

Toward an integrated understanding of supply chain resilience: A systematic review and multi-layered capability architecture

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Abstract

Purpose – Increasing systemic volatility, geopolitical fragmentation, and digital interdependencies have intensified the vulnerability of global supply chains (SCs). While research on supply chain resilience (SCR) has expanded rapidly in recent years, the literature remains conceptually fragmented across capability-based, network-structural, and performance-oriented perspectives. This study aims to consolidate recent SCR research and develop an integrated conceptual understanding of how disruption exposure, structural conditions, and adaptive capabilities jointly shape resilience in supply chain networks (SCNs).

Design/methodology/approach – Following the systematic review methodology proposed by Tranfield et al. (2003), this research synthesizes peer-reviewed journal articles indexed in Scopus between 2020 and 2024. A total of 94 publications were analyzed with regard to their theoretical grounding and methodological rigor to identify key resilience drivers, capability configurations, structural interdependencies, and research gaps across global SCNs.

Findings – The review shows that SCR emerges from the interaction between disruption exposure, structural network conditions, and the enactment of resilience capabilities. Structural characteristics such as network topology, governance structures, and institutional constraints shape system vulnerability, while capabilities enable coordinated responses to disruptions. However, important research gaps remain regarding tier-specific vulnerabilities, disruption propagation mechanisms, and an integration of structural network perspectives with dynamic capability approaches.

Originality – This study develops a theoretically integrated, multi-layered capability architecture of SCR that consolidates fragmented capability-based, structural, and performance-oriented perspectives. By conceptualizing resilience as an emergent system property arising from the interaction between disruption exposure, structural conditions, and adaptive capabilities, the framework advances conceptual clarity and provides a foundation for future research on resilient and viable SCNs.

Keywords: Dynamic Capabilities, Supply Chain Networks, Supply Chain Resilience, Systematic Literature Review

Paper type: Review Article

1. Introduction

Global SCs have undergone a profound transformation in recent decades, evolving from linear, efficiency-driven systems into complex, adaptive, and highly interconnected networks (Choi et al., 2022; Sawik, 2022). As the concept of global value creation becomes increasingly networked, SCs are exposed to multifaceted disruptions that occur with greater frequency and intensity. These disruptions can manifest in many forms, ranging from natural disasters and geopolitical conflicts to global health crises. These recent developments underscore the necessity of strengthening the robustness and continuity of critical SCs (Singh et al., 2021). While traditional supply chain management (SCM) solutions have optimized operational performance and cost efficiency, they fall short in anticipating unexpected shocks, facilitating rapid recovery, and ensuring end-to-end transparency (Burgos & Ivanov, 2021; Li et al., 2021).

Concurrently, scientists increasingly emphasize the necessity for SCs to evolve beyond efficiency and short-term optimization towards long-term viability and adaptability (Gruchmann et al., 2024; Ivanov & Keskin, 2023). Nevertheless, current research remains focused on post-disruption recovery rather than proactively adopting frameworks that are oriented towards prevention and ensuring organizational viability (Echefaj et al., 2024; Ivanov, 2024a; Zhu et al., 2024).

While disruptions emerge from external sources, including environmental, political, or social events, failures can also be traced back to internal managerial decisions. Lean production or single-sourcing strategies, for instance, have proven to drive efficiency gains. However, these strategies can simultaneously weaken buffer capacities and amplify systemic fragility (Baghersad et al., 2022). Consequently, organizational decisions can unintentionally increase vulnerability to external shocks. The growing interconnectedness of organizations within global networks further exacerbates this challenge. Disruptions at a single node can propagate across multiple levels, and lead to serious operational and economic consequences (Erol et al., 2010; Pettit et al., 2013; Azadegan & Dooley, 2021; Chauhan et al., 2021).

Christopher and Peck (2004) originally introduced the concept of SCR, framing it as the capacity of a SC to recover from disruption by either reverting to its original state or evolving towards a more advantageous one. Since this foundational contribution, the definition of SCR has expanded progressively. Contemporary literature generally conceptualizes SCR as a multidimensional capability enabling SCs to anticipate potential disruptions, mobilize rapid and coordinated responses, and restore operational performance promptly and effectively (Ponomarov & Holcomb, 2009).

Although SCR has primarily been developed within SCM, logistics, and operations management, broader research streams provide complementary insights into the structural, institutional, and spatial foundations of this concept. In particular, global value chain (GVC) research, global production network (GPN) theory, economic geography, and regional resilience studies show that resilience is not only shaped by operational capabilities, but also by governance systems, territorial embeddedness, power asymmetries, and institutional contexts.

From a GVC perspective, production systems dispersed around the globe are coordinated through various governance structures that affect the distribution of risks, resources, and decision-making authority among firms and locations (Gereffi et al., 2005; Ponte & Sturgeon, 2014). This perspective is particularly relevant for SCR because pandemics, geopolitical conflicts, trade restrictions, and shortages of critical inputs expose dependencies embedded in globally fragmented value creation systems. Consequently, achieving resilience not only relies on firm-level preparedness and operational flexibility, but also on the design and governance of international value chains.

GPN theory broadens this perspective by conceptualizing production as a complex and spatially embedded network of firms, institutions, regions, and states (Yeung & Coe, 2015). Subsequent developments in GPN research have further highlighted the importance of network structures, strategic coupling processes, and territorial embeddedness in shaping economic outcomes across interconnected production systems (Coe & Hess, 2019). More recent contributions to GPN research emphasize the growing influence of geopolitical fragmentation, strategic decoupling, and changing risk environments on the resilience and adaptability of globally distributed production networks (Hess & Horner, 2024; Kalvelage & Tups, 2024; Yeung, 2024). These insights suggest that SCR is shaped not only by organizational capabilities but also by structural and institutional conditions within which production networks operate. Understanding SCR requires analytical perspectives that integrate disruption exposure, network configurations, governance arrangements, and adaptive capabilities across multiple levels of analysis.

Research in economic geography and regional resilience further underscores the importance of spatial and institutional conditions. Regional resilience studies demonstrate that the capacity to absorb, recover from, and adapt to shocks varies across regions depending on industrial structures, knowledge bases, institutional quality, and adaptive ability (Boschma, 2015; Martin, 2012; Martin & Sunley, 2015). Recent research further highlights the role of regional diversification, institutional adaptability, place-based capabilities, and multi-scalar governance mechanisms in shaping resilience trajectories under conditions of increasing geopolitical uncertainty and economic restructuring (Sutton et al., 2023; Trippl et al., 2024). These findings are highly relevant to contemporary SCR research, as recent crises have intensified discussions about regionalization, reshoring, nearshoring, and the strategic reconfiguration of global SC architectures.

These perspectives suggest that SCR should not be understood solely as a collection of organizational or inter-organizational capabilities. Instead, SCR emerges from the interaction between disruption exposure, governance structures, spatial dependencies, institutional environments, and adaptive capacities. However, these broader insights are only partially integrated into contemporary SCR research, which continues to be strongly influenced by capability-based and operations-oriented approaches. As a result, essential questions about the link between structural and institutional factors, network vulnerabilities, and resilience-building mechanisms remain insufficiently understood. This fragmentation provides important motivation for this study, which seeks to develop a more comprehensive understanding of SCR. While the review focuses on contemporary SCR research, these complementary perspectives provide an important theoretical context for interpreting resilience beyond purely operational and firm-level explanations.

In recent years, SCR has gained considerable prominence in both academic discourse and policy debates in advanced economies. In the United States, for instance, strengthening resilient SCs was formally established as a strategic objective in the 2012 National Strategy for Global Supply Chain Security. It was followed by a series of policy initiatives targeting the manufacturing, defence, and high-technology industries. Similarly, the United Kingdom has incorporated SCR within its broader industrial development agenda, emphasizing complementary actions such as innovation capacity, workforce development, financial mechanisms, inter-organizational collaboration, and systemic risk mitigation. China has also intensified its efforts to strengthen SCR and, in response to recurring disruptions and escalating geopolitical uncertainties, has implemented robust measures to improve resilience and ensure the security of national SCNs (Liu et al., 2023; Thürer et al., 2020; Wei et al., 2023). These global efforts underscore the strategic importance of SCR as a consistently and globally acknowledged priority. In this context, analyzing new developments in SCR research is critical to advancing theoretical understanding and supporting organizations maintain their competitiveness in an increasingly volatile and interconnected global environment.

Over the past decade, research on SCR has expanded significantly and now includes conceptual work (e.g., Adobor, 2019; Ali & Gölgeci, 2019; Shishodia et al., 2023; Tukamuhabwa et al., 2015), studies investigating performance impacts (e.g., DuHadway et al., 2019; Zhao et al., 2019), analyses of antecedents and enablers (e.g., Chunsheng et al., 2020; Jain et al., 2017), assessments of resilience levels (e.g., Islam et al., 2023), and the development of resilience-strengthening strategies (e.g., Ali et al., 2023; Sabouhi et al., 2021; Song et al., 2022; Yavari & Ajalli, 2021).

These papers use various qualitative, quantitative, and modeling approaches. Several structured literature reviews have synthesized parts of this landscape, but most focus on relatively narrow topics or specific methodological domains.

Against this backdrop, this study aims to provide a more comprehensive and integrative understanding of recent developments in the field of SCR. Considering the marked increase in research on SCR in response to recent global shifts, this study conducts a systematic review of peer-reviewed research published between 2020 and 2024. This period marks a decisive turning point: the COVID-19 pandemic outbreak, subsequent geopolitical realignments, and macroeconomic shocks reshaped global SCs on an unprecedented scale and triggered an extraordinary surge in SCR-related research. As highlighted in recent literature, more than two-thirds of all SCR publications in the past decade were published after 2020, highlighting the methodological, conceptual, and technological shifts that characterize the contemporary research landscape.

Limiting the review to this period therefore ensures that the analysis captures the most relevant theoretical advancements, digital innovations, and network-oriented perspectives that define the current status of this field. This well-focused timeframe provides a robust basis for integrating descriptive analysis with a detailed exploration of conceptual, structural, and methodological contributions. Beyond mapping the most recent developments in knowledge, the review identifies emerging challenges and trends – particularly those driven by digitalization, collaborative SCN architectures, and evolving global risk profiles. Building on this insights, this study introduces an integrative framework and outlines promising avenues for future research on SCR.

To achieve these objectives, the study is divided into four core elements. First, a systematic search for peer-reviewed publications related to SCR was conducted in the SCOPUS database. After an initial screening, a descriptive overview was created to capture publication trends, thematic developments, and methodological patterns. Based on predefined quality criteria for journals, a refined sample of highly relevant and rigorously conducted studies was subsequently examined in detail and mapped along thematic (problem-oriented) and methodological (approach-driven) dimensions.

Second, building on the dominant analytical logic adopted in recent literature, the study reviews the current state of global SCR, incorporating an alternative analytical perspective focused on (a) the external disruption context that motivates resilience efforts, (b) the internal systemic frictions that constrain resilience, and (c) the strategic pathways through which organizations respond to and overcome disruptions.

Third, the findings of the study are used to identify emerging shifts in the design and management of global SCNs. The growing impact of digitalization, real-time visibility, platform-based coordination, sustainability requirements, and changing geopolitical dynamics indicates that traditional resilience models are no longer sufficient. This paper therefore presents new research avenues related to digitally enabled risk identification, multi-tier collaboration, ecological resilience, and the strategic redesign of global SC architectures.

Finally, the study combines the findings from the descriptive and analytical phases to formulate a forward-looking research agenda. This agenda delineates important conceptual, structural, and methodological gaps that should guide future research on the design of resilient global SCs and provides support for theoretical advancements proposed within the framework of the Disruption–Friction–Resolution (DFR) model.

2. Literature review

This study follows the approach for systematic literature reviews defined by Tranfield et al. (2003), which sets out key principles for management research. Tranfield et al. (2003) argue that such reviews increase the rigor of review processes by providing a structured approach to identifying scientific contributions within specific research areas or in response to given research questions (Becheikh et al., 2006). This methodology is generally regarded as robust and suitable for analyzing scientific publications (Supriharyanti & Sukoco, 2023). The main steps include formulating research questions, defining the search strategy, assessing study quality, verifying results, and extracting data. The research protocol of this study is shown in Table 1.

Table 1 Research protocol.

Step 1: Formulating research questions

- 1. How has SCR been conceptually defined and developed in the academic literature since 2020?
- 2. Which structural and dynamic factors such as network topology and disruption propagation shape current understandings of SCR?
- 3. Which theoretical and methodological gaps remain in current SCR research, and how can future research contribute to a more integrated understanding of resilient SCNs?

Step 2: Defining search strategy

- 1. Data base: Scopus
- 2. Period: 01/01/2020 – 12/31/2024: This period captures the most intense phase of SCR-related research, reflecting methodological, conceptual and technological shifts triggered by COVID-19, geopolitical reconfigurations and digital transformation.
- 3. Subject areas: Business, Management & Accounting (BUSI), Computer Science (COMP), Decision Sciences (DECI), Engineering (ENGI)
- 4. Keywords: ‘supply chain resilience’, ‘resilient supply chain’, ‘supply chain resiliency’, ‘supply network resilience’, ‘supply chain’, ‘resilient*’, ‘network’, ‘disruption*’, ‘supply chain risk*’, ‘supply chain vulnerability’, ‘supply chain flexibility’, ‘supply chain agility’

Step 3: Defining exclusion criteria

- 1. Articles that mention SCR only as a side concept
- 2. Non-academic journals in languages other than English
- 3. Types of publications: books, book chapters, conference papers, editorials, and other non-peer-reviewed formats
- 4. Articles published outside the Scopus subject categories BUSI, COMP, DECI, ENGI

Step 4: Defining inclusion criteria

- 1. Empirical, conceptual and theoretically oriented publications on SCR in English
- 2. Peer-reviewed journal articles
- 3. Articles within the defined Scopus categories BUSI, COMP, DECI, ENGI
- 4. Studies focusing SCR at the SC or SCN level, especially capability-based, network-oriented, or structural/dynamic perspectives

Source: Own representation based on Tranfield et al. (2003)

3. Step 1: Defining research questions

The study explores the development and current understanding of SCR by addressing three core research questions. First, it examines how SCR has been conceptually defined and developed in the academic literature since 2020, thereby contributing to a more integrated and contemporary understanding of the concept. Second, the study analyzes the structural and dynamic factors that shape SCR, including network topology, disruption propagation, and other mechanisms that influence the adaptive behaviour of SCNs. Third, it identifies theoretical and methodological gaps that remain in the current literature and outlines avenues for future research that can advance both scholarly debate and managerial practice. Together, these questions clarify the conceptual foundations of SCR and support the development of more resilient and adaptable supply chain strategies.

4. Step 2: Defining search strategy

Following established guidelines for systematic literature reviews (Bergström et al., 2015; Skrzek-Lubasińska & Szaban, 2019), the search was conducted as a computerized database query using Scopus. Scopus was selected due to its comprehensive coverage of high-quality journals across management, engineering, and related fields, as well as its advanced search functionalities (Pascucci et al., 2018). In alignment with the justification outlined in Table 1, the search focused exclusively on peer-reviewed journal articles published between January 2020 and December 2024, capturing the period in which SCR research experienced the strongest methodological, conceptual, and technological shifts triggered by COVID-19, digital transformation, and geopolitical reconfigurations.

To identify literature explicitly addressing SCR, the search strategy incorporated the core keyword ‘supply chain resilience’ along with its common variants (‘resilient supply chain’, ‘supply chain resiliency’, ‘supply network resilience’) and related terms frequently used in the SCR domain. These included ‘supply chain’, ‘resilien*’, ‘network’, ‘disruption*’, ‘supply chain risk*’, ‘supply chain vulnerability’, ‘supply chain flexibility’, and ‘supply chain agility’. Only studies that clearly conceptualized

resilience within a SC or SCN context were included. Articles discussing concepts such as flexibility or robustness were considered only when these were explicitly linked to SCR. To ensure methodological rigor and consistency, the search was restricted to English-language journal articles within the relevant Scopus subject areas – specifically BUSI, COMP, DECI, and ENGI. The search process was conducted twice to enhance reliability and comprehensiveness, resulting in an initial sample of 1,464 articles.

5. Step 3: Evaluating the quality of the studies

In alignment with the guidelines of Tranfield et al. (2003), all retrieved articles were subjected to a rigorous multistage screening process. Only peer-reviewed articles written in English and explicitly addressing SCR were eligible for inclusion. The screening process began with a title-level evaluation based on the predefined exclusion criteria, which resulted in the removal of 879 records from the initial set of 1,464 articles due to insufficient relevance or lack of an explicit SCR focus. In the second stage, an abstract-level screening was conducted using the predefined inclusion criteria, resulting in the exclusion of an additional 262 articles. The remaining publications underwent a full-text assessment to evaluate theoretical depth, methodological rigor, and alignment with the research questions, which led to a removal of a further 229 studies. Ultimately, 94 articles met all inclusion criteria and were retained for the final review (see Fig. 1).

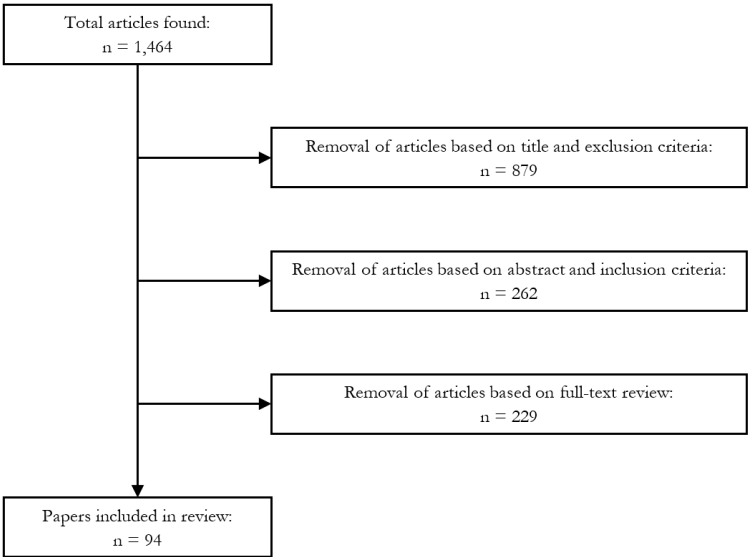


Figure 1 Stages of the systematic review process.

6. Step 4: Validating search results

The initial dataset of 1,464 articles was analyzed over the five-year period from 2020 to 2024. The publishing trend shows a significant increase in scientific interest in the early years of pandemic, with an annual number of publications increasing from 247 articles in 2020 to 361 in 2021 and reaching a peak of 403 articles in 2022. This sharp rise reflects the substantial global disruptions caused by the COVID-19 pandemic and the ensuing geopolitical and macroeconomic shocks, which significantly heightened academic interest in SCR. After 2022, the volume of publications declined to 279 articles in 2023 and further to 174 articles in 2024, indicating a gradual normalization of research activity following the crisis-induced increase. Overall, more than two-thirds of all identified SCR publications were produced between 2021 and 2023, underscoring the pivotal influence of the pandemic on the development and evolution of this research area. Figure 2 depicts research trends in terms of the number of published articles in the five-year period from 2020 to 2024.

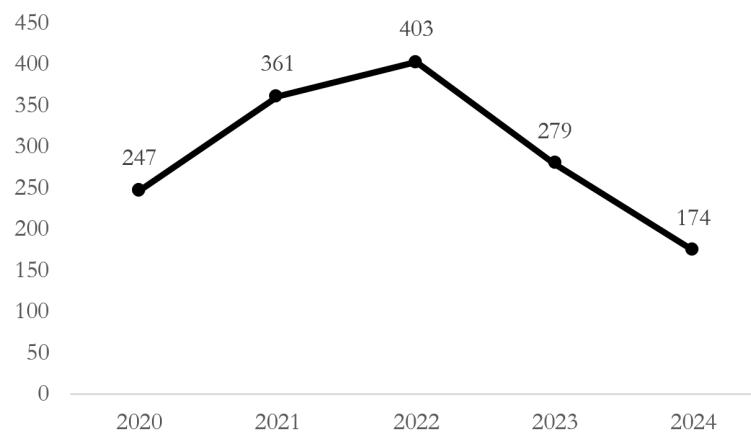


Figure 2 Publication trend in SCR research between 2020 and 2024.

In Table 2, the distribution of journals within the 94 included articles is summarized to illustrate which academic outlets most prominently shape current SCR research. The dataset reveals that publications are concentrated in a small number of high-impact journals, indicating a clear clustering of scientific discourse within the Operations and SCM field. The most frequently represented outlets include International Journal of Production Research, International Journal of Production Economics, International Journal of Physical Distribution & Logistics Management, The International Journal of Logistics Management, International Journal of Operations & Production Management, and Annals of Operations Research, which constitute the core publication venues.

By mapping the journal distribution, Table 2 highlights the central publication channels through which SCR knowledge is currently disseminated, providing transparency regarding the field's intellectual structure and identifying the dominant academic outlets driving contemporary research development.

Table 2 Distribution of reviewed articles across academic journals.

List of journals	Number of articles selected
International Journal of Production Research	23
International Journal of Production Economics	15
International Journal of Physical Distribution & Logistics Management	7
The International Journal of Logistics Management	7
International Journal of Operations & Production Management	7
Annals of Operations Research	7
Computers & Industrial Engineering	6
Supply Chain Management: An International Journal	5
International Journal of Logistics Research and Applications	5
Production Planning & Control	4
Omega	3
Journal of Operations Management	2
European Journal of Operational Research	1
Production and Operations Management	1
Journal of Supply Chain Management	1

Source: Own representation

7. Data coding and analytical procedure

To enhance analytical rigor and transparency, a systematic full-text review was conducted on all 94 articles included in the final sample. The coding process involved an iterative analytical procedure that identified recurring concepts, explanatory mechanisms, and resilience-related topics across the SCR literature. During the first stage, each article was reviewed to identify central concepts associated with disruption exposure, network structures, governance mechanisms, resilience capabilities, and resilience outcomes. These topics included disruption risks, ripple effects, SC complexity, institutional constraints, visibility, collaboration, agility, recovery, and viability.

In the second stage, conceptually related concepts were grouped into broader thematic clusters through iterative comparison and abstraction. Then, the coding framework was continuously refined by repeatedly comparing coded studies and emerging category definitions to improve consistency and reduce conceptual overlap. This iterative process identified recurring patterns in the literature and helped develop a coherent analytical structure for synthesizing diverse SCR perspectives.

The resulting clusters were then consolidated into four higher-order analytical categories that reflect distinct yet interrelated dimensions of SCR: Disruption landscapes (DL), structural and institutional frictions (SIF), resilience capability configurations (RCC), and system-level resilience outcomes (SLRO). These categories serve as analytical lenses for organizing and synthesizing the different findings reported in the reviewed studies, thereby supporting the development of a more integrated understanding of SCR.

To further complement the conceptual analysis, each study was classified according to its methodological orientation. Following established review practices, the studies were coded as either qualitative approaches (QualA), which encompass conceptual papers, case studies, and interview-based research, or quantitative approaches (QuanA), including survey-based studies, empirical modelling, simulation, and optimization approaches. The combination of conceptual and methodological coding enabled a systematic comparison of the literature and facilitated the identification of dominant research patterns, underexplored themes, and future research opportunities.

To ensure methodological rigor in the classification and synthesis of the reviewed literature, this study adopts a structured analytical framework integrating conceptual and methodological perspectives. Rather than reproducing predefined thematic taxonomies, the framework is designed to support the development of theory by organizing prior findings according to their functional role in explaining SCR. The conceptual dimension facilitates identifying explanatory gaps related to disruption contexts, structural conditions, and resilience mechanisms. The methodological dimension highlights dominant research designs and potential avenues for methodological advancement.

Each study was subsequently classified along both dimensions, resulting in a structured analytical coding matrix that enables systematic comparison while reducing descriptive redundancy. The analytical coding is summarized in Table 3, which provides an overview of how the reviewed studies contribute to the defined conceptual and methodological dimensions of SCR.

Table 3 Functional and methodological coding of the reviewed SCR studies.

No.	Author (Year)	DL	SIF	RCC	SLRO	QualA	QuanA
1	Acar et al. (2022)	•	•	•	•		•
2	Adobor (2020)		•	•	•	•	
3	Ali et al. (2023)	•		•	•		•
4	Ali et al. (2023)	•		•	•	•	
5	Aman & Seuring (2023)	•	•	•	•	•	•
6	Azadegan & Dooley (2021)	•	•	•	•		•
7	Babaei et al. (2023)	•	•		•		•
8	Bag et al. (2023)	•		•	•		•
9	Bag et al. (2022)	•		•	•		•
10	Baghersad et al. (2022)	•		•	•		•
11	Belhadi et al. (2022)	•		•	•		•
12	Belhadi et al. (2024)	•		•	•		•
13	Birkel & Hartmann (2020)	•		•	•	•	
14	Chauhan et al. (2021)	•	•		•		•

Table 3 (Continued)

No.	Author (Year)	DL	SIF	RCC	SLRO	QualA	QuanA
15	Cohen et al. (2022)		•	•		•	
16	Delbufalo (2022)		•	•			•
17	Dev et al. (2021)	•		•	•		•
18	Dohale et al. (2024)	•		•	•		•
19	Dohmen et al. (2023)	•		•	•		•
20	Dolgui & Ivanov (2022)		•	•		•	
21	Dubey et al. (2020)			•	•		•
22	Echefaj et al. (2024)	•		•	•		•
23	Eggert & Hartmann (2022)	•		•	•		•
24	El Baz & Ruel (2021)	•		•	•		•
25	El Baz et al. (2023)	•		•	•		•
26	Eryarsoy et al. (2022)	•	•		•		•
27	Faruquee et al. (2021)	•		•	•		•
28	Fattahi et al. (2020)	•	•	•	•		•
29	Garvey & Carnovale (2020)	•	•		•		•
30	Giannoccaro & Iftikhar (2020)	•	•	•	•		•
31	Gruchmann et al. (2024)	•	•	•	•	•	
32	Gu et al. (2021)			•	•		•
33	Gunessee & Subramanian (2021)			•	•		•
34	Habibi et al. (2023)	•		•	•		•
35	Hosseini et al. (2020)	•	•		•		•
36	Iftikhar et al. (2023)			•	•		•
37	Ivanov (2024a)	•	•		•	•	
38	Ivanov (2024b)	•	•		•		•
39	Ivanov & Dolgui (2020)	•	•		•	•	
40	Ivanov & Keskin (2023)	•	•		•		•
41	Juan et al. (2021)	•		•	•		•
42	Kähkönen et al. (2023)	•		•	•		•
43	Kamalahmadi et al. (2022)	•	•		•	•	
44	Kaur & Singh (2021)	•		•	•		•
45	Kumar & Singh (2021)			•	•		•
46	Kungwalsong et al. (2022)	•		•	•		•
47	Li et al. (2021)	•		•	•		•
48	Li & Zobel (2020)	•	•		•		•
49	Li et al. (2020)	•	•		•		•
50	Liu et al. (2021)	•	•		•		•

Table 3 (Continued)

No.	Author (Year)	DL	SIF	RCC	SLRO	QualA	QuanA
51	Lohmer et al. (2020)	•	•	•	•		•
52	Manupati et al. (2022)	•	•	•	•		•
53	Modgil et al. (2022)	•		•	•	•	
54	Modgil et al. (2022)	•		•	•	•	
55	Moosavi & Hosseini (2021)	•	•		•		•
56	Munir et al. (2022)	•		•	•		•
57	Nayal et al. (2022)	•		•	•		•
58	Negri et al. (2024)			•	•	•	
59	Nguyen et al. (2021)	•	•		•		•
60	Nikookar & Yanadori (2022)	•		•	•		•
61	Olivares-Aguila & ElMaraghy (2021)	•	•	•	•		•
62	Owida et al. (2022)	•		•	•	•	
63	Parast (2020)			•	•	•	
64	Pavlov et al. (2022)	•	•	•	•		•
65	Poberschnigg et al. (2020)			•	•	•	
66	Queiroz et al. (2022)	•		•	•		•
67	Rajesh (2022)	•		•	•		•
68	Ralston & Blackhurst (2020)	•		•	•	•	
69	Ribeiro & Barbosa-Póvoa (2023)	•	•	•	•		•
70	Roscoe et al. (2020)			•	•		•
71	Sabouhi et al. (2021)	•	•		•		•
72	Sabouhi et al. (2020)	•	•		•		•
73	Sauer et al. (2022)	•		•	•	•	
74	Sawik (2022)	•	•		•		•
75	Sazvar et al. (2021)	•	•		•		•
76	Sharma et al. (2024)	•		•			•
77	Shen & Sun (2021)	•			•	•	
78	Shi et al. (2024)	•	•		•	•	
79	Shi et al. (2020)	•	•				•
80	Shi et al. (2022)	•	•				•
81	Singh et al. (2021)			•	•		•
82	Son et al. (2021)	•		•	•		•
83	Song et al. (2022)			•	•	•	
84	Taghizadeh et al. (2021)	•		•	•		•
85	Um & Han (2021)			•	•		•

Table 3 (Continued)

No.	Author (Year)	DL	SIF	RCC	SLRO	QualA	QuanA
86	Vali-Siar et al. (2022)	•	•		•		•
87	Wang & Zhao (2023)	•		•	•		•
88	Wong et al. (2020)			•	•		•
89	Wong et al. (2024)			•	•		•
90	Yang et al. (2021)			•	•		•
91	Zhang et al. (2024)			•	•		•
92	Zhao et al. (2024)	•		•	•	•	
93	Zhu et al. (2024)	•		•	•		•
94	Zouari et al. (2021)			•	•		•

Source: Own representation

8. Emerging debates and synthesis of findings

Beyond identifying thematic categories, the review reveals several recurring debates that shape current SCR research. These debates highlight differing assumptions regarding the origins of resilience, the mechanisms by which resilience is developed, and the outcomes that resilience ultimately seeks to achieve. Synthesizing these perspectives provides a deeper understanding of the fragmentation characterizing the SCR literature.

The first debate concerns the relative importance of capability-based and structural explanations of SCR. A substantial proportion of the reviewed studies conceptualize resilience as an outcome of organizational and inter-organizational capabilities such as agility, flexibility, visibility, collaboration, and adaptive capacity (Gruchmann et al., 2024; Ivanov & Keskin, 2023). Other studies, in contrast, emphasize the influence of structural conditions, such as network complexity, SC dependencies, governance arrangements, and institutional constraints, in shaping resilience outcomes (Dolgui & Ivanov, 2022; Hosseini et al., 2020). The former perspective focuses on developing and deploying resilience capabilities, while the latter highlights the broader structural context in which these capabilities operate. The reviewed literature suggests that SCR emerges from the interaction between these two perspectives rather than from either one in isolation.

A second debate relates to the underlying purpose of resilience. Early conceptualizations of SCR primarily focused on recovery-oriented outcomes, emphasizing robustness, continuity, and the capacity to return to a pre-disruption state following adverse events. More recent studies increasingly adopt a viability-oriented approach, viewing resilience as a dynamic process of adaptation, transformation, and long-term survival under conditions of persistent uncertainty (Ivanov & Dolgui, 2020; Ivanov, 2024a). This shift reflects a broader movement from short-term disruption management toward the development of adaptive systems capable of sustaining performance and functionality in volatile settings. Thus, resilience is increasingly conceptualized as a dynamic capability extending beyond recovery to encompass continuous renewal and strategic adaptation.

A third debate concerns the appropriate level of analysis for understanding resilience. Many studies examine resilience at firm level, focusing on organizational resources, managerial practices, and operational abilities. However, an increasing number of contributions emphasize that resilience is inherently embedded within broader SCNs and can only be understood by considering interdependencies, ripple effects, and systemic vulnerabilities across multiple actors and tiers (Garvey & Carnovale, 2020; Dolgui & Ivanov, 2022). This viewpoint shifts the focus from isolated organizational responses toward resilience as an emergent property of interconnected SC systems. Thus, SCR research is gradually moving toward more network-oriented and system-level conceptualizations.

These debates suggest that the SCR literature remains fragmented across different theoretical assumptions, levels of analysis, and resilience objectives. Simultaneously, they reveal a growing convergence toward more integrative perspectives that acknowledge the interplay between disruption exposure, structural conditions, resilience capabilities, and system-level outcomes. These findings provide a foundation for identifying key research gaps and motivate the design of the multi-layered capability architecture proposed in this study.

9. Research gaps

To identify research gaps, the distribution of the reviewed studies was analyzed across the conceptual and methodological dimensions of the final coding matrix (see Table 3). The majority of studies adopt an integrative perspective by combining DL, RCC, and SLRO, indicating that SCR is predominantly examined as a capability-based response to disruption with measurable performance implications.

In contrast, SIF receive comparatively limited and less systematic attention. Only a smaller subset of studies explicitly models governance structures, network interdependencies, or institutional constraints as distinct explanatory sources of vulnerability. This pattern suggests that structural conditions shaping SCR remain less theoretically and empirically developed relative to capability-based approaches.

Regarding outcomes, SCR is predominantly operationalized through performance-oriented indicators, frequently linked to operational or financial metrics. Broader multidimensional conceptualizations of system-level resilience appear less consistently integrated across the reviewed studies.

Methodologically, QuanA, such as survey-based empirical analyses, simulation models, and optimization studies, clearly dominate the field. QualA, such as theory-building and process-oriented research designs, are comparatively less prevalent. This methodological focus highlights opportunities for deeper theoretical development and more diverse research designs to advance the understanding of SCR.

10. Toward a multi-layered capability architecture of SCR

The preceding review reveals a dominant capability-based orientation in the SCR literature, accompanied by comparatively limited attention to the structural and institutional conditions shaping vulnerability. While existing studies frequently combine disruption contexts, resilience capabilities, and performance outcomes, these elements are conceptually fragmented and not fully integrated into a coherent explanatory framework.

In particular, resilience is often operationalized as either an outcome variable or a set of isolated capabilities, rather than as part of the broader structural and institutional configurations within which SCs operate. This fragmentation hinders the theoretical development of SCR and restricts the accumulation of knowledge.

To address these limitations, this section develops a multi-layered capability architecture framework of SCR that unifies disruption exposure, structural frictions, capability configurations, and system-level outcomes. Rather than conceptualizing resilience as a constant attribute, SCR is reframed as an emergent property of interacting capability layers embedded within environmental and structural conditions.

The proposed architecture builds on the dimensions analyzed in Table 3 which are considered four distinct but interrelated layers: DL, SIF, RCC, and SLRO. First, DL define the external exposure conditions under which SCs operate. Environmental turbulence, demand shocks, and supply risks generate the uncertainty and volatility that necessitate resilience responses. While these factors trigger resilience dynamics, they do not determine system performance on their own.

Second, SIF shape the system's underlying vulnerabilities. Network complexities, governance structures, institutional constraints, power asymmetries, dependency structures, and structural rigidity determine how disruptions spread and constrain response options. These structural dimensions can explain why similarly exposed SCs may exhibit different resilience trajectories.

Third, RCC represent the SC's dynamic response system. Rather than considering capabilities as isolated mechanisms, the architecture views them as layered and interdependent. Sensing and scanning capabilities enable the early detection of disturbances, while absorptive capabilities provide buffering and stabilization. Adaptive capabilities facilitate reconfiguration, and relational and collaborative capabilities coordinate distributed responses. Finally, transformative capabilities enable long-term renewal. Together, these layers of capabilities constitute the core resilience system.

Finally, SLRO capture the emergent consequences of the interplay between exposure, structural conditions, and capability configurations. Operational continuity, financial stability, strategic renewal, long-term viability, and system robustness represent multidimensional expressions of SCR performance.

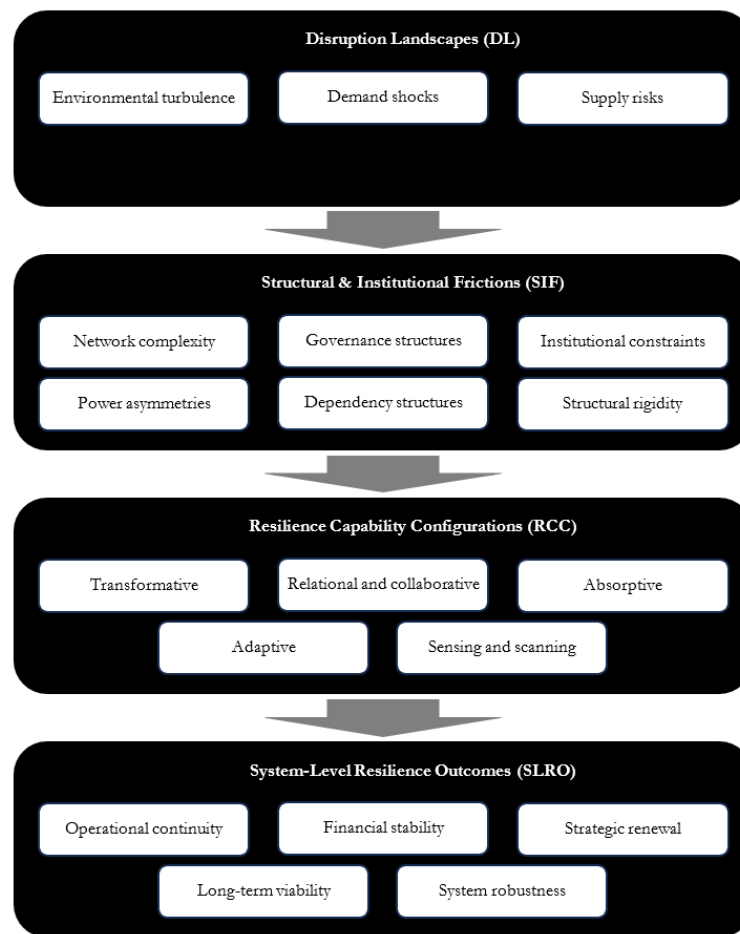


Figure 3 A multi-layered capability architecture of SCR.

By integrating these four layers into a coherent architecture, SCR is not conceptualized as a single outcome or static capability, but rather as a multi-level configuration process. This layered perspective clarifies causal relationships, reconciles fragmented strands of the literature, and establishes a structured basis for future theoretical and empirical advancement.

11. Theoretical positioning of the multi-layered capability architecture of SCR

The proposed multi-layered capability architecture of SCR extends capability-based and systems-oriented perspectives by embedding resilience capabilities within disruption exposure and structural-institutional conditions. Previous research on dynamic capabilities has primarily conceptualized SCR in terms of sensing, reconfiguration, and transformation. While this view sheds light on adaptive processes, it largely abstracts from structural constraints that shape capability enactment. In contrast, network and viability approaches emphasize structural complexity, interdependencies, and governance structures but often treat capabilities as implicit mechanisms.

The framework integrates this perspective by conceptualizing SCR as an emergent system property arising from the interaction between DL, SIF, and RCC. Drawing on institutional and resource dependence theory, SIF are modelled as conditioning forces that explain heterogeneous resilience trajectories under similar disruption exposure. By analytically distinguishing DL, SIF, RCC, and SLRO, the framework reframes SCR as a layered configuring process embedded in structural contexts and manifested in system-level outcomes. This positioning provides a coherent foundation for cumulative and theoretically integrative SCR research.

12. Layer interaction and causal logic of the architecture

The explanatory contribution of the architecture lies in its layered interaction logic. Rather than depicting SCR as a direct reaction to disruption, the framework advances a contingent causal structure in which DL, SIF, and RCC interact to shape SLRO.

Disruption exposure initiates resilience processes but does not determine their trajectory. Similar disruption profiles may generate divergent outcomes because exposure effects are filtered through structural and institutional configurations that shape vulnerability and constrain response options. SIF therefore function as conditioning mechanisms that define the structural space within which capabilities can be enacted.

RCC constitute the mediating layer between exposure and outcomes. Capabilities translate disruption signals into coordinated responses, yet their impact depends on both shock intensity and structural context. The architecture thus specifies a layered causal logic: disruption exposure influences SLRO through capability enactment, while structural frictions condition the strength and direction of this relationship.

SLRO emerge from the interaction of these layers. SCR is conceptualized as an emergent system property shaped by disruption exposure, structural constraints, and adaptive capacity. This viewpoint clarifies causal pathways and explains variations in SCR performance.

13. Conceptual contributions

The proposed architecture advances SCR research in four central ways. First, it reconciles structural and capability-based explanations within a unified configurational framework. Rather than privileging either dynamic capabilities or network characteristics, SCR is conceptualized as arising from the interaction between the four layers.

Second, the framework redefines SCR as an emergent system property instead of a static attribute or a linear outcome of isolated capabilities. By distinguishing contextual conditions from adaptive mechanisms, it provides a clearer explanation for heterogeneous resilience trajectories under similar disruption exposure.

Third, the analytical separation of DL, SIF, RCC, and SLRO enhances construct clarity and reduces conceptual overlap in the existing literature, thereby strengthening theoretical precision and enabling cumulative knowledge development.

Fourth, the new model broadens the scope of SCR outcomes beyond short-term operational recovery by incorporating long-term viability and strategic renewal as integral system-level manifestations.

Collectively, the architecture offers a structured and theoretically integrative foundation for advancing SCR research.

14. Comparison with existing SCR frameworks and perspectives

Existing SCR frameworks and perspectives have substantially advanced the understanding of resilience by focusing on specific aspects of disruption management and adaptive response. Capability-based approaches conceptualize resilience as the development and deployment of organizational and inter-organizational capabilities like flexibility, agility, visibility, collaboration, and adaptive capacity (Ivanov & Keskin, 2023; Ponomarov & Holcomb, 2009; Tukamuhabwa et al., 2015). While these approaches provide valuable insights into resilience-building mechanisms, they tend to devote limited attention to the structural and institutional conditions that influence the effectiveness of these capabilities.

More recent, viability-oriented frameworks expand on the concept of resilience by emphasizing long-term adaptability and survivability, as well as the capacity of SCs to function under persistent disruption (Ivanov & Dolgui, 2020; Ivanov, 2024a). While these approaches offer a valuable systems perspective, they tend to focus typically on resilience outcomes and adaptive responses, often treating disruption exposure and structural constraints as contextual rather than explanatory dimensions.

Network-oriented perspectives broaden SCR research by emphasizing SC interdependencies, ripple effects, and systemic vulnerabilities across interconnected networks (Garvey & Carnovale, 2020; Dolgui & Ivanov, 2022; Hosseini et al., 2020). While these contributions highlight the importance of network structures and disruption propagation mechanisms, they generally lack integration with capability-based explanations of resilience development and deployment.

This study proposes a multi-layered capability architecture that seeks to address limitations by integrating DL, SIF, RCC, and SLRO within a single explanatory framework. Unlike many existing approaches, which focus mainly on individual dimensions of resilience, the proposed architecture explicitly defines SCR as the outcome of interactions among these four layers.

A significant contribution of the framework is its capacity to connect environmental conditions, structural constraints, organizational capabilities, and resilience outcomes within a coherent analytical structure. This allows for a more profound explanation of why SCs exposed to similar disruptions may have significantly different resilience trajectories. By integrating capability-, viability-, and network-oriented perspectives, the framework promotes a more holistic and theoretically integrated understanding of SCR across increasingly complex and interconnected SCNs.

15. Conclusion

Global SCs are no longer exposed to episodic disruptions but to persistent systemic volatility characterized by cascading failures, geopolitical fragmentation, digital interdependencies, and climate-related disruptions. In such an environment, resilience cannot be reduced to recovery speed or operational robustness. Rather, it represents a structural and dynamic system quality that determines long-term viability of SCNs. Despite considerable theoretical and empirical progress achieved in SCR research since 2020, the rapid expansion of the field has also been accompanied by increasing conceptual fragmentation between capability-based, network-structural, and performance-oriented perspectives.

This study addressed the fragmentation by systematically reviewing contemporary SCR research and developing a theoretically integrated multi-layered capability architecture. The proposed framework contributes to a more comprehensive conceptualization of SCR by moving beyond the view of resilience as a static attribute or linear outcome of isolated mechanisms. Instead, resilience is conceptualized as an emergent system property arising from the interaction between DL, SIF, RCC, and SLRO.

16. Main purpose and core insights

The main purpose of the paper is to consolidate recent SCR research into a coherent, explanatory structure that integrates disruption exposure, structural vulnerability, adaptive capability enactment, and system-level outcomes. By synthesizing 94 peer-reviewed studies, the review identified three overarching patterns in the contemporary SCR literature.

First, SCR research remains strongly capability-centric. Dynamic capabilities, such as sensing, absorptive, adaptive, collaborative, and transformative, are recognized as key mechanisms for coping with disruptions. However, their structural embeddedness within SCNs is often undertheorized.

Second, SIF are less systematically integrated into resilience explanations. Although disruption propagation and network topology are increasingly modeled, these perspectives rarely converge with capability-based theorizing in a unified causal logic.

Third, resilience outcomes are predominantly operationalized through short-term operational and financial performance indicators. Broader system-level dimensions, such as long-term viability, strategic renewal, and system robustness, receive less consistent conceptual attention. Methodologically, the field is dominated by quantitative modeling and survey-based approaches, indicating opportunities for stronger theory building and process-oriented research designs.

Taken together, these findings highlight the necessity of a more configurational understanding of SCR that integrates environmental exposure, structural conditioning forces, multi-layered capability configurations, and multidimensional outcomes.

17. Theoretical implications

The proposed multi-layered capability architecture advances SCR theory in four ways. In contrast to many existing SCR frameworks, the proposed architecture integrates structural and institutional conditions with capability-based explanations and system-level resilience outcomes.

First, the framework unifies structural and capability-based explanations within a unified framework. Rather than attributing resilience to either adaptive capabilities or network design characteristics, this framework emphasizes their interaction under specific disruption conditions.

Second, the framework conceptualizes SCR as an emergent system property rather than a static attribute. By distinguishing DL, SIF, RCC, and SLRO, the framework introduces a layered causal logic that explains heterogeneous resilience outcomes under similar exposure conditions.

Third, analytically separating contextual conditions from adaptive mechanisms enhances construct clarity and reduces conceptual overlap within the SCR literature. This differentiation fosters theoretical precision and supports knowledge development in the SCR domain.

Fourth, the framework broadens the scope of SCR outcomes beyond operational recovery by incorporating long-term viability and strategic renewal as integral system-level manifestations. By doing so, the framework connects SCR research with emerging, viability-oriented perspectives and establishes SCR as a foundational quality of future-ready SCNs.

18. Managerial and policy implications

For managers, the findings highlight that resilience cannot be achieved through isolated investments in flexibility, redundancy, or digital technologies. Instead, achieving SCR requires systemic alignment between network design, governance structures, digital integration, and the coordinated enactment of resilience capabilities across SC tiers. Structural vulnerabilities, such as excessive dependency, rigid governance arrangements, or limited network visibility, must therefore be addressed alongside capability development.

From a policy perspective, the results underline the importance of institutional frameworks that enhance transparency, reduce systemic fragility, and foster interorganizational coordination in strategically critical industries. Public policy can play a catalytic role in strengthening systemic resilience by supporting digital infrastructure, enabling collaborative platforms, and promoting regulatory coherence across SC ecosystems.

19. Limitations

Despite its contributions, this study is subject to several limitations. First, the review focuses exclusively on peer-reviewed SCR literature published between 2020 and 2024. While this period captures the most recent theoretical and empirical developments resulting from COVID-19 pandemic and subsequent geopolitical disruptions, it may not fully reflect earlier conceptual foundations or long-term developments in resilience research.

Second, although the study acknowledges complementary perspectives from GVC research, GPN theory, economic geography, and regional resilience studies, these streams were not systematically included in the review protocol. Consequently, the findings primarily capture developments within the SCR literature and may not fully reflect resilience mechanisms operating at regional, national, or macroeconomic levels. Future reviews could adopt a broader interdisciplinary scope to further integrate these perspectives and advance a more comprehensive understanding of resilience across interconnected economic systems.

Third, the study relies on publications indexed in the Scopus database and therefore excludes potentially relevant contributions from other databases, books, conference proceedings, and grey literature. Although this approach enhances methodological consistency and quality control, it may limit the comprehensiveness of the evidence base.

Finally, the proposed multi-layered capability architecture is conceptual in nature and has not yet been empirically validated. Future empirical research is therefore required to examine the proposed relationships and assess the explanatory power of the framework across different industries, supply chain structures, and disruption contexts.

20. Future research directions

This study opens several avenues for future research. First, empirical studies could test the proposed multi-layered capability architecture by using longitudinal and multi-tier SCR data to analyze the interactive effects of disruption exposure, structural friction, and resilience capabilities on SCR outcomes. These studies could provide deeper insights into the dynamic and evolving nature of resilience in different disruption contexts.

Second, future research could investigate the role of SIF in moderating the effectiveness of resilience capabilities, especially in complex, highly interconnected SCNs. Particular attention should be given to how governance structures, network dependencies, and institutional constraints influence the deployment and effectiveness of resilience-building mechanisms.

Third, integrating perspectives from network science, system dynamics, economic geography, and digital SC analytics could advance the understanding of disruption propagation and systemic vulnerabilities across SCNs. Such interdisciplinary approaches may contribute to a more holistic understanding of resilience as a multi-level and network-embedded phenomenon. Fourth, future studies could explore the implications of geopolitical fragmentation, strategic decoupling, reshoring, and nearshoring on the development of resilient SC architectures. Understanding how firms redesign SCNs under conditions of uncertainty is a particularly promising research area given the increasing importance of geopolitical risks.

Finally, future research should investigate the relationship between SCR, sustainability, and the long-term viability of SCs. Specifically, more attention should be given to understanding how to balance economic, environmental, and social goals while maintaining resilience in increasingly volatile environments.

Addressing these issues will be essential for designing resilient SCs that remain adaptable, competitive, and sustainable in the face of future disruptions.

Conflict of interest:

The author declares no conflict of interest.

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