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Supply chain integration-performance nexus in emerging & developing economies: a systematic review

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ABSTRACT

The literature on SCI-performance nexus remains inconclusive and inconsistent. This study analyses the most recent literature aiming to clarify the most important conceptualisations of SCI, identify existing performance measures, and assess the evidence supporting the SCI-performance nexus. This investigation contributes to the extant literature in several ways: stipulating the current state of knowledge, deriving valid insights, revealing gaps in the current body of knowledge, and suggesting directions for future research. It employed the systematic review method, investigating fifty empirical studies published in peer-reviewed journals between 2010 and 2023. Our findings reveal that the multidimensional measure of SCI, encompassing supplier, internal, and customer integration, has emerged as the standard framework. Performance measures primarily focus on operational and firm-level outcomes. Though the empirical evidence on the SCI-performance nexus remains complex, SCI generally has positive impacts on performance in the EDEs context. Three conceptual models explaining existing relationships have emerged. Future research ought to verify the validity of the proposed conceptual models. The study's broader applicability may have been constrained by its exclusive focus on studies conducted within the context of EDEs.

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1. Introduction

In today's business landscape, firms must collaborate, both upstream and downstream, with other firms in the supply chain to maintain competitiveness (Chiang et al., 2015; Kamal & Irani, 2014). Supply Chain Management (SCM) literature suggests that competition has shifted from among individual firms to among supply chains, highlighting supply chain integration (SCI) as an important managerial tool to provide a competitive gain to firms (Tarifa-Fernandez & De Burgos-Jiménez, 2017). Key activities, such as integration, are crucial for enhancing both the supply chain and firm performance (Tiwari, 2021; van der Vaart & van Donk, 2008). The absence of integration can lead to negative consequences, such as excessive inventory or stock-outs, known as the "bullwhip effect" (Lee & Billington, 1992; Li et al., 2009). Hence, *Supply Chain Integration* (SCI) has received significant attention from academia and practitioners alike (Ataseven & Nair, 2017; Danese et al., 2020; Flynn et al., 2010; Frohlich & Westbrook, 2001; Schoenherr & Swink, 2012), establishing itself as a trendy topic in operations and supply chain management for the last two decades (Li et al., 2022).

SCI has been broadly defined in the literature. Zhao et al. (2008) defined SCI as "the degree to which an organization strategically collaborates with its SC partners and manages intra- and inter-organization processes to achieve effective and efficient flows of products, services, information, money, and decisions, to provide maximum value to its customers." In their seminal work, Flynn et al. (2010) defined SCI as "the degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organization processes to achieve effective and efficient

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integration of physical, information, and financial flows." Supply chain coordination and collaboration have also been used as synonymous to SCI (Ataseven & Nair, 2017; Li et al., 2022). Despite its maturity, SCI remains an important topic given recent global SC disruptions, the emergence of new technologies, rapidly changing customer demands, and shorter product lifecycles (Li et al., 2022).

The relationship between SCI and performance has been a topic of interest in SCM literature since the early 2000s. However, despite the impressive progress achieved over the last decade (Kamal & Irani, 2014; Leuschner et al., 2013; Wiengarten & Longoni, 2015), evidence of the SCI-performance nexus remains inconclusive. These studies include the seminal work of Frohlich and Westbrook (2001), subsequent studies on this topic (Narasimhan & Kim, 2002; Rosenzweig et al., 2003; Swink et al., 2007; Vickery et al., 2003), and other recent studies (Agyei-Owusu et al., 2022; Amoako-Gyampah et al., 2020; Bae et al., 2023; Tan et al., 2023; Wiengarten et al., 2019). While some studies argue for a positive effect of SCI on performance (Ataseven & Nair, 2017; Chang et al., 2016; Frohlich & Westbrook, 2001; Hamid et al., 2020; Khanuja & Jain, 2019; Leuschner et al., 2013; Mackelprang et al., 2014; Sofyalioğlu & Öztürk, 2012), others report inconsistent findings (Afshan & Motwani, 2018; Fabbe-Costes & Jahre, 2008; Flynn et al., 2010; He & Lai, 2012; Kim, 2013; Mackelprang et al., 2014; Rosenzweig et al., 2003; Swink et al., 2007).

These ambiguities and inconsistencies in evidence suggest the prevalence of theoretical and empirical gaps calling for a systematic investigation of the SCI-performance nexus to gain a nuanced understanding of the basic factors and the conceptual models that explain these divergent results. Specifically, we seek to identify the dominant dimensions of SCI that have been studied as yet, examine the prevalent performance measures used to assess the impact of SCI, evaluate the existing conceptual frameworks explaining the SCI-performance nexus, and identify gaps and suggest future research directions to advance our understanding of SCI and its linkages with performance in the EDEs context and beyond. Hence, this study aims to address these objectives through a systematic review of the most recent empirical research (2010–2023). Previous reviews on the SCI-performance nexus included those by Li et al. (2022), Hassan and Abbasi (2021), Danese et al. (2020), Khanuja and Jain (2019), Tarifa-Fernandez and De Burgos-Jiménez (2017), and Kim (2013). Despite similarities with previous reviews, this study seeks to consolidate fragmented findings and highlight gaps that have hindered theoretical development in SCM.

The novelty of this study is threefold as elaborated next. First, this study provides a novel contribution to the existing literature by providing a comprehensive and up-to-date review of the SCI-performance nexus, with a specific focus on manufacturing firms in EDEs. Unlike previous reviews, that had a broader focus, both industry-wise and geographically, this study delves deeper into the context of firms operating in the EDEs, due to the unique challenges and opportunities facing these firms. This focus is particularly important in the face of the growing prominence of the manufacturing sector in the EDEs (Wang et al., 2020). There is a bold argument that industrial development is a driver of economic development and that manufacturing dwells at the centre of every economy (Ojubanire et al., 2023). Firms in these economies are increasingly prioritising SCI efforts in the manufacturing, sourcing, and delivery processes (Georgise et al., 2014). We argue that focusing on the manufacturing and the EDEs context provides a unique outlook that previous studies have not adequately addressed. The second novelty lies in its timeliness. Recent technological advancements, such as AI, robotics, blockchain, RFID, and IoT, have significantly impacted SCM practices (Attaran, 2020; Baisa et al., 2024; Schniederjans et al., 2020) such as SCI. Hence, understanding the dynamics of the SCI-performance nexus in the era of these technological changes is crucial. Third, this study employs a qualitative synthesis approach to identify key themes, gaps, and inconsistencies in the literature, providing valuable insights to knowledge, practice, and policy making. Additionally, it addresses gaps that other methods, such as meta-analysis lack due to smaller sample sizes (Wang et al., 2024). Consequently, the findings from this study contribute to the building of robust theoretical frameworks, provide practical guidelines for improving performance, and suggest future research agenda in the EDEs context and beyond.

This study addresses the following research questions: 1) What are the key SCI dimensions and performance outcomes extensively explored in the EDEs manufacturing industry? 2) Which conceptual models explain the SCI-performance nexus within the EDEs manufacturing industry? 3) What is the current state of knowledge and research evidence on the SCI-performance nexus in the EDEs manufacturing industry? To address these questions, the study employs a systematic review methodology. Our synthesis

of published empirical studies have allowed for the identification of theoretical and conceptual issues, the provision of future research agendas, and the proposal of practical implications for managers in the EDEs. Most importantly, the findings can enhance our understanding on the progression of SCI and SCM theories.

The rest of this paper is structured as follows: Section two presents the research methodology consisting of the data collection and analysis procedures; Section three presents descriptive analysis while section four delves into thematic analysis; Section five discusses the findings from the analysis section; and section six provides the study's conclusions, implications, limitations, and potential paths for future research.

2. Methodology

A systematic review approach was employed to comprehensively identify, evaluate, and synthesise existing research on the SCI-performance nexus. Systematic reviews synthesise studies in a transparent, and reproducible manner to enhance the knowledge base and inform policymaking and practice (Tranfield et al., 2003). As noted by Tiwari (2021), systematic reviews provide several advantages, including the ability to categorise and analyse contributions to the literature and to synthesise existing studies on a specific topic to inform both research and practice.

Following the framework of Denyer and Tranfield (2009), this review follows to a five-step process: 1) research question formulation, 2) study location, 3) study selection and evaluation, 4) analysis and synthesis, and 5) reporting of results. This approach has been successfully employed in prior studies investigating the SCI-performance nexus (Danese et al., 2020; Hassan & Abbasi, 2021; Khanuja & Jain, 2019; Li et al., 2022). Given that the research questions were outlined in the introduction section, the remaining four steps of the review process are elaborated in the subsequent two subsections.

2.1. Locating, evaluating, and selecting studies

A systematic search of *titles*, *abstracts*, and *keywords* associated with SCI and performance was conducted in the *Scopus* database towards the end of 2022 and the beginning of 2023 to identify relevant studies. Scopus was chosen due to its status as "the largest abstract and citation databases for academic reputed scientific journals, conference proceedings, books, and book chapters" (Tiwari, 2021). Specifically, the search utilised key terms and phrases such as "supply chain integration", "internal integration", "external integration", "supplier integration", "customer integration" and "performance," as suggested by previous studies including Danese et al. (2020) and Li et al. (2022). Inclusion criteria, detailed in Table 1, were applied to refine the selection of relevant studies.

Given the dynamic and complex nature of the business landscape that rolled up in the past decade, this study focused on studies published between 2010 and 2023. This timeframe is characterised by the digitalisation of supply chain activities, marked by significant technological advancements, such as artificial intelligence (AI), robotics, cloud computing, 3D printing, advanced analytics, blockchain, RFID, internet of things (IoT), and cloud technology (Attaran, 2020; Schniederjans et al., 2020). These technologies have profoundly influenced and facilitated SCI practices, making the selected timeframe particularly relevant.

The initial search of the Scopus database yielded 1,207 publications. After applying the established inclusion criteria, this number was narrowed down to 272 articles. These articles were then further evaluated to determine their relevance to the research questions and adherence to minimum quality

Table 1. Criteria for inclusion of papers.

Criteria for inclusion	Narrative
Keywords	Supply Chain Integration, Internal Integration, External Integration, Supplier Integration, Customer Integration, and Performance
Type of documents	Articles
Types of sources	Peer-reviewed journals
Study context	Manufacturing industry in Emerging and Developing Economies (EDEs)
Language	English
Period (Time interval)	2010–2023

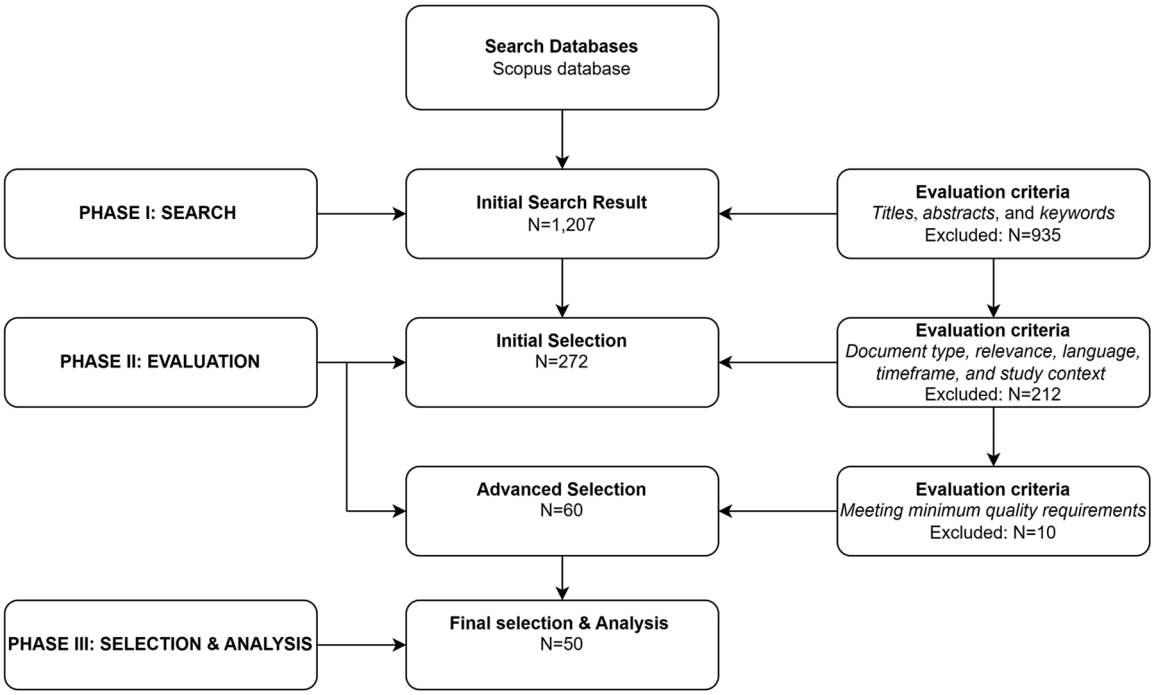


Figure 1. Inclusion criteria flowchart.

standards. Subsequently, 50 studies were selected for inclusion in the review, exceeding the rule-of-thumb threshold of 40 articles proposed by Paul et al. (2021) for a systematic review. The evaluation and selection process is illustrated in Figure 1.

2.2. Data analysis, synthesis, and reporting of findings

Both descriptive and thematic analyses were conducted on the selected studies published within the specified timeframe. The findings are presented using descriptive tools such as tables and figures to provide a clear overview of the data. Moreover, the thematic analysis classified studies according to the scope of the investigation outlined in the three research questions. Conclusions and implications were drawn based on the synthesis and analysis of these findings. Lastly, limitations and directions for future research were identified, informed by the gaps observed in the extant literature.

3. Descriptive analysis and findings

The descriptive analysis section provides an overview of the studies included in the systematic review, examining publication trends, journal outlets, geographical focus, industry settings, and the statistical methodologies applied.

3.1. Publication trend

Figure 2 illustrates the temporal distribution of the studies. It reveals a notable increase in scholarly attention since 2017, with 37 (74%) studies published in this period, compared to only 13 (26%) studies between 2010 and 2016. However, the publication trend demonstrates some inconsistency, with fluctuations observed between 2010 and 2019. The recent surge in research interest, particularly in the EDEs context where the manufacturing sector is thriving, likely explains this upward trend. Notable recent studies in the EDEs include those by Agyei-Owusu et al. (2022), Afshan et al. (2022), Abdallah et al. (2021), Oliveira and Gonzalez (2022), Nguyen et al. (2022), and Tan et al. (2023). Hence, there is a growing

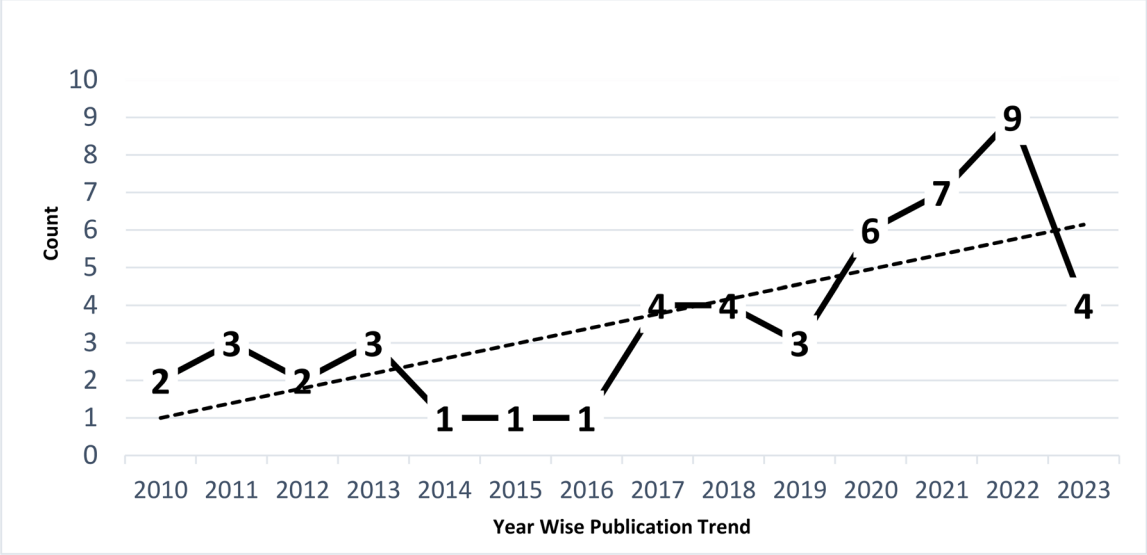


Figure 2. Publication trend.

Table 2. Journal publication rate.

Journal Name	Freq	Journal Name	Freq
Int'l Journal of Production Economics	5	Asian Journal of Business Ethics	1
Journal of Operations Management	2	Journal of Systems and Information Technology	1
Int'l Journal of Operations and Production Management	2	Int'l Journal of Information Technology and Decision Making	1
Int'l Journal of Logistics Research and Applications	2	Revista de Métodos Cuantitativos para la Economía y la Empresa	1
Journal of Industrial Engineering and Management	2	Int'l Journal of Industrial Engineering and Management	1
Production Planning and Control	2	Journal of International Logistics and Trade	1
Industrial Management and Data Systems	2	Global Journal of Flexible Systems Management	1
Industrial Marketing Management	2	Asia Pacific Journal of Marketing and Logistics	1
Supply Chain Management: An Int'l Journal	2	IEEE Transactions on Engineering Management	1
Journal of Enterprise Information Management	2	Brazilian Business Review	1
Int'l Journal of Supply Chain Management	2	SAGE Open	1
Benchmarking: An International Journal	1	Operations and Supply Chain Management	1
Operations Management Research	1	Management Research Review	1
Cogent Business & Management	1	Uncertain Supply Chain Management	1
Int'l Journal of Physical Distribution & Logistics Management	1	Organizations and Markets in Emerging Economies	1
Int'l Journal of Emerging Markets	1	Int'l Journal of Business Information Systems	1
Int'l Journal of Productivity and Performance	1	Int'l Journal of Integrated Supply Management	1
Journal of Business and Industrial Marketing	1	Measuring Business Excellence	1

interest in understanding the dynamics shaping the SCI-performance nexus within the rapidly evolving industrial landscape of EDEs.

3.2. Publication by journals

The reviewed studies were published in 36 academic journals covering diverse disciplines. The journal with the highest publication size was the *International Journal of Production Economics* (N = 5). Close to half of the journals are related to the field of Operations and SCM, highlighting the importance of the topic in today's global business. Moreover, the diversity of journals in which the sample studies were published indicates the multidisciplinary nature of SCM research. Details of the journals are presented in Table 2.

3.3. Study context

From a geographical perspective, the studies encompass both emerging and developing economies, as illustrated in Figure 3. The majority (N = 39) were conducted within eight countries, while the remaining (N = 11) were distributed across nine nations. Notably, China-based studies constitute the largest share

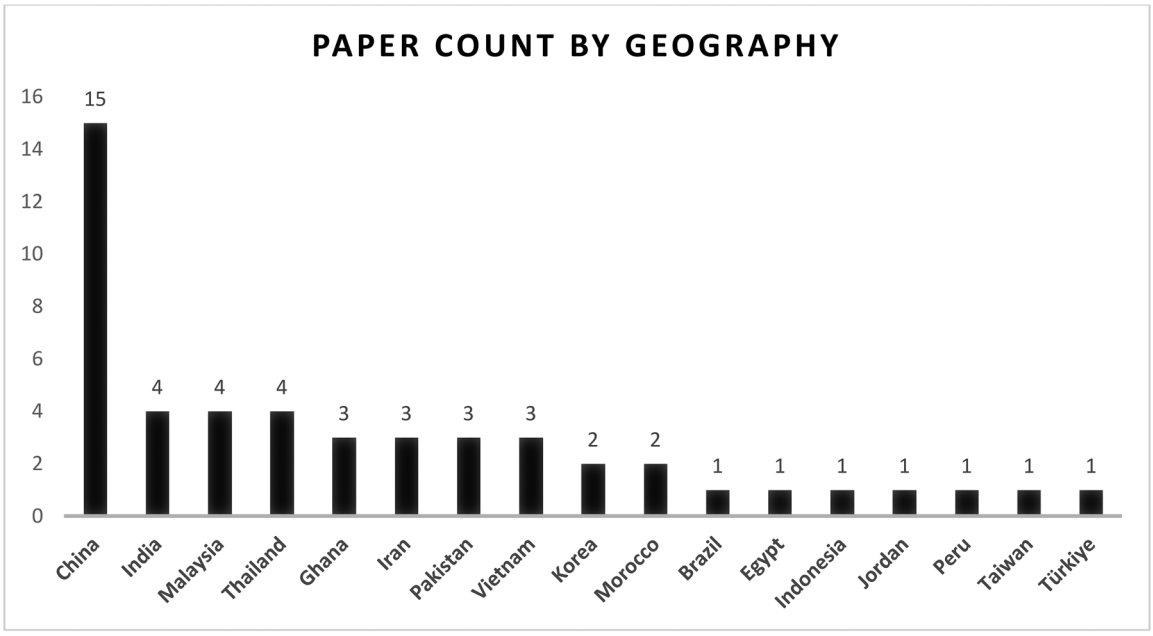


Figure 3. Contextual background of studies.

(N = 15), followed by India, Malaysia, and Thailand. The prominence of *China-based* studies aligns with the findings of previous reviews (Kamal & Irani, 2014; Novais et al., 2019). Overall, *Asia-based* studies are predominant (N = 41), which reveals the substantial role of these nations due to the on-going global shift of manufacturing activities from developed to emerging economies (Wang et al., 2020). This result also signals the limited research representation from other regions, such as Africa, which may be attributed to the nascent stage of the manufacturing sector in these economies. The geographic diversity of the studies suggests a growing scholarly interest in investigating the *SCI-performance* nexus across variety of contexts.

With respect to *industry setting*, the majority of the studies (N = 42) exclusively focused on the manufacturing sector. However, a smaller subset of these studies (N = 8) also addressed other sectors, with the service sector being the most prevalent. Within the manufacturing domain, the studies encompassed a diverse range of subsectors, including automotive, electronics, textiles, machinery, food, and beverages. A few studies delved into specific sectors such as semi-conductors (Tan et al., 2023), textile and garment (Bui et al., 2021), and automotive and auto-parts (Aunyawong et al., 2020; Boon-Itt & Wong, 2011; Feng et al., 2017; Lu et al., 2018; Wong et al., 2011). This trend in the literature may reflect concerns about sample size insufficiency when studying a particular sector. While a focus on a specific industry can enhance the internal validity of findings, it may also limit the generalisability of results to a broader industrial context (Boon-Itt & Wong, 2011; Feng et al., 2017).

3.4. Statistical methodologies

The reviewed studies predominantly applied *structural equation modelling (SEM)* and its variant, the *partial least squares structural equation modelling (PLS-SEM)*. Additional analytical techniques employed included *multiple regression analysis (MRA)*, such as ordinary least squares, threshold regression analysis, and mediated multiple regression analysis, as well as *hierarchical regression analysis (HRA)*. SEM and PLS-SEM were the principal methods (N = 39), followed by MRA (N = 5), and HRA (N = 2). SEM is particularly valued for its capability to simultaneously test complex and multistage relationships among variables (Adams et al., 2014). Moreover, SEM is often recommended for studies seeking to test theories involving complex models (Shah et al., 2020). The PLS-SEM is particularly suitable for exploratory studies and those with smaller sample sizes. Notably, only 16 studies had sample sizes exceeding 250, while the remaining (N = 34) had sample sizes below 250, which is generally regarded as small in the literature and appropriate for employing the PLS-SEM (Chen et al., 2018).

4. Thematic analysis and findings

This section presents a systematic categorisation of the selected studies based on their content, aligning with the research objectives of this study. As noted by Khanuja and Jain (2019), thematic analysis employs classification as a foundational approach to gain a comprehensive understanding of a construct and its applications. The thematic approach, therefore, unfolds in four key subsections. First, it identifies the most extensively investigated dimensions of SCI. Second, it identifies the most widely explored performance outcomes. Third, it constructs conceptual models to elucidate the SCI–performance nexus as evidenced in the reviewed studies. Finally, it examines the current state of knowledge and research evidence pertaining to the SCI-performance nexus, highlighting key findings, gaps, and emerging trends.

4.1. Dimensions of SCI

As a crucial and strategic component of SCM, SCI has emerged as a significant research area within the operations and supply chain management literature since the mid-1990s (Ataseven & Nair, 2017). The extant literature conceptualises SCI through multiple dimensions, primarily categorised into supplier, internal and customer integration. These dominant dimensions are widely recognised across various studies (Flynn et al., 2010; Frohlich & Westbrook, 2001; Mackelprang et al., 2014; Schoenherr & Swink, 2012). External integration, encompassing supplier and customer integration emphasises the establishment of close, interactive relationships with both suppliers and customers, whereas internal integration refers to the harmonisation of functional areas within a firm to operate as a cohesive, integrated process (Flynn et al., 2010). Moreover, SCI has been conceptualised based on its temporal orientation, distinguishing between *operational integration,* which addresses short-term perspective, and *strategic integration,* which is oriented towards long-term objectives (Leuschner et al., 2013; Mackelprang et al., 2014; Yeung, 2008). Additionally, Alfalla-Luque et al. (2013) identified three distinct approaches to measuring SCI in the existing literature: *external and internal*; *process*; and *information/data* and *physical/material flows integration*. Table 3 provides a comprehensive summary of the findings from the reviewed studies.

Table 3 highlights various SCI dimensions investigated in the reviewed studies. The findings indicate inconsistency in the definition and conceptualisation of SCI within the literature, with diverse measures employed, ranging from internal to strategic integration. Moreover, the analysis reveals that prior studies have utilised both unidimensional and multidimensional constructs. Nonetheless, the majority of studies focus on at least one of the traditional dimensions–internal, customer, or supplier integration–or examined combinations of these dimensions when measuring SCI. These observations agree with previous findings (Hassan & Abbasi, 2021; Khanuja & Jain, 2019; Tarifa-Fernandez & De Burgos-Jiménez, 2017). Table 4 summarises the extent of adoption of SCI dimensions in prior studies.

The analysis reveals that the majority of studies concurrently examined SCI through the lenses of internal, supplier, and customer integration, and their relationship with various performance outcomes. Despite the diversity of SCI dimensions explored in the literature, the adoption of these three dimensions as preferred measures of SCI has gained widespread acceptance (Erboz et al., 2022; Li et al., 2022). Consequently, the operationalisation of SCI using the tri-dimensional measure of internal, supplier, and customer integration has become the established standard in studies examining the SCI-performance nexus. Flynn et al. (2010) and Huo (2012) argue that these dimensions effectively encapsulate the diverse aspects of SCI, suggesting that the broader range of SCI dimensions can be consolidated into this triad. While single-dimensional measures were once more prevalent, there has been a gradual shift towards multi-dimensional measures, with the tri-dimensional approach gaining particular traction.

4.2. Performance outcome measures

This study aims not only to identify the SCI dimensions but also to explore the corresponding performance outcomes. Research on the *SCI-performance* nexus has traditionally explored three primary relationships: internal SCI and performance, external SCI and performance, and the combined effect of internal and external SCI on performance (Hussein Zolait et al., 2010). The extant literature on the

Table 3. SCI Dimensions in reviewed studies.

Study	II	CI	SI	SCI	EI	Information Integration/ Sharing	Process Integration	Operational Integration/ Coordination	Strategic Integration/ Partnership
Alejandro and Luis (2022)	✓	✓	✓						
Hadikusuma and Siagian (2022)	✓				✓				
Ruzo-Sanmartín et al. (2023)		✓							
Tan et al. (2023)				✓					
Som and Anyigba (2022)						✓		✓	
Yu et al. (2022)	✓	✓	✓						
Oliveira and Gonzalez (2022)						✓		✓	✓
Agyei-Owusu et al. (2022)	✓	✓	✓						
Afshan et al. (2022)	✓	✓	✓						
Erboz et al. (2022)				✓					
Bui et al. (2021)	✓	✓	✓						
Liu et al. (2021)	✓				✓				
Liu and Chiu (2021)	✓								
Kunnapapdeelert and Pitchayadejanant (2021)	✓	✓	✓						
Nguyen et al. (2022)					✓	✓	✓		
Bae et al. (2023)		✓	✓						
Dzogbewu et al. (2021)	✓	✓	✓						
Khanuja and Jain (2022)	✓	✓	✓						
Abdallah et al. (2021)	✓	✓	✓						
Abdelilah et al. (2023)					✓				
Afshan and Motwani (2021)			✓						
Sundram et al. (2020)				✓					
Kalyar et al. (2019)	✓	✓	✓		✓				
Aunyawong et al. (2020)				✓					
Piprani et al. (2020)	✓	✓	✓						
Hendijani and Saeidi Saei (2020)	✓						✓		
Yu et al. (2019)				✓					
Errassafi et al. (2019)	✓	✓	✓						
Khan and Wisner (2019)				✓					
Chen et al. (2018)		✓	✓						
Sundram et al. (2018)				✓					
Zhang et al. (2018)	✓					✓	✓		✓
Lu et al. (2018)				✓					
Hooshangi et al. (2017)	✓	✓	✓						
Qi et al. (2017)	✓				✓				
Kim (2017)				✓					
Feng et al. (2017)				✓					
Lii and Kuo (2016)	✓	✓	✓						
Yu (2015)	✓	✓	✓						
Ghobakhloo et al. (2014)							✓		
Huo et al. (2013)							✓		
Yu et al. (2013)	✓	✓	✓						
Liu et al. (2013)						✓		✓	
Huo (2012)	✓	✓	✓						
He and Lai (2012)								✓	✓
Vivek et al. (2011)				✓					
Flynn et al. (2010)	✓	✓	✓						
Boon-Itt and Wong (2011)	✓	✓	✓						
Wong et al. (2011)	✓	✓	✓						
Hussein Zolait et al. (2010)						✓			
Total count	26	23	23	11	6	6	5	4	3

Note: SI = supplier integration; II = internal integration; CI = customer integration; and EI = external integration.

Table 4. Scale of SCI dimensions adoption.

SCI construct	Measures	Paper Count	Remark
Multidimensional	Internal, Customer, and Supplier	20	Joint
Unidimensional	SCI	11	Single
Multidimensional	II and EI	3	Joint
Uni/Multidimensional	Process/Information/Operational/Strategic integration	9	Single or joint
Unidimensional	Internal integration	1	Single
Others	System, relational, product, financial flow, physical flow integration, and synchronized planning	5	Single or joint

SCI-performance relationship employs a diverse range of performance measures, encompassing firm/organisational, financial/business, operational, and supply chain performance (SCP). This multifaceted approach reflects the complex and interconnected nature of performance outcomes within supply chains.

Chen et al. (2004) argue that *firm performance* should be the main performance indicator, given its alignment with the objective of shareholders' wealth maximisation (Agyei-Owusu et al., 2022). *Firm performance* reflects a firm's ability to achieve financial (profitability) and market-oriented (growth) goals (Li et al., 2006; Zhang et al., 2018), and is regarded as the ultimate measure of performance (Huo, 2012; Zhang et al., 2018). It is measured using subjective and objective indicators, which prior research has recurrently confirmed to be positively correlated (Chen et al., 2018). *Financial/Business performance,* a common measure of business success, is assessed using simple financial indicators that capture a firm's economic objectives (Chen & Paulraj, 2004). Common metrics include return on assets, return on investment, return on sales, profitability, and market share (Afshan et al., 2022). However, the extant literature cautions against the danger of relying solely on financial measures, emphasising the importance of considering their limitations, particularly in manufacturing and supply chain contexts (Chen & Paulraj, 2004).

Operational performance (OP) is another key indicator often utilised in SCI studies, particularly as a measure in research involving manufacturing and production firms (Hamid et al., 2020). Measuring *OP* is believed to overcome the limitations associated with exclusively using financial indicators, as operational metrics are inward-looking and focus on the efficiency and effectiveness of operations taking place within the firm (Chen & Paulraj, 2004). The consideration of operational metrics, alongside financial measures, provides a more comprehensive assessment of a firm's performance.

Supply Chain Performance (SCP) has recently emerged as a focal area of research within the study of SCM, garnering significant attention from scholars in recent years (Ruzo-Sanmartín et al., 2023; Tan et al., 2023). Kalyar et al. (2019) noted that SCP measures fall into four key dimensions: strategic, operational, financial, and tactical. SCP has been defined and measured in various ways due to the various definitions and constructs found in the literature (Kalyar et al. 2019). One perspective defines SCP as the overall performance of a firm that emanates from the effective management of its supply chain processes (Som & Anyigba, 2022). The foundational work of Beamon (1999) introduced three key SCP measures: resource, output, and flexibility, which have been widely adopted in subsequent studies (Piprani et al., 2020). Tsanos et al. (2014) introduced *efficiency* and *effectiveness* as additional measures of SCP, aiming to capture performance at the supply chain level, as opposed to the firm level focus inherent in prior measures (Kalyar et al. 2019).

Prior studies have used several constructs to measure performance. The constructs vary from study to study, to a certain degree. This discrepancy can be attributed to the inherent complexity of supply chains, which complicates the consistent application of performance metrics (Kalyar et al. 2019). Nonetheless, certain constructs are commonly used to assess performance. A summary of the most widely adopted performance measures and their respective constructs is provided in Table 5.

As depicted in Table 5, there is significant overlap in the measurement constructs used across different performance metrics. *Firm and financial/business performance* overlap significantly as *firm performance* is an aggregation of *financial/business*, *operational*, and *market-oriented* performance goals (Flynn et al., 2010, Liu et al., 2016). Similarly, there is notable resemblance between operational and SCP measures. While operational metrics directly address the efficiency and effectiveness of operations within the focal firm (Chen & Paulraj, 2004), SCP measures extend across the entire supply chain (Tsanos et al., 2014). Market-oriented measures have been considered alongside the other performance measures. Despite efforts in previous studies to align performance metrics with firms' SC goals, overlaps and redundancies persist in the selection of these metrics. This complexity can hinder the selection of distinct metrics consistent with the argument of Kalyar et al. (2019).

This review identified the four most extensively investigated performance measures: operational, firm, financial/business, and SC performance (see Table 6). The majority of studies evaluated only one performance measure as the outcome variable. However, a few studies simultaneously investigated the effects of SCI on both operational and financial/business performance (Flynn et al., 2010; Hendijani & Saeidi Saei, 2020; Liu et al., 2013; Yu, 2015).

Another important finding is the predominance of studies that assessed performance at the *focal firm* level rather than the *supply chain (SC)* level, which contradicts the ideal of SCM measurement framework, which advocates for metrics encompassing the entire supply chain. This result aligns with the findings of Chen and Paulraj (2004). However, there appears to be progress over time, as several recent studies have increasingly adopted supply chain-level measures (Table 6). Despite this trend, the link between SCI and SCP demands further exploration and understanding, given its emerging prominence as a research agenda (Ruzo-Sanmartín et al., 2023).

Table 5. Performance measures and constructs from prior studies.

Study	Performance Measure(s)	Constructs	Common Constructs
Narasimhan and Kim (2002)	*Firm Performance*	Sales growth; Market share growth; and Profitability (Return on investment, ROI; Return on assets, ROA; Revenue Growth; Financial liquidity; and Net profit)	Sales growth, ROI, ROA, ROS; Growth on ROI, ROA & ROS; Market share; Growth in market share & Profit; and Customer satisfaction
Kim (2009)		Sales growth and Market share growth; Total cost reduction; ROI, ROA, financial liquidity, and net profit; and Customer satisfaction	
Sheng et al. (2011)		Sales growth, Market share growth, Profit growth, and ROI	
Rosenzweig et al. (2003)	*Financial/ Business performance*	ROA; Percentage of revenues from new products; Sales growth; and Customer satisfaction	Sales growth, Profit margin, ROA, ROI & ROS; Growth in profit, ROA, ROI & ROS; and Market share & Growth in market share
Vickery et al. (2003)		ROA; ROI; and ROS	
Petersen et al. (2005)		Increased sales; Increased profit; and Increased ROI	
Germain and Iyer (2006)		Average ROI; Average profit; and Profit growth	
Swink et al. (2007)		Sales growth, Market share, Profitability; and Customer satisfaction	
Kim (2009)		Total cost reduction; ROI, ROA, financial liquidity, and net profit	
Flynn et al. (2010)		Sales growth; Return on sales (ROS); Growth in ROS; Growth in profit; Market share growth; ROI; and Growth in ROI	
Lanier et al. (2010)		ROA, Profit margin, Asset turnover, and Cash cycle	
Liu et al. (2013)		ROI, Profits as a percentage of sales, Net income before tax, and the present value of the firm	
Frohlich and Westbrook (2001)	*Market/ Marketplace performance*	Market share; Profitability; and ROI	Market share, Growth in market share, and Customer satisfaction
Swink et al. (2007)		Growth in sales; Market share; Profitability	
Kim (2009)		Sales growth and Market share growth	
Chen et al. (2009)		Market share and Customer Satisfaction	
Nguyen et al. (2022)		Market share; Customer satisfaction; and Responsiveness to customers' requirements	
Armistead and Mapes (1993)	*Operational performance*	Quality; Delivery; Flexibility, and Price (Cost)	Cost, Quality, Delivery, Time, and Flexibility
Neely et al. (1995)		Cost, Time, Quality, Delivery, and Flexibility	
Chen and Paulraj (2004)		Cost, Delivery Speed and Reliability, Quality, and Flexibility	
Das et al. (2006)		Cycle time; Customization; Cost; Quality; speed (delivery); New product introduction time; and Flexibility	
Devaraj et al. (2007)		Cost, Quality, Delivery, and Flexibility	
Flynn et al. (2010)		Flexibility, Delivery, Response time, and Customer Service	
Wong et al. (2011)		Delivery, Cost, Quality, and Flexibility	
Schoenherr and Swink (2012)		Quality, Delivery, Flexibility, and Cost	
Beamon (1999)	*SCP*	Resources (total cost, manufacturing cost, distribution cost and inventory cost, and ROI); Output (sales, profit, fill rate, on-time deliveries, backorder/stockout, customer response time, lead time, shipping errors, and customer complaints); and Flexibility (volume, delivery, mix and new product flexibility)	Cost, Profitability, Customer Service, Reliability, Flexibility, and Inventory management
Lai et al. (2002)		Reliability, Responsiveness, Flexibility, Cost, and Assets	
Tsanos et al. (2014)		Efficiency (SC cycle efficiency & SC flexibility) and Effectiveness (Order fulfilment lead-time & Perfect order fulfilment)	
Balfaqih et al. (2016)		Cost/finance, Customer, Internal processes, Innovativeness, Flexibility, Reliability, Time, Responsiveness, Quality, Asset management, Efficiency, Resource, Output, and Information.	

Table 6. Performance outcomes from the review.

Performance Outcome	Researcher(s)	Paper Count[1]
Operational	Hadikusuma and Siagian (2022); Oliveira and Gonzalez (2022); Liu et al. (2021); Kunnapapdeelert and Pitchayadejanant (2021); Bae et al. (2023); Dzogbewu et al. (2021); Abdelilah et al. (2023); Yu et al. (2019); Hendijani & Saeidi Saei, 2020); Errassafi et al. (2019); Sundram et al. (2018); Lu et al. (2018); Feng et al. (2017); Yu (2015); Flynn et al. (2010); Liu et al. (2013); Boon-Itt and Wong (2011); Wong et al. (2011)	18
Firm	Agyei-Owusu et al. (2022); Bui et al. (2021); Liu and Chiu (2021); Nguyen et al. (2022); Sundram et al. (2020); Khan and Wisner (2019); Chen et al. (2018); Zhang et al. (2018); Hooshangi et al. (2017); Kim (2017); Lii and Kuo (2016); Ghobakhloo et al. (2014); He and Lai (2012); Vivek et al. (2011); Hussein Zolait et al. (2010)	15
Financial/ Business	Alejandro and Luis (2022); Yu et al. (2022); Afshan et al. (2022); Abdallah et al. (2021); Afshan and Motwani (2021); Hendijani and Saeidi Saei (2020); Qi et al. (2017); Yu (2015); Huo et al. (2013); Liu et al. (2013); Yu et al. (2013); Huo (2012); Flynn et al. (2010)	13
SCP	Ruzo-Sanmartín et al. (2023); Tan et al. (2023); Som and Anyigba (2022); Erboz et al. (2022); Khanuja and Jain (2022); Kalyar et al. (2019); Aunyawong et al. (2020); Piprani et al. (2020)	8

Note: [1]Four studies considered more than one performance outcome causing double counting.

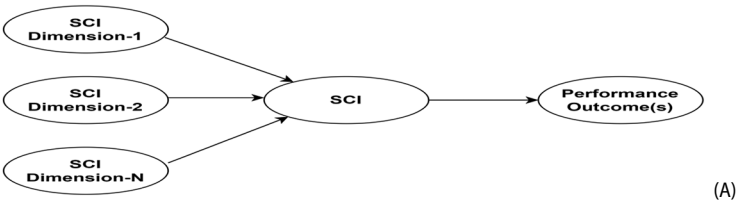
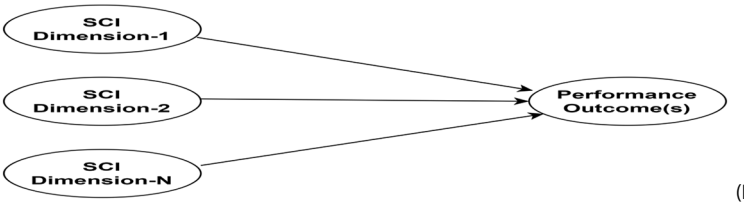
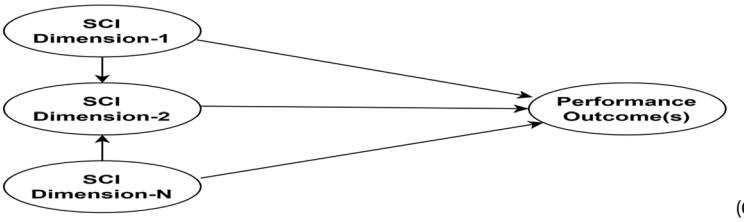
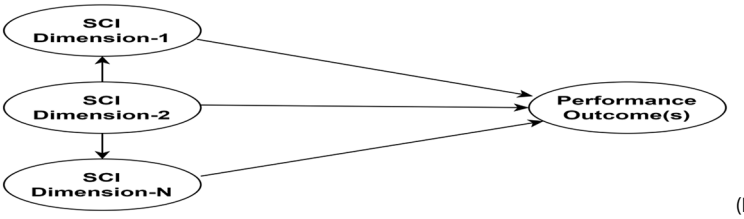
4.3. Conceptual models of SCI-performance nexus

The literature suggests a multifaceted relationship between SCI and performance, encompassing both direct and indirect effects (He & Lai, 2012). Additionally, the terms supply chain 'collaboration' or 'cooperation' (SCC) has been used as a synonymous construct for integration (Adams et al., 2014). Cao and Zhang (2011) argue that SCC more effectively captures the collaborative partnerships among independent supply chain members than SCI. In this section, we analyse various conceptual models that reflect the nature of the SCI-performance relationships investigated in this study. Our analysis identified three broad categories of models: *direct relationship models*, *antecedent-based relationship models*, and *mediator-moderator relationship models*.

Direct relationship models examine the direct effect of SCI dimensions on one or more performance outcomes. Our findings revealed seven studies and four distinct variants within this category (Table 7). The first variant (Model A) directly measures the effect of SCI, as a single construct, on performance. Only one study adopted this approach (Oliveira & Gonzalez, 2022). The second variant (Model B) directly measures the effect of SCI, as a multidimensional construct, on performance. Four studies employed this model (Bae et al., 2023; Flynn et al., 2010; Hussein Zolait et al., 2010; Nguyen et al., 2022). The third variant (Model C) extends model B by further investigating the partial mediation effect of one dimension (e.g., internal integration) on the relationship between other dimensions (supplier and customer integration) and operational performance (Errassafi et al., 2019). The fourth variant (Model D) is similar to model C but explores both the direct impact of certain SCI dimensions (e.g., supplier and customer integration) on performance, and through the mediation of other SCI dimension (e.g., internal integration) (Dzogbewu et al., 2021).

Research on the SCI-performance nexus has increasingly emphasized the need to extend beyond simplistic models and consider the influence of contingent factors that can shape these relationships (Afshan & Motwani, 2021; Gimenez et al., 2012; Liu et al., 2013; Wiengarten et al., 2019). Scholars have called for a greater focus on understanding the contingencies under which the SCI-performance relationships

Table 7. Direct relationship models.

Model Description	Direct relationship models
Uni-dimensional measure of SCI & its effect on performance	 (A)
Multi-dimensional measure of SCI & direct effect on performance	 (B)
Multi-dimensional measure of SCI with the interaction of dimensions & effect on performance	 (C)
Multi-dimensional measure of SCI with interaction of dimensions & effect on performance	 (D)

remain effective (Liu et al., 2013; Wong et al., 2011). Consequently, studies examining the effects of antecedents and contingencies have gained prominence in recent years (He et al., 2017; Huo et al., 2014; Rutainurwa et al., 2024; Wong et al., 2011).

The second category of studies considers *antecedent-based relationship models,* which investigate factors that drive SCI in the SCI-performance nexus (Table 8). These studies investigate how antecedent variables influence SCI dimensions and, in turn, impact performance. Theoretically, SCI dimensions act as mediators between antecedent variables and performance. While some studies identify SCI as the sole mediator, others explore the combined mediating effects of SCI and other variables, with most of the reviewed studies falling into this category.

This category encompasses twenty-six studies and nine models, which can be further grouped into three broad classes. The first group of models (Models A-B) reflects two key variants. One hypothesises that SCI fully mediates the relationship between antecedent variables and performance (Afshan & Motwani, 2021; Alejandro & Luis, 2022; Chen et al., 2018; Feng et al., 2017; Ghobakhloo et al., 2014; Huo et al., 2013; Kunnapapdeelert & Pitchayadejanant, 2021; Qi et al., 2017; Yu, 2015), while the other examines the joint mediating effect of SCI other variables, such as supply chain flexibility (Vivek et al., 2011).

The second group comprises four models (Models C to F), which posit the partial mediation role of SCI, wherein antecedents affect performance both directly and indirectly through SCI (Bui et al., 2021; Erboz et al., 2022; Hadikusuma & Siagian, 2022; Hooshangi et al., 2017; Kim, 2017; Liu et al., 2021; Ruzo-Sanmartín et al., 2023; Som & Anyigba, 2022; Sundram et al., 2018; Tan et al., 2023; Yu et al., 2022). These models are the most commonly adopted in this category. Model G extends previous models by incorporating additional mediator in the form of intermediate performance outcome, such as SCP, SC responsiveness, and competitive capability, between SCI and overall performance outcomes (Lii & Kuo, 2016; Sundram et al., 2020; Yu et al., 2019). Finally, Models H and I explore the moderating role of variables in the SCI-performance relationship, including the influence of antecedent variables as drivers of SCI (Kalyar et al. 2019; Liu & Chiu, 2021).

The third category of models, designated as the *mediator-moderator relationship* models, investigates the effect of mediator and moderator variables on the SCI-performance nexus (Table 9). It encompasses seventeen studies and four variants. The first variant (Model A) represents studies that hypothesise a fully mediated SCI-performance relationship (Afshan et al., 2022; He & Lai, 2012). The second variant (Model B), the most prevalent in this category, hypothesises both direct and indirect effects of SCI on performance (Abdallah et al., 2021; Agyei-Owusu et al., 2022; Aunyawong et al., 2020; Huo, 2012; Khanuja & Jain, 2022; Khan & Wisner, 2019; Piprani et al., 2020; Yu et al., 2013). Model C explores fully mediated relationships between SCI and performance while also considering the moderating effect of variables on the relationship between SCI and mediator variables, or between mediator variables and performance (Abdelilah et al., 2023; Zhang et al., 2018). Finally, Model D focuses on the moderating effect of variables in the SCI-performance relationship (Boon-Itt & Wong, 2011; Hendijani & Saeidi Saei, 2020; Liu et al., 2013; Lu et al., 2018; Wong et al., 2011).

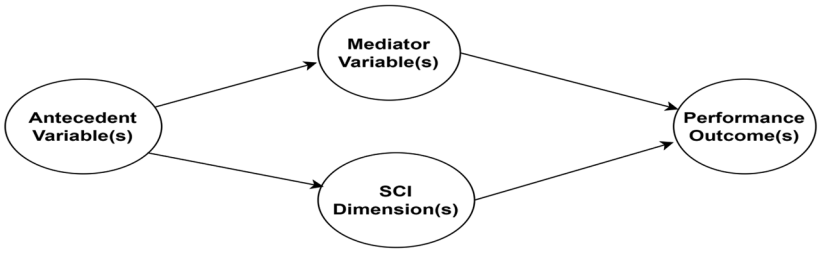
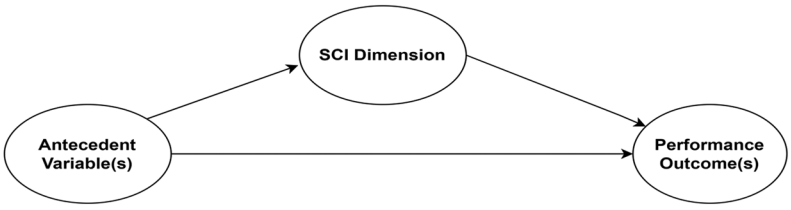
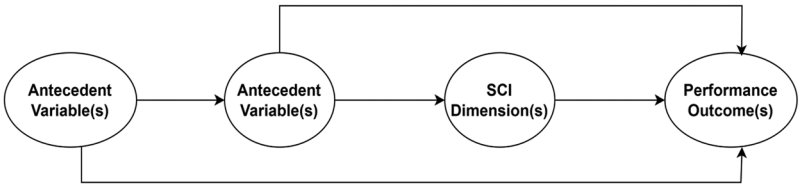
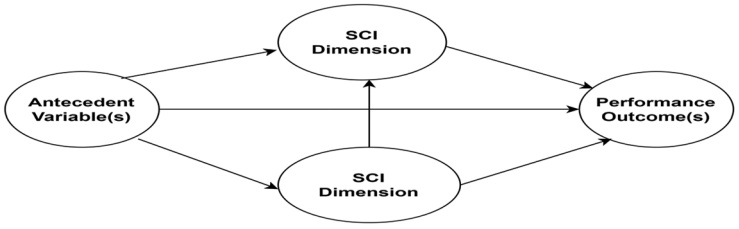
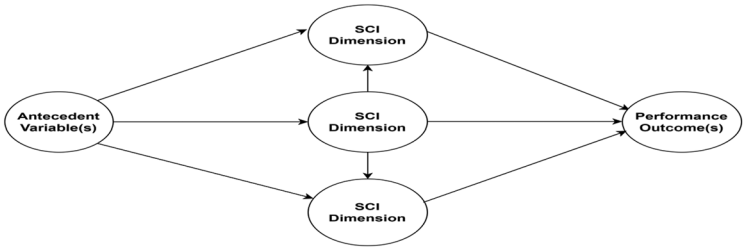
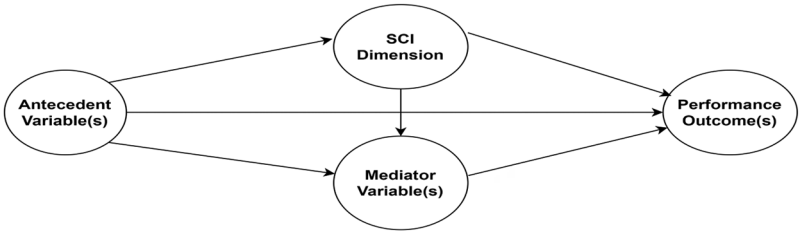
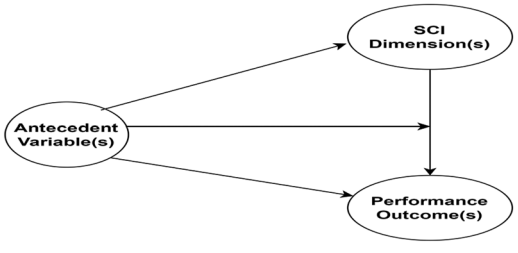
4.4. SCI-performance relationship effects

This study aims to explore the current state of knowledge and research evidence regarding the *SCI-performance* nexus. The analysis examines the relationship from multiple perspectives, including the nature of SCI constructs, performance measures adopted, effect paths and signs, and the role of mediator and moderator variables. Table 10 summarises the findings from the reviewed studies.

From the perspective of the effect level, three types of effects on the SCI-performance nexus were analysed: fully positive, partially positive, and insignificant. The findings reveal that the number of studies with full and partial effects is nearly balanced, with none of the studies reporting an insignificant SCI-performance relationship. This finding matches with previous reviews (Fabbe-Costes & Jahre, 2008; Tarifa-Fernandez & De Burgos-Jiménez, 2017).

From the perspective of SCI measurement, the study observed a general trend of adopting both unidimensional and multidimensional constructs (Flynn et al., 2010; Huo, 2012), with an extensive preference for the multidimensional constructs in extant literature, particularly the tri-dimensional model

Table 8. Antecedent(s)-based relationship models.

Model Description	Antecedent(s)-based relationship models
Full mediation via SCI	 (A)
Full mediation via SCI & other mediator(s)	 (B)
Partial mediation via SCI	 (C)
Antecedents with sequential order & partially mediation via SCI	 (D)
Partial mediation of SCI & one-way interaction between SCI dimensions	 (E)
Partial mediation of SCI & two-way interaction between SCI dimensions	 (F)
Partial mediation via SCI & other mediator(s) with interaction effect	 (G)
Partial mediation via SCI & moderating role of Antecedent variable(s)	 (H)

(*Continued*)

Table 8. Continued.

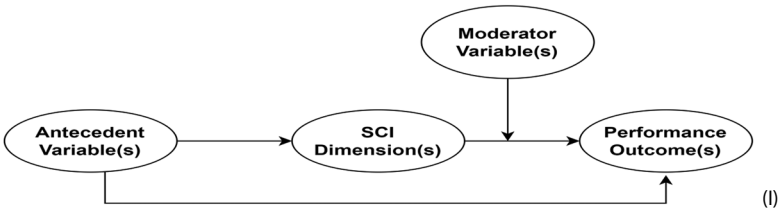
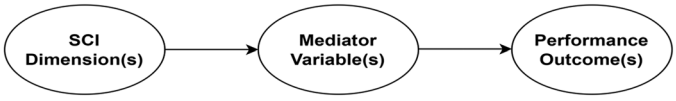
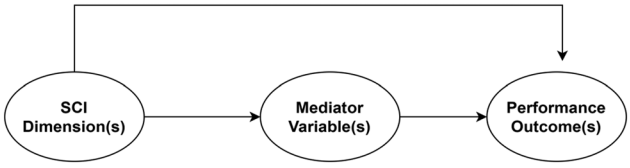
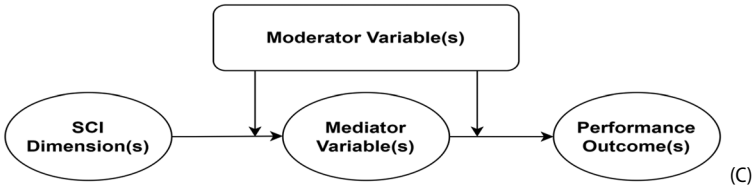
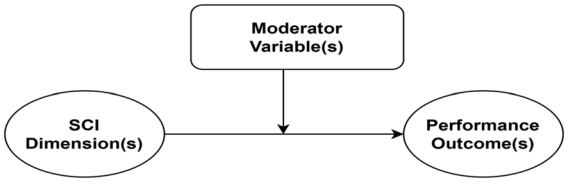
Model Description	Antecedent(s)-based relationship models
Partial mediation via SCI & moderating role of other variable(s)	

Table 9. Mediator-moderator relationship models.

Model Description	Mediator-moderator relationship models
Full mediation between SCI & Performance	
Direct & indirect effect of SCI on performance	
Mediated & moderated effects of SCI on performance	
Moderated effects of SCI on performance	

encompassing internal, supplier, and customer integration. Accordingly, the multidimensional approach to SCI measurement is more prevalent.

Regarding the path of influence of SCI on performance, both direct and indirect relationships exist. For *direct relationship models*, SCI can have both standalone and interactive effects on performance. For instance, internal integration can directly impact performance and interact with customer or supplier integration (Dzogbewu et al., 2021; Errassafi et al., 2019). For *antecedent-based relationship models*, SCI often mediates the effect of antecedents on performance. This finding demonstrates SCI's crucial role in mediating the relationship between antecedents and performance outcomes. For *mediator-moderator models*, SCI can directly and indirectly affect performance. While the direct effects occur from SCI to performance, the indirect effects involve mediation or moderation by other variables. The findings reveal that full-mediation of the SCI-performance nexus by an intervening variable is infrequent.

Regarding mediation effects, *antecedent relationship models* have demonstrated that SCI typically partially mediates the relationship between antecedents and performance outcomes. While full mediation is observed, as demonstrated in some studies (Feng et al., 2017; Ghobakhloo et al., 2014; Kim, 2017; Sundram et al., 2018), partial mediation is more prevalent. Similarly, both partial and full mediation effects are observed in the *mediator-moderator models*. SCI often partially mediates the relationship, but full mediation can also occur through other variables such as *intermediate performance outcomes*, *supply chain agility*, and *service orientation* (Abdelilah et al., 2023; Afshan et al., 2022; He & Lai, 2012). Moreover, partial moderation effects are consistently observed in all the SCI-performance relationships. Factors such as *internal integration* and *trust* (Zhang et al., 2018), *market orientation* (Liu et al., 2013), *environmental uncertainty* (Wong et al., 2011), and *technological and demand uncertainty* (Boon-Itt & Wong, 2011) have been identified as moderators determining the strength of this relationship.

Table 10. Key findings of the SCI-performance nexus.

Study	Conceptual model	SCI Dimension		Performance Measure	Effect route		Mediation Moderation		Effect sign		
		Uni	Multi		Direct	Indirect	Full	Partial	+Ve	partial	No
Oliveira and Gonzalez (2022)	DRM	✓		Operational	✓				✓		
Nguyen et al. (2022)	DRM		✓	Firm	✓	✓				✓	
Bae et al. (2023)	DRM		✓	Operational	✓	✓			✓		
Dzogbewu et al. (2021)	DRM		✓	Operational	✓	✓				✓	
Errassafi et al. (2019)	DRM		✓	Operational	✓	✓			✓		
Flynn et al. (2010)	DRM		✓	Operational	✓					✓	
				Financial	✓					✓	
Hussein Zolait et al. (2010)	DRM		✓	Firm	✓				✓		
Alejandro and Luis (2022)	ARM		✓	Financial		✓		✓		✓	
Hadikusuma and Siagian (2022)	ARM		✓	Operational	✓	✓		✓	✓		
Ruzo-Sanmartín et al. (2023)	ARM	✓		SCP		✓		✓		✓	
Tan et al. (2023)	ARM	✓		SCP		✓		✓		✓	
Som and Anyigba (2022)	ARM		✓	SCP	✓	✓		✓		✓	
Yu et al. (2022)	ARM		✓	Financial		✓		✓		✓	
Erboz et al. (2022)	ARM	✓		SCP	✓	✓		✓	✓		
Bui et al. (2021)	ARM		✓	Firm	✓	✓		✓	✓		
Liu et al. (2021)	ARM		✓	Operational	✓	✓		✓		✓	
Liu and Chiu (2021)	ARM	✓		Firm	✓	✓		✓	✓		
Kunnapapdeelert and Pitchayadejanant (2021)	ARM		✓	Operational		✓		✓		✓	
Afshan and Motwani (2021)	ARM	✓		Financial		✓	✓		✓		
Sundram et al. (2020)	ARM	✓		Firm		✓	✓		✓		
Kalyar et al. (2019)	ARM		✓	SCP	✓	✓		✓		✓	
Yu et al. (2019)	ARM	✓		Operational	✓	✓		✓		✓	
Sundram et al. (2018)	ARM	✓		Operational		✓	✓		✓		
Chen et al. (2018)	ARM		✓	Firm		✓		✓	✓		
Hooshangi et al. (2017)	ARM		✓	Firm	✓	✓		✓		✓	
Qi et al. (2017)	ARM		✓	Financial		✓		✓	✓		
Kim (2017)	ARM	✓		Firm		✓	✓		✓		
Feng et al. (2017)	ARM	✓		Operational		✓	✓		✓		
Lii and Kuo (2016)	ARM		✓	Firm	✓	✓		✓		✓	
Yu (2015)	ARM		✓	Operational		✓		✓		✓	
				Financial		✓		✓		✓	
Ghobakhloo et al. (2014)	ARM	✓		Firm		✓	✓		✓		
Huo et al. (2013)	ARM		✓	Financial		✓		✓	✓		
Vivek et al. (2011)	ARM	✓		Firm		✓		✓	✓		
Afshan et al. (2022)	MMM		✓	Financial		✓	✓		✓		
Agyei-Owusu et al. (2022)	MMM		✓	Firm	✓	✓		✓		✓	
Khanuja and Jain (2022)	MMM		✓	SCP	✓	✓		✓		✓	
Abdallah et al. (2021)	MMM		✓	Financial	✓	✓		✓		✓	
Abdelilah et al. (2023)	MMM	✓		Operational		✓	✓		✓		
Aunyawong et al. (2020)	MMM	✓		SCP	✓	✓		✓	✓		
Piprani et al. (2020)	MMM		✓	SCP	✓	✓		✓		✓	
Hendijani and Saeidi Saei (2020)	MMM		✓	Operational	✓			✓		✓	
				Financial	✓			✓		✓	
Khan and Wisner (2019)	MMM	✓		Firm		✓	✓		✓		
Zhang et al. (2018)	MMM		✓	Firm	✓			✓	✓		
Lu et al. (2018)	MMM	✓		Operational	N/A	N/A	N/A	N/A	N/A	N/A	
Yu et al. (2013)	MMM		✓	Financial	✓	✓		✓		✓	
Liu et al. (2013)	MMM		✓	Operational	✓			✓		✓	
				Financial	✓			✓		✓	
He and Lai (2012)	MMM		✓	Firm		✓	✓		✓		
Huo (2012)	MMM		✓	Financial	✓	✓		✓		✓	
Boon-Itt and Wong (2011)	MMM		✓	Operational	✓			✓		✓	
Wong et al. (2011)	MMM		✓	Operational	✓			✓	✓		
Total count		**17**	**33**	**N/A**	**29**	**41**	**10**	**32**	**25**	**24**	

DRM = Direct Relationship Models; ARM = Antecedent Relationship Models; MMM = Mediator-Moderator Models; +Ve = statistically positive effect at *p*-value of 1%, 5% or 10%.

5. Discussion

The analysis presented in section four underscores the critical yet complex nexus between SCI and performance within the Emerging and Developing Economies (EDEs) context. The study findings show some crucial facts on SCI, its measurement dimensions, and how these dimensions impact firm performance and supply chain effectiveness. This section reflects on these dimensions, the different performance outcomes that SCI dimensions influence, the various conceptual models that explain the SCI-performance nexus, and the multifaced relationships between SCI and performance outcomes.

5.1. Key dimensions of SCI

Measuring SCI using its multidimensional approach, specifically encompassing internal, supplier, and customer integration, has emerged as a typical framework across studies. While additional dimensions of SCI have been identified in the literature, they are usually subsumed within these three, reinforcing the idea that this tri-dimensional approach effectively encapsulates the diverse dimensions of SCI. Despite the prevalence of this multidimensional approach, the unidimensional measurement of SCI has not been disregarded in much of the contemporary literature, demonstrating that some studies continue to employ unidimensional measures of SCI. Nonetheless, the review has also observed that the extant literature still entertains inconsistencies in the definitions and conceptualisations of SCI, which future studies have to address.

5.2. Performance outcomes

The impact of SCI on performance is observed across various measures, from operational metrics to the broader financial and firm-level performance. SCI can also impact the performance of the extended supply chain network, encompassing suppliers and customers. Operational performance has emerged as a prominent outcome metric, reflecting EDEs firms' focus on basic metrics, such as cost efficiency, product quality, delivery speed, and response times. There are a handful of studies that have attempted to simultaneously measure performance using multiple outcomes. Whereas other few studies opted to measure performance in a sequential approach, starting from basic outcomes, such as operational, and extending to more comprehensive and robust measures, such as firm performance, encompassing financial and market outcomes.

The findings imply that while SCI may improve operational efficiencies, translating these gains into broader outcomes, such as financial, firm, and SC performance outcomes, deserves notable consideration given their medium- and long-term focus, and strategic importance. Additionally, financial, firm, and supply chain performance metrics demands sustained alignment across the supply chain. Moreover, the findings indicate that there is a preoccupation with measuring performance at the focal firm-level, suggesting that firms need to extend their performance measurements to encompass the entire supply network in light of the shift in competition from firm-level to supply chain level. However, the extant literature exhibits some overlaps and redundancies in performance metrics that need further refinements in future studies.

5.3. Conceptual models and pathways

Three broad conceptual models explain the SCI-performance nexus in the EDEs context: direct-relationship models, antecedent-based models, and mediator-moderator models. These models indicate that SCI determine performance outcomes both directly and indirectly. The first category of models often oversimplify the nexus between SCI and performance since they disregard the role of antecedent and contingent variables, such as mediator and moderator variables.

To address the gaps in direct relationship models, antecedent-based models consider external variables that drive SCI, which, in turn, impact intermediate and final performance outcomes. These categories of models are the most prevalent of all. Moreover, this study analysed a third group, known as mediator-moderator models. These models highlight how mediator and moderator variables can determine the effect of SCI on performance. Mediator variables explain the mechanisms and specific pathways through which SCI influences performance, providing a more nuanced understanding of the SCI-performance nexus. Moderator variables suggest the conditions under which the SCI-performance nexus is more effective. Additionally, they define the boundary under which the SCI-performance nexus stands true. The study of mediator-moderator based relationships provide broad understanding of the complicated dynamics in the SCI-performance nexus. The latter two models add complexity to the analysis of relationships, addressing the oversimplification observed in direct relationship models. This underlines the importance of identifying the right models applicable in a given context and the complexity of relationships.

5.4. SCI-performance nexus and effects

The SCI-performance relationship is complex, consisting of both direct and indirect effects and varying with the SCI dimensions and performance metrics employed. The study findings categorise the effects into three types: fully positive, partially positive, and negligible effects. The study results indicate that SCI generally improves performance. However, the degree of influence varies depending on the nature of SCI and performance dimensions investigated, and the consideration of antecedent, mediator, and moderator variables in the SCI-performance relationships. The predominance of SCI's partial effects on performance is likely to reflect the peculiar challenges of firms in the EDEs, where performance improvements may be delayed due to resource limitations, such as infrastructure and technology. However, the lack of fully insignificant or negative relationships should be interpreted with caution due to the possibility of methodological limitations, such as smaller sample sizes in the EDEs context.

Direct relationship models highlight that SCI can have a direct effect on the operational and financial performance of firms. This effect becomes bold when unidimensional integration is prioritised. For instance, internal integration yields improvement in operational efficiency through enhancement of information flows, cost reductions, and restructuring operations within the firm. External integration improves responsiveness and quality, contributing to improvement in customer satisfaction and market competitiveness. However, the results indicate that multidimensional SCI models, integrating internal, supplier, and customer dimensions, provide more enhanced performance outcomes. Studies confirmed that firms employing a multidimensional approach enjoy higher levels of performance.

Antecedent variables play a crucial role in shaping the SCI-performance relationship as they serve as driving forces influencing the effectiveness and extent of SCI's influence on performance. Antecedents can be related to organisational (culture, management, structure, etc.), technological (information and supply chain technologies), and environmental (customer demands, competitive pressures, economic conditions, regulations, etc.) factors. For example, information technologies enhance the strength of SCI's effect on performance, through improving information sharing among supply chain partners and reducing lead-times. Many of the reviewed studies observed SCI as a partial mediator between antecedent variables and performance. Additionally, some studies demonstrate how antecedent variables interact with SCI dimensions to enhance or diminish performance. The SCI-performance nexus may be stronger or weaker depending on the effects of antecedent variables. Moreover, certain studies highlight the sequential nature of relationships from antecedent variables to a certain dimension of SCI (e.g., internal integration), which in turn facilitates other types of dimensions, such as supplier and customer integration. This illustrates the role of aligning a firm's internal operations to achieve effectiveness in external collaboration with suppliers and customers.

The SCI-performance nexus is also impacted by mediator and moderator variables. For example, environmental uncertainty or market volatility moderates the strength of SCI's effect on performance, especially in the EDEs context where markets are volatile. The reviewed studies reveal that internal integration often mediates the relationship between external dimensions. This indicates internal integration's instrumental role in bolstering the full benefit of external integration through optimising internal processes to support external collaboration. In addition, mediator variables, such as supply chain agility and service orientation, and moderator variables, such as market orientation and environmental uncertainty, are observed to have partial effects on the SCI-performance nexus, demonstrating the crucial role mediator and moderator variables play in shaping these relationships, particularly in the EDEs context.

6. Conclusions, implications, limitations, and future research

6.1. Conclusions

This study synthesises recent empirical studies conducted in the context of Emerging and Developing Economies (EDEs), with a focus on the manufacturing sector. It contributes to the understanding of SCI, its core dimensions, performance outcomes, the conceptual models explaining the SCI-performance nexus, and the effects of SCI on performance outcomes.

This study provides valuable insights into the current landscape of research on the SCI-performance nexus in the EDEs context, including publication trends, journal outlets, geographical focus, industry settings, and statistical methodologies. It highlights the growing scholarly prominence of SCI, particularly in the context of EDEs where manufacturing industries are flourishing. Besides, it highlights that there is disproportional concentration of studies in Asia, underscoring the need for a broader regional representation, particularly in regions such as Africa where the industry is still at its early stage and with its unique challenges and opportunities. Moreover, the results relating to journal outlets highlight the multidisciplinary nature of research on SCI-performance nexus, despite the dominance of publications in journals directly related to the fields of operations and SCM. The multidisciplinary nature emphasises the importance overcoming disciplinary boundaries to build comprehensive insights into SCI. Furthermore, the study reveals the predominance of SEM and PLS-SEM, as the preferred statistical tools, in light of their capability to handle complex relationships and address common constraints like small sample sizes in EDEs studies. The descriptive findings call for broader geographic and methodological approach in order to advance our understanding of the SCI-performance nexus.

The thematic analyses reveal that the empirical studies predominantly employ the multidimensional measures of SCI, Specifically, the tri-dimensional measure of SCI, encompassing internal. supplier, and customer, integration, has emerged as the typical framework. This approach is believed to encapsulate the various dimensions of SCI. Therefore, the multidimensional method remains the preferred SCI construct, and the path towards enhanced performance outcomes. However, some studies keep applying the unidimensional measure of SCI, despite the predominance of the multidimensional approach.

Operational performance remains the predominant outcome measure in the literature, particularly in the EDEs context. The other performance outcome metrics encompass firm, financial/business, and supply chain performance (SCP). Studies typically focused on adopting a single performance measure, such as operational performance, when analysing the SCI-performance nexus. The preoccupation of studies on basic and particular metrics, like operational performance, in the EDEs context can be attributed to several factors such as resource constraints, focus on immediate and tangible gains, and infrastructure and technological limitations. The study observed that performance metrics employed in the extant literature exhibit overlaps and redundancies in measurement, suggesting the prevalence of variations in the definitions and conceptualisations of outcome variables, and the need to address this gap through further research.

This study also identified three broad categories of conceptual models: *direct relationship*, *antecedent-based relationship*, and *mediator-moderator models*. These models explain the SCI-performance nexus, particularly in the EDEs context. While the first category of models provides a very simplistic path of relationship from SCI to performance, the other two provide a more sophisticated and realistic view of the SCI-performance relationship due to their consideration of contingent variables, such as antecedent, mediator, and moderator variables. The consideration of these variables allows for a more robust analysis of the mechanisms, pathways, contexts, and boundaries shaping the SCI-performance nexus. The results suggest that the SCI-performance relationships are much more complex than the simplistic and direct relationship views assumed in some studies. The models proposed in this study differ from those proposed in previous studies, such as Li et al. (2022), due to the consideration of complex models explaining the SCI-performance nexus. However, these models cannot be considered exhaustive, given that the focus of this review was limited to a specific industry and economic context. Moreover, caution should be taken when interpreting these results given the limited sample size of the reviewed studies.

This study has confirmed that SCI generally improves the performance of firms. However, the effect of SCI can vary depending on the SCI and performance measures employed in a given study and context. The evidence in this study supports the pivotal role of antecedent, mediator, and moderator variables in influencing the SCI-performance nexus. Therefore, future studies should consider the role of contingent variables when studying such relationships. This evidence agrees with the literature, such as Tarifa-Fernandez and De Burgos-Jiménez (2017). However, none of the reviewed studies reported a fully insignificant or negative relationship. Detailed comparisons among the findings of the reviewed studies was not possible given the variations in the definition of SCI dimensions, performance measures, theoretical lenses, and analysis tools employed. These variations in the conceptualisation and measurement

of key variables may reflect the "infancy of SCI" (Alfalla-Luque et al., 2013) in EDEs, and the urgent need to address these gaps in future studies. Moreover, caution should be taken when interpreting these results in light of the potential effects of methodological tools employed, such as the dominance of SEM and PLS-SEM, on determining the SCI-performance nexus.

6.2. Theoretical and managerial implications

This study provides both theoretical and managerial implications. Theoretically, the study contributes to SCM literature in three important ways. First, it provides evidence on whether SCI influences performance within the unique context of EDEs, where manufacturing firms are exposed to peculiar challenges such as resource constraints, underdeveloped infrastructure, and technological limitations. Second, it provides conceptual models that explain and capture the complex mechanisms, paths, and contexts shaping the SCI-performance nexus. Third, this study addresses a gap in SCI research through comprehensive review of the most recent EDEs-based studies in contrast to reviews that have historically focused on mature economies.

Managerial implications of the study are twofold. First, supply chain managers should recognise SCI as a key performance driver. However, they should also be aware of the complex and multifaceted nature of the SCI-performance nexus, considering the impacts of various antecedent, mediator, and moderator variables shaping these complex relationships. Second, supply chain managers should work towards achieving beyond operational and firm-level performance outcomes, providing due attention to supply chain-wide performance gains.

6.3. Research limitations and future research agenda

This study has some limitations related to its methodology, analysis, and scope. Hence, the conclusions and implications drawn should be viewed within the context of these limitations. Methodologically, the inclusion of publications only from 2010 to 2023, reliance on a single database, and the exclusive dependence on published and survey-based articles may have excluded some important data sources and limited the sample size. This may have limited the scope of the review and impaired generalisability of the findings on a broader scale. Analytically, a more in-depth analysis of the inconsistencies in the definitions and conceptualisations of SCI and performance dimensions and metrics, theoretical lenses employed, and analytical tools applied in the reviewed studies could have further enhanced the robustness of the study results. Scope-wise, the predominance of manufacturing-focused and EDEs based studies may have limited generalizability of the results to other sectors and economic contexts.

Future empirical research should address the limitations of previous studies, including the need for a more consistent definitions, conceptualisations, and measurements of SCI and performance metrics, in line with the proposals of Alfalla-Luque et al. (2013) and Fabbe-Costes and Jahre (2008). Studies need to consider a broader range of performance measures, beyond firm-level measures and encompassing supply chain-wide metrics, to capture the full impact of SCI. Additionally, the role of contingent variables should be considered in the study of the SCI-performance nexus as consideration of these variables provides a more nuanced evaluation of complex relationships. Besides, future research should empirically verify the validity of the proposed conceptual models. Moreover, future research should delve deeper into specific industries, such as textiles, automobiles, and pharmaceuticals. The focus on particular sectors can enhance the generalisability of results while combining diverse sectors may detract the practicality and plausibility of results. Furthermore, scholars should consider conducting more empirical studies in the context of EDEs, particularly in underrepresented regions like Africa.

Author contribution

Goitom Abera Baisa: Conceptualisation, methodology, writing original draft, formal analysis; Dante Benjamin Matellini: Methodology, review & editing, validation, formal analysis; Ian D. Jenkinson: Methodology, review & editing, validation, formal analysis; Chia-Hsun Chang: Methodology, review & editing, validation, formal analysis; All authors have approved the final manuscript.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

All data analysed in this study are publicly available through the Scopus database as indicated in our methodology section. The corresponding author, Goitom Abera Baisa, agrees to make data and materials supporting the results or analyses presented in this paper available upon reasonable request.

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