and contextual constraints	Eckstein et al. [73]; Blome et al. [74]; Yu et al. [78]
RBV	Deployment of VRIN resources (strategic inventory, backup suppliers, redundant capacity) for resilience	Neglect of systemic network effects	Barratt & Oke [96]; Gunasekaran et al. [102]
Social Network	Disruption propagation across network nodes; resilience shaped by structural, relational, and cognitive social capital	Underplayed firm-level capabilities; selective node vulnerability impacts	Dolgui et al. [3]; Ivanov et al. [43]; Kim et al. [45]
GVC	Linking firm-level resilience with systemic reconfiguration across global production networks	Requires integration with micro- and meso-level theories	Gereffi et al. [35]; Blažek & Lypianin [39]; Delbufalo [88]; Ambulkar et al. [97]

GVC theory provides a multi-layered lens, linking firm-level resilience with systemic reconfiguration across global production networks. By conceptualizing supply chains as interlinked value-creating nodes, GVC theory emphasizes strategic resource allocation, functional upgrading, and adaptive governance across production tiers [35,39,84,85]. Specifically, GVC reconfiguration enhances resilience through node- and link-level mechanisms [45]. At the node level, resilience is strengthened through the following: (1) production redistribution, which mitigates concentration risk and enhances redundancy and flexibility [72,73]; (2) functional upgrading, which secures value through knowledge-intensive activities and higher-value functions [104]; and (3) contract renegotiation and decision-right redistribution, reinforcing trust and reducing opportunism [44,92,105]. At the link level, (1) GVC reconfiguration improves systemic resilience by constructing new logistics corridors and adopting multimodal transport systems that enhance agility and shorten lead times [52,106]; (2) redistributing tasks across partners facilitates entry into new ecosystems and promotes diversification, thereby reinforcing resilience [83,90,107]; (3) collaborative protocols and transparent governance mechanisms strengthen inter-firm coordination, ensuring operational continuity and adaptation [13,34]. Together, these mechanisms reveal how GVC reconfiguration not only mitigates risks but also preserves, realigns, and enhances value, offering a systemic framework for understanding SCR under global uncertainty. However, GVC theory requires integration with micro- and meso-level perspectives for

effective operationalization. Coupling it with dynamic capabilities, the RBV, CAS, or social network theory enables a multi-layered account of how resilience is built and governed, thereby enhancing its explanatory power for SCR under global uncertainties.

5.3. Manufacturing Practices and Strategic Responses (Clusters 4–7)

This section integrates literature from Cluster 4 (major reviews), Cluster 5 (bibliometric analyses), Cluster 6 (supply chain digitalization), and Cluster 7 (supply chain agility), providing a multi-tier framework of manufacturing practices that align with GVC reconfiguration to enhance MSCR.

Resilience is conceptualized as a multidimensional construct defined by attributes that collectively determine supply chains' capacity to cope with uncertainty [12,23]. For instance, agility, as the ability to reconfigure operations and resources in response to shocks, enhances performance by integrating supply- and demand-side management, supported by process compliance, informatization, and innovative asset deployment [6,73,74]. Flexibility emphasizes dynamic reconfiguration, increasingly supported by big data analytics [53,102]. Adaptability involves structural and procedural adjustments to long-term shifts, with risk perception as a key moderator [14,56]. Visibility improves information sharing, coordination, and monitoring, thereby strengthening transparency and responsiveness [7,85]. Together with flexibility, it enables the proactive anticipation and mitigation of shocks through knowledge management, supply base agglomeration, diversification, and resource reconfiguration [88,97]. Redundancy provides resource buffers but requires alignment with flexibility to avoid efficiency trade-offs [46,68]. Robustness captures the ability to maintain stable operations under disruptions [7,56]. Moreover, network structures inherently possess resilience-enhancing properties [79,108]. Building on these resilience attributes, from a GVC perspective, MSCR is a manufacturer-centered capability enabling MSCs to preserve, realign, and enhance value amid shocks, ensuring secure and continuous operations [3,56].

Strategic responses to systematically enhance MSCR attributes can be organized into a three-tier framework comprising node-, link-, and policy-level strategies [93]. At the node level, firms adapt to GVC reconfiguration across geography, value, and governance dimensions. Geographic measures such as supplier diversification and the redistribution of production capacities reduce concentration risks while improving redundancy and agility [44,82]. In terms of value, functional upgrading and digitally driven value creation enable firms to capture higher-value segments and reduce dependence on vulnerable low-value activities. Industry 4.0 technologies—including additive manufacturing, AI, big data analytics, blockchain, IoT, and digital twins—enhance agility, visibility, and flexibility while simultaneously addressing the dual challenge of reducing carbon emissions and sustaining economic performance [77,109]. Governance-related practices, such as collaborative governance, contract renegotiation, and transparency mechanisms, further reinforce robustness and sustain value creation [4,36,110].

At the link level, inter-firm strategies focus on strengthening connectivity. Geographic initiatives include resilient logistics corridors, multimodal transport, and flexible inventory allocation to enhance agility and reduce lead times [111,112]. Value-oriented mechanisms such as resource pooling, risk-sharing agreements, and digital platforms supporting cross-functional coordination and manufacturing redistribution enable collective responses to demand and supply fluctuations, improving adaptability, flexibility, and visibility [38,112,113]. Governance measures include joint risk management, standardized protocols, and blockchain-enabled traceability, which foster trust, enhance robustness, and minimize resource waste and inventory mismatches through IoT-driven demand forecasting [85]. Inter-firm network configurations also strengthen network structures, facilitating knowledge sharing and coordinated responses across the supply chain.

At the policy level, governments provide an enabling environment by buffering systemic risks and fostering long-term structural adjustments [75]. Geographic instruments help mitigate vulnerabilities arising from trade disputes and geopolitical shocks, contributing to redundancy and agility [16,114]. Investments in both digital and physical infrastructure enhance connectivity, visibility, and coordination across production networks [7,57]. At the same time, neoliberal globalization has embedded systemic fragility into GVCs, necessitating a shift toward "dancing supply chains"—fluid, adaptive ecosystems responsive to geopolitical and economic shifts [48,76]. Such policy frameworks encourage firms to integrate ESG principles, positioning sustainability as both a strategic driver and a capability that reinforces robustness, adaptability, and overall MSCR [115]. Governance priorities diverge across contexts: advanced economies emphasize innovation and standard-setting, whereas emerging economies focus on ecosystem building and infrastructure expansion, jointly reinforcing sustainable and regionally integrated GVC development [93].

6. Discussion

This study addresses the two central research questions outlined at the outset. For RQ1, GVC reconfiguration serves as a critical mediating mechanism between macro-environmental shocks and MSCR. Against the backdrop of financial crises, geopolitical tensions, and sustainability pressures, GVCs undergo transformation in three dimensions: geographical layout, value distribution, and governance structure. Geographic reconfiguration through regionalization and diversification mitigates concentration risks and enhances redundancy and agility, while network design and inter-firm connectivity strengthen network structures. Value redistribution—enabled by Industry 4.0 technologies and digitalization—facilitates functional upgrading, strengthens visibility and flexibility, and reduces dependence on vulnerable low-value activities. Governance adaptation, through collaborative arrangements, transparency mechanisms, and sustainability-oriented policies, mitigates systemic risk contagion and safeguards operational continuity. Taken together, these shifts enable MSCs to preserve, realign, and enhance value in response to shocks, with node- and link-level mechanisms mediating resilience-enhancing effects across global production networks.

For RQ2, a three-tier strategic framework—spanning node, link, and policy levels—emerges as central to strengthening MSCR in reconfigured GVCs. At the node level, firms enhance resilience by adopting supplier diversification, collaborative governance, and functional upgrading, while leveraging digital technologies—such as additive manufacturing, AI, big data analytics, blockchain, IoT, and digital twins—to improve agility, flexibility, visibility, and adaptability, while also strengthening internal network structures, thereby enabling proactive anticipation and the mitigation of shocks. At the link level, inter-firm strategies emphasize resilient logistics corridors, multimodal transport, joint risk management, and collective mechanisms like resource pooling, digital platforms, and blockchain-enabled traceability, enhancing transparency and reducing waste through IoT-based forecasting. At the policy level, governments buffer systemic risks through trade policy instruments, investments in digital and physical infrastructure, and sustainability-oriented regulatory frameworks that guide firms toward resilient and responsible practices, supporting redundancy, robustness, and overall MSCR. Reframing supply chains as adaptive "dancing supply chains", policies can incentivize firms to embed ESG principles, positioning sustainability as both a strategic driver and a capability that reinforces MSCR.

Finally, our detailed conceptual framework is presented in Figure 10. This framework synthesizes the above mechanisms and provides the foundation for the subsequent discussion of implications and future research directions. Specifically, macro-environmental shocks—such as financial crises, geopolitical tensions, the COVID-19 pandemic, and sus-

tainability pressures—drive GVC reconfiguration along three dimensions: geographical layout, value distribution, and governance structure. Within global production networks, value chains and supply chains are interconnected through firms (nodes) and inter-firm connections (links). Firm-level supply chain activities adjust in response to shifts in value along the GVC. Consequently, GVC reconfiguration across these dimensions compels supply chains to strengthen their core attributes, including agility, redundancy, flexibility, adaptability, visibility, robustness, and network structures. These enhancements take place at both the node and link levels, thereby reinforcing MSCR. Building on this foundation, we propose strategies to enhance MSCR at the node and link levels. We further emphasize the role of policy interventions in supporting and reinforcing these strategies, ensuring the development of more robust and adaptive production networks.

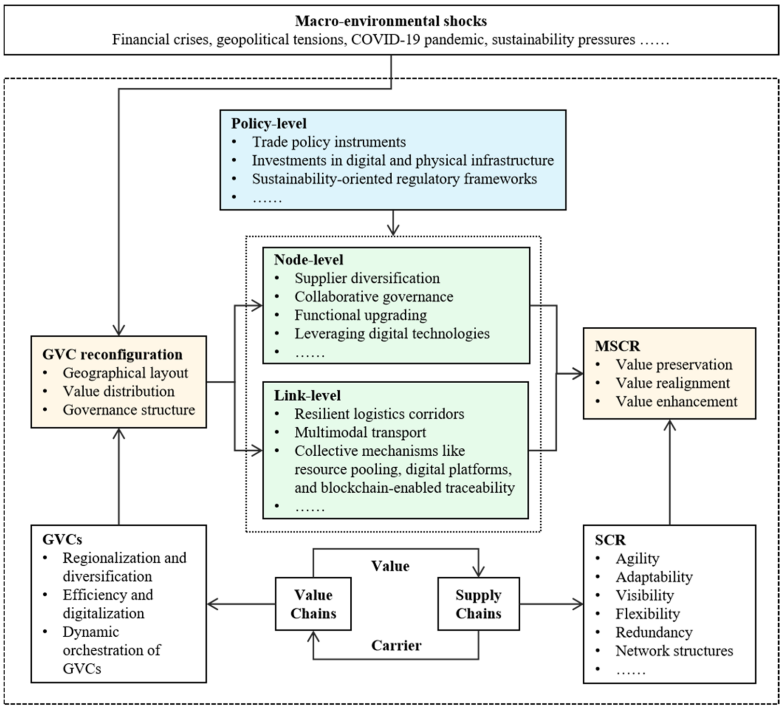


Figure 10. Detailed conceptual framework.

6.1. Main Implications

6.1.1. Theoretical Implications

This study advances the theoretical discourse on MSCR by embedding it explicitly within the GVC framework. While prior studies have predominantly conceptualized SCR at the firm or generic supply chain level, our findings highlight that the structural and functional dynamics of MSCs can only be fully understood within the multi-layered architecture of GVCs. This represents an extension of the multi-level understanding of resilience proposed by Gereffi et al. [55]. By defining MSCR as a manufacturer-centered capability to preserve, realign, and enhance value during shocks, this study extends existing SCR frameworks. It further underscores that resilience entails not only survival but also upgrading and competitiveness within reconfigured GVCs. This perspective is supported by prior research [8,36,42]. Furthermore, the study uncovers the mediating role of GVC reconfiguration in connecting macro-level shocks to SCR; bridging theoretical gaps across macroeconomics, international business, and operations management; and offering an integrative lens to understand how external complexity translates into operational challenges.

6.1.2. Methodological Implications

This study advances systematic literature reviews (SLRs) and bibliometric analyses by introducing an enhanced B-SLR. The method integrates database-driven retrieval with forward and backward snowballing, thereby mitigating potential omissions and ensuring corpus completeness. In doing so, it incorporates high-quality review methodologies employed in prior studies (e.g., Van Wee [65]; Nguyen et al. [18]) into the approach of Marzi et al. [61]. Analytical rigor is further strengthened through a visualization framework based on CiteSpace, encompassing keyword co-occurrence networks, timeline visualization, burst detection, and semantic neighborhood analysis. This multi-dimensional approach moves beyond descriptive mapping by capturing thematic evolution, identifying emerging research frontiers, and revealing conceptual interdependencies.

Moreover, by employing bibliometric visualization, this study delineates the emerging convergence between GVC and SCR research. The research suggests a convergence of GVC and SCR studies toward supply chain frameworks characterized by integration, resilience, and sustainability. Such frameworks highlight multi-level integration, digital governance, green innovation, and collaborative networks, which jointly strengthen systemic capabilities and drive value chain transformation. Building on these insights, we establish the orientation of this study and outline potential avenues for future investigation.

6.1.3. Managerial Implications

This study contributes by offering a strategic framework that operationalizes MSCR enhancement under GVC reconfiguration. Existing research typically examined firm-level practices or policy interventions in isolation, whereas our framework highlights how coordinated actions across firms, industry alliances, and policymakers can jointly strengthen resilience. This represents an extension of the insights offered by Kim et al. [45] and Cohen & Kouvelis [56]. For firms, resilience is strengthened through supplier diversification, functional upgrading, collaborative governance, and digital adoption. For industry alliances, collaborative initiatives, including inter-firm cooperation in logistics, multimodal transport, and blockchain-enabled traceability, as well as shared platforms, pooled resources, and standard-setting, are implemented. These initiatives enhance transparency, disseminate resilience practices, and reduce waste across networks. For policymakers, resilience is supported through trade policies, infrastructure investment, and sustainability-oriented regulations. Overall, the framework demonstrates how firm actions, industry-level collaborations, and policy measures can be aligned with GVC reconfiguration to orchestrate resilience, with digital transformation and sustainability acting as cross-cutting enablers. This perspective is supported by prior studies, including Zhao et al. [60], Zheng et al. [19], and Dubey et al. [75].

6.2. Future Research Directions

Building on the findings of this study and the observed trends in GVC and SCR research, future research on MSCR amid GVC reconfiguration can be organized as three interconnected directions, emphasizing firm capabilities, multi-level networks, and macro–micro integration.

6.2.1. Firm-Level GVC Participation and Resilience Capability Enhancement

Firm-level strategies remain central to MSCR. Future studies should investigate how firms leverage GVC participation to enhance internal resilience by integrating digitalization, Industry 4.0 technologies (additive manufacturing, AI, big data analytics, blockchain, IoT, digital twins), and green innovations (circular economy practices, carbon accounting, eco-design) into operations [18,21,57]. Research should explore how geographic

diversification, functional upgrading, and digitally driven value creation contribute to performance stability, redundancy, and agility under systemic shocks [36,47]. Governance-related practices such as collaborative governance, contract renegotiation, and transparency mechanisms further support relational resilience and long-term value creation [4]. Methodologically, longitudinal case studies, panel data analysis, and quasi-experimental designs can capture the dynamic impact of digital–green innovations on firm-level resilience and ESG performance.

6.2.2. Inter-Firm Collaboration and Multi-Level Network Resilience

Beyond individual firms, research should examine how multi-tier networks—encompassing suppliers, logistics providers, partners, and governmental actors—jointly enhance MSCR. Studies could analyze how digital platforms, resource pooling, risk-sharing mechanisms, and collaborative sustainability practices improve network-level agility and adaptability [22,83]. Geographic strategies such as resilient logistics corridors, flexible inventory allocation, and multimodal transport can reduce systemic vulnerability [38]. Governance measures, including blockchain-enabled traceability, joint risk management, and standardized protocols, foster transparency and coordination, enabling collective responses to disruptions [85]. Empirical network modeling, agent-based simulations, and scenario analysis are recommended to assess inter-firm coordination, resilience spillovers, and the effectiveness of collaborative strategies across multi-tier networks.

6.2.3. Integrative Modeling of Macro-Micro Linkages and Multi-Disciplinary Integration

Future research should advance frameworks that connect macro-level shocks with firm capabilities and network dynamics [4,16,43]. Multi-disciplinary approaches—including CAS theory, RBV, dynamic capabilities, social network theory, socio-technical systems, and institutional economics—can clarify how GVC reconfiguration shapes resilience trajectories over time [11,45]. Longitudinal empirical studies and mixed-method designs combining digital data, simulations, and scenario analysis are recommended to capture the dynamic interactions between digital–green innovation, enterprise strategies, multi-tier network collaboration, and policy interventions, providing actionable guidance for managers and policymakers.

7. Conclusions

This study systematically investigates MSCR in the context of GVC reconfiguration, addressing two central research questions. Drawing on an enhanced B-SLR of 120 peer-reviewed articles, it develops an integrative framework linking macro-environmental shocks, GVC reconfiguration, and MSCR, thereby bridging a critical gap in the literature that has largely examined resilience either at the firm level or as a generic supply chain property.

The findings reveal that macro-environmental shocks expose structural vulnerabilities across GVCs, driving reconfigurations along geographical, value, and governance dimensions. These reconfigurations mediate the relationship between shocks and MSCR through both node- and link-level mechanisms, thereby addressing RQ1. MSCR is conceptualized as a manufacturer-centered capability, enabling firms not only to preserve and realign value but also to enhance it strategically under volatile conditions. Building on these insights, a multi-tier strategic framework is proposed to address RQ2, systematically organizing strategic responses into node-, link-, and policy-level strategies that leverage GVC reconfiguration to strengthen MSCR attributes. This study advances three key contributions. First, at the theoretical level, it embeds MSCR within a GVC framework, clarifying how GVC reconfiguration mediates SCR under macro-level shocks. Second, at the methodological level,

it ensures corpus completeness through snowballing and refines bibliometric mapping with multi-dimensional visualization. Third, at the managerial level, it provides actionable guidance for firms, industry alliances, and policymakers to align MSCR strategies with the dynamics of global production networks.

Based on the bibliometric analysis, the research suggests a convergence of GVC and SCR studies toward supply chain frameworks characterized by integration, resilience, and sustainability. Such frameworks highlight multi-level integration, digital governance, green innovation, and collaborative networks, which jointly strengthen systemic capabilities and drive value chain transformation. Accordingly, future research should (1) focus on firm-level GVC participation and resilience capability enhancement; (2) explore inter-firm collaboration within multi-tier networks, particularly through the deployment of digital–green innovations to strengthen adaptive supply chain practices; and (3) develop integrative models that connect micro-level firm behaviors with macro-level governance, policy, and institutional contexts. Collectively, these directions provide a coherent, multi-level roadmap for advancing scholarship on MSCR in dynamic and reconfigured GVCs.

Nevertheless, several limitations warrant consideration. First, the focus on peer-reviewed research may have excluded gray literature, such as industry reports, policy documents, and firm-level cases, potentially limiting the representation of practical experience and policy effects. In addition, we only examined whether journals belonged to the Web of Science Core Collection, while potential quality differences among journals within this database may have been overlooked. Second, GVCs and MSCR are highly dynamic and interdisciplinary. This study may not fully capture variations across industries, regions, or temporal contexts, which could bias conclusions regarding strategy effectiveness. Third, while the study focuses on firms and governments, other actors, such as universities and international organizations, may play important roles, and resilience-building itself may trigger subsequent value chain adjustments.

Future research could address these limitations by integrating high-quality literature—not only gray literature but also stricter quality screening of journal papers—to provide more robust evidence and conclusions. This integration would help bridge theory and practice, enhancing both the realism and the feasibility of strategies for strengthening MSCR. To overcome contextual and temporal constraints, quantitative approaches such as network simulation, scenario analysis, and longitudinal studies could assess the effectiveness of node- and link-level strategies across different settings. Moreover, expanding the scope of analysis to include universities, international organizations, and other institutional actors would illuminate underexplored drivers of resilience and capture potential feedback loops. Such efforts would provide a more comprehensive understanding of MSCR enhancement pathways in complex, multi-tiered GVCs, offering actionable guidance for manufacturing firms, industrial networks, and policymakers in volatile global production networks.

Supplementary Materials: The PRISMA-ScR Checklist can be downloaded at https://www.mdpi.com/article/10.3390/systems13100873/s1 [116].

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

The literature on SCR and GVC has evolved from early conceptual and theoretical studies on supply chain security to investigations of resilience definitions, resilience constructs, disruption recovery, and ripple effects. More recent research emphasizes digital technologies, such as Industry 4.0, digital twins, and the physical internet, as well as supply chain network design and GVC evolution, reflecting a shift toward multi-level, technology-driven, and interdisciplinary analyses.

Methodologically, studies progressed from qualitative literature surveys and conceptual synthesis to systematic reviews and concept mapping frameworks, and more recently to bibliometric analyses, co-occurrence mapping, and quantitative content analyses, indicating a trend from qualitative synthesis to multi-method, data-driven approaches.

Despite these advances, two notable gaps remain. Conceptually, most studies focus on single-firm or sectoral resilience, with limited attention to multi-tier resilience mechanisms across firms, industries, and GVCs. Methodologically, although bibliometric techniques are increasingly applied, integrated multi-method approaches combining systematic reviews with bibliometric and conceptual analyses remain scarce, limiting a comprehensive understanding of resilience evolution and operationalization.

Table A1. Literature Review on SCR and GVCs.

Reference	Year	Focus	Methodology
Williams et al. [95]	2008	Supply chain security and research agenda	Literature review and categorization of existing research
Hohenstein et al. [12]	2015	Phenomenon of SCR	Systematic literature review
Tukamuhabwa et al. [11]	2015	Definition and theoretical foundations of SCR	Literature review
Hosseini et al. [26]	2016	Definitions and measurement of system resilience	Classification
Kamalahmadi & Parast [13]	2016	Enterprise and SCR principles	Literature survey
Ali et al. [8]	2017	SCR constructs	Systematic literature review with concept mapping framework
Ivanov et al. [9]	2017	Disruption recovery in supply chains	Literature review
Dolgui et al. [68]	2018	Ripple effect in supply chains	Literature review and classification
Ghobakhloo [50]	2018	Review of SC digitalization and Industry 4.0	Systematic literature review
Wan et al. [27]	2018	Resilience in transportation systems	Systematic review
Ali & Gölgeci [23]	2019	SCR research trends	Systematic review + VOS viewer co-occurrence analysis
Frank et al. [77]	2019	Industry 4.0 in manufacturing	Conceptual review and empirical synthesis
Bešinović [28]	2020	Railway transport resilience	Literature review
De Marchi et al. [33]	2020	Evolution of GVCs in international business	Systematic review and quantitative content analysis
Dolgui et al. [3]	2020	Supply chain adaptation to ever changing environments	Literature analysis along with tertiary studies
Kano et al. [31]	2020	Multi-disciplinary review of GVCs	Literature review
Xu et al. [24]	2020	Disruption risks in supply chain management	Bibliometric analysis

Table A1. *Cont.*

Reference	Year	Focus	Methodology
Aldrighetti et al. [5]	2021	Supply chain network design under disruption risks	Systematic literature review
Cohen & Kouvelis [56]	2021	"Triple A & R" framework for defining excellence capabilities in global supply chains	Literature review
Hillmann & Guenther [42]	2021	Organizational resilience as construct and its measurement	Systematic literature review
Goyal & Kumar [29]	2021	SCR and performance	Systematic review and bibliometric review
Wieland [4]	2021	Supply chain based on panarchy theory	Literature review
Zheng et al. [19]	2021	Applications of Industry 4.0 in manufacturing and SCR	Systematic literature review
Katsaliaki et al. [10]	2022	Supply chain disruptions and resilience	Literature review
Nguyen et al. [18]	2022	Digital twin and physical internet in SC	Literature review and bibliometric analysis
Chen et al. [25]	2023	Uncertainty analysis and optimization in supply chain management	Systematic review and bibliometric analysis
Hokmabadi et al. [20]	2024	SMEs/startups resilience through digital transformation	Systematic review

Appendix B

Table A2. Keyword clustering and main keywords. The silhouette of a cluster is used to measure the quality of the cluster configuration. Its value is between −1 and 1. The closer the value to 1, the better the clustering quality. Since the silhouette score of each cluster is close to 1, it indicates the reliability of the identified clusters. Keywords (LLR) represent the keywords obtained via the log likelihood ratio (LLR) algorithm, and the LLR score and p value are listed in parentheses. The higher the LLR score is, the greater the deviation between the occurrence and the expectation of the word in the text collection, and it is more likely to be a keyword with a unique meaning. The p value is the probability value used to judge statistical hypotheses, indicating the probability of observed data occurring when the null hypothesis is true. In this case, a smaller p value indicates that the LLR value of the keyword is significant; that is, the keyword is statistically significant in the text collection. Keywords (LSIs) represent keywords summarized via the latent semantic indexing (LSI) algorithm, which is used to understand the latent semantic relationships between papers.

ID	Silhouette	Label	Top Terms (LLR)	Top Terms (LSI)
0	0.861	Post-Washington consensus world	post-Washington consensus world (37.57, 1.0×10^{-4}); episodic supply chain (33.33, 1.0×10^{-4}); COVID-19 pandemic (29.1, 1.0×10^{-4}); firm-level evidence (29.1, 1.0×10^{-4}); emerging economies (29.1, 1.0×10^{-4})	global value chain; post-Washington consensus world; episodic supply chain; firm-level evidence; advanced digitalization | global supply chain; early evidence; foreign subsidiaries; value creation; episodic supply chain
1	0.678	Financial performance	financial performance (32.17, 1.0×10^{-4}); dynamism disruption orientation (32.17, 1.0×10^{-4}); major finding (29.66, 1.0×10^{-4}); future research (29.66, 1.0×10^{-4}); liner shipping industry (24.66, 1.0×10^{-4})	supply chain resilience; supply chain; financial performance; dynamic capabilities perspective; major finding | production system; further study; theoretical foundation; digital transformation; strategic supplier relationship

Table A2. *Cont.*

ID	Silhouette	Label	Top Terms (LLR)	Top Terms (LSI)
2	0.849	Global financial crisis	global financial crisis (36.54, 1.0×10^{-4}); empirical study (36.54, 1.0×10^{-4}); social-ecological perspective (31.9, 1.0×10^{-4}); supply network resilience capabilities (31.9, 1.0×10^{-4}); multitier supply chain management (27.28, 1.0×10^{-4})	supply chain resilience; empirical study; global financial crisis; social-ecological perspective; supply network resilience capabilities | multifaceted effect; supply chain agility; chain disruption; Chinese manufacturing supply chain; supply base complexity
3	0.817	Ripple effect	ripple effect (37.19, 1.0×10^{-4}); disruption management (29.57, 1.0×10^{-4}); marrying supply chain sustainability (22.04, 1.0×10^{-4}); sustainable supply chain design (14.6, 0.001); sustainability analysis (14.6, 0.001)	supply chain; ripple effect; disruption management; marrying supply chain sustainability; disruption risk | marrying supply chain sustainability; supply chain; disruption risk; recent literature; ripple effect
4	0.799	Major review	major review (30.26, 1.0×10^{-4}); future research agenda (30.26, 1.0×10^{-4}); supply chain disruption (30.26, 1.0×10^{-4}); manufacturing companies (25.15, 1.0×10^{-4}); manufacturing context (20.07, 1.0×10^{-4})	major review; supply chain disruption; future research agenda; manufacturing companies; facing GVC challenge ｜ manufacturing context; systematic literature review; UK construction value chain; risk distribution; steel reuse
5	0.832	Bibliometric analysis	bibliometric analysis (50.79, 1.0×10^{-4}); literature review (31.35, 1.0×10^{-4}); supply chain management (31.35, 1.0×10^{-4}); value dynamics (24.98, 1.0×10^{-4}); kingpins bottleneck (24.98, 1.0×10^{-4})	bibliometric analysis; disruption risk; literature review; supply chain management; value dynamics | supply chain; transformative supply chain management; value dynamics; disruption risk; supply chain management
6	0.796	Supply chain digitalization	supply chain digitalization (21.47, 1.0×10^{-4}); multimediation model (21.47, 1.0×10^{-4}); government effectiveness (18.39, 1.0×10^{-4}); dynamic digital capabilities (18.39, 1.0×10^{-4}); enabling role (15.38, 1.0×10^{-4})	multimediation model; supply chain digitalization; government effectiveness; dynamic digital capabilities; supply chain integration | supply chain resilience; moderating effect; supply chain; big data analytics capability; building supply chain resilience
7	0.854	Supply chain agility	supply chain agility (39.77, 1.0×10^{-4}); moderating effect (30.04, 1.0×10^{-4}); structural equation model (25.2, 1.0×10^{-4}); product complexity (21, 1.0×10^{-4}); supply chain adaptability (21, 1.0×10^{-4})	supply chain; supply chain agility; moderating effect; dynamic capabilities perspective; structural equation model | managing cyber; exploratory analysis; information risk; supply chain risk; COVID-19 pandemic driving
8	0.865	Supply network disruption	supply network disruption (26.08, 1.0×10^{-4});structural perspective (26.08, 1.0×10^{-4}); medium-sized firm (17.21, 1.0×10^{-4}); internal social capital (17.21, 1.0×10^{-4}); chain disruption (11.72, 0.001)	supply network disruption; structural perspective; medium-sized firm; supply chain resilience; internal social capital | medium-sized firm; internal social capital; chain disruption; supply chain resilience; supply network disruption

Table A3. Key References by Cluster. The number of articles contained in each cluster is as follows: Cluster 0 has 33 articles; Cluster 1 has 56 articles; Cluster 2 has 30 articles; Cluster 3 has 16 articles; Cluster 4 has 27 articles; Cluster 5 has 18 articles; Cluster 6 has 40 articles; Cluster 7 has 30 articles; and Cluster 8 has 12 articles. Since some articles appear in multiple clusters, we avoided duplication here and listed five representative articles for each cluster.

ID	Label	Reference	Focus	Methodology
0	Post-Washington consensus world	Gereffi [28]	Global value chains in the post-Washington consensus era	Conceptual analysis
		Calza et al. [17]	Digitalization and resilience in developing and emerging economies	Empirical analysis
		Shih & Lin [34]	Manufacturing upgrading and co-location in the COVID-19 era	Empirical analysis
		Phillips et al. [36]	GVC reconfiguration under COVID-19 and geopolitical tensions	Case-based conceptual and policy analysis
		Li et al. [99]	China's embodied CO_2 emissions and value added in GVCs	Structural path analysis
1	Financial performance	Chowdhury & Quaddus [15]	A scale for measuring SCR	Qualitative field study + quantitative survey
		Yu et al. [78]	Dynamism, disruption orientation and financial performance	Empirical survey analysis
		Hillmann & Guenther [42]	Organizational resilience as construct and its measurement	Systematic literature review
		Kamalahmadi & Parast [13]	Enterprise and SCR principles	Literature survey
		Ali et al. [8]	SCR constructs	Systematic literature review with concept mapping framework
2	Global financial crisis	Jüttner & Maklan [44]	SCR in the global financial crisis	Empirical Study
		Tukamuhabwa et al. [84]	SCR in a developing country context	Case study
		Statsenko et al. [79]	Post-crisis supply chain adaptation from a socio-ecological perspective	Qualitative multiple case study
		Ambulkar et al. [97]	Firm resilience under disruption	Empirical analysis
		Delbufalo [88]	Effects of supply base complexity on agility and resilience	Empirical analysis
3	Ripple effect	Ivanov et al. [46]	Trade-off "efficiency-flexibility-resilience" in ripple effect propagation	Quantitative analysis
		Ivanov et al. [69]	SC dynamics and disruption propagation	Quantitative analysis and empirical analysis
		Fahimnia & Jabbarzadeh [103]	Integration of sustainability and resilience in supply chains	Multi-objective optimization model
		Jabbarzadeh [70]	Resilient and sustainable supply chain design	A stochastic bi-objective optimization model
		Scheibe & Blackhurst [71]	Disruption propagation, systemic risk and accident theory	Theory case study

Table A3. *Cont.*

ID	Label	Reference	Focus	Methodology
4	Major review	Ghobakhloo [50]	Review of SC digitalization and Industry 4.0	Systematic literature review
		Aldrighetti et al. [5]	SCN design under disruption risks	Systematic literature review
		Nguyen et al. [18]	Digital twin and physical internet in SC	Literature review and bibliometric analysis
		Zheng et al. [19]	Applications of Industry 4.0 in manufacturing and SCR	Systematic literature review
		Frank et al. [77]	Industry 4.0 in manufacturing	Conceptual review and empirical synthesis
5	Bibliometric analysis	Xu et al. [24]	Disruption risks in supply chain management	Bibliometric analysis
		Wieland [4]	Supply chain based on panarchy theory	Literature review
		Cohen & Kouvelis [56]	"Triple A & R" framework for defining excellence capabilities in global supply chains	Literature review
		Goyal & Kumar [29]	SCR and performance	Systematic review and bibliometric review
		Free & Hecimovic [48]	Neoliberal globalization policies and global supply chains	Case study
6	Supply chain digitalization	Zhao et al. [60]	Impact of supply chain digitalization on SCR and performance	Survey and questionnaire
		Brusset & Teller [14]	Supply chain capabilities, risks, and resilience	Survey and empirical study
		Dubey et al. [75]	SC digital transformation and resilience	Multi-method approach
		Ali & Gölgeci [23]	SCR research trends	Systematic review and VOS viewer co-occurrence analysis
		Munir et al. [76]	Supply chain integration and supply chain risk management	Empirical study
7	Supply chain agility	Blome et al. [74]	Antecedents of SC agility and its effect on performance	Empirical survey
		Eckstein et al. [73]	SC agility, adaptability, and product complexity	Empirical study
		Gunasekaran et al. [102]	Big data and predictive analytics and supply chain and organizational performance	Empirical survey
		Aman & Seuring [93]	SCR approaches in emerging economies	Survey + SCOR-based quantitative analysis
		Van Hoek & Dobrzykowski [80]	Supply chain risks and COVID-19 pandemic and reshoring considerations	Case study
8	Supply network disruption	Kim & Chen [45]	Supply network disruption and resilience	Qualitative research
		Kawa & Światowiec-Szczepańska [52]	Logistics value and customer satisfaction in e-commerce	Survey and empirical study
		Chen et al. [25]	Uncertainty analysis and optimization in supply chain management	Systematic review and bibliometric analysis
		Dolgui et al. [68]	Ripple effect in supply chains	Literature review and classification
		Hohenstein et al. [12]	Phenomenon of SCR	Systematic literature review

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