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Enhancing Performance Through Supply Chain Integration in Manufacturing Pharmaceutical Firms in Yemen

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Abstract
On the grounds of the Resource-Based View Theory, this study investigates how supply chain integration (internal, customer, and supplier integration) impacts firm performance. Using an empirical research approach, data were gathered through a questionnaire from 97 managers and employees of pharmaceutical firms in Yemen to assess the influence of SCI on firm performance. By analyzing the data using SPSS and SmartPLS software, the findings reveal that internal and customer integration significantly impact firm performance, whereas supplier integration did not show a significant effect. The study provides insights for firms that can enhance their overall performance by effectively implementing internal, customer, and supplier integration in their production and marketing processes. Also, SCI facilitates direct communication and stronger relationships with customers and suppliers, ultimately leading to improved efficiency and competitiveness.

Keywords: Supply Chain Integration (SCI), Internal Integration (II), Customer Integration (CI), Supplier Integration (SI), Firm Performance (FP), and Resource-Based View (RBV).

1. Introduction

Supply Chain Integration (SCI) is increasingly vital for ensuring long-term organizational success, (Huo et al., 2014). To remain competitive, businesses must collaborate closely with both suppliers and customers, fostering strong partnerships. SCI involves the strategic coordination between manufacturers and supply chain partners to optimize internal and external resources and capabilities throughout the supply chain, (Flynn et al., 2010). When functioning together, supply chain members enhance performance, increase profitability, and effectively meet customer demands, (Kumar et al., 2017). Recognized as a key factor in gaining a competitive edge, SCI has been shown to significantly impact both the operational efficiency and financial performance of firms, (Devaraj et al., 2007; Hendijani & Saeidi Saei 2020).

In today's business landscape, tasks like sourcing raw materials, managing inventory, and distributing goods are no longer confined within individual organizations but have shifted to the broader supply

chain level, (Hendijani & Saeidi Saei, 2020). Companies now acknowledge that independent operation is not feasible and that collaboration with supply chain partners, including suppliers and customers, is essential, (Bavarsad et al., 2017). Researchers have highlighted the benefits of supply chain integration (SCI) and the importance of coordination among supply chain participants, (Flynn et al., 2010). In fact, SCI is recognized as a key factor influencing a company overall performance, (Van der Vaart & van Donk, 2008).

SCI influences firm performance directly and indirectly. Directly, collaboration among companies within the supply chain leads to enhanced firm performance, (Flynn et al., 2010; Huo et al., 2014; Hendijani & Saeidi Saei, 2020; Kumar et al., 2017). Indirectly, SCI enables firms to identify and eliminate non-value-adding activities across the supply chain, (Hendijani & Saeidi Saei, 2020). This process improves product quality, reduces production costs, and ultimately drives greater value creation and higher customer satisfaction, (Rosenzweig et al., 2003).

There is a contradiction in the previous studies on the impact of SCI on company performance, (Flynn et al., 2010; Hou & Zhao, 2012; Zhao et al., 2013). According to the contingency perspective, this inconsistency may stem from the failure to account for various contingency factors, (Hendijani & Saeidi Saei, 2020). Some of these factors include technological uncertainty, (Boon-itt & Pongpanarat, 2011), demand uncertainty, (Iyer et al., 2009), IT competence, (Li, 2015), as well as product type and complexity, (Wong et al., 2011).

This research examines the link between SCI and firm performance. Based on previous studies, SCI is categorized into three dimensions: internal integration, supplier integration, and customer integration, (Flynn et al., 2010). This classification provides a comprehensive perspective on suppliers and customers as key business partners, (Flynn et al., 2010; Kumar et al., 2017; Hendijani & Saeidi Saei, 2020). By doing so, this study seeks to contribute to the existing literature on SCI and its impact on firm performance.

The structure of this paper is as follows: The first section explores the theoretical foundations of supply chain integration (SCI) and its impact on firm performance. This is followed by an explanation of the research hypotheses and the development of the research model based on existing literature. Next, the research methodology is outlined. Finally, the study findings are presented, and conclusions are drawn accordingly.

2. Theoretical Background and Development of Hypothesis

2.1 Underpinning Theory

2.1.1 Resource-Based View

The Resource-Based View (RBV) is a strategic management theory emphasizing the significance of a firm internal resources in achieving and sustaining a competitive advantage. Originally proposed by Wernerfelt (1984) and further developed by Barney (1991), RBV asserts that a firm success is primarily determined by its valuable, rare, inimitable, and non-substitutable (VRIN) resources. These resources, whether tangible or intangible, include physical assets, employee expertise, brand reputation, and intellectual capital. Moreover, firms must align their capabilities with external opportunities rather than merely imitating industry leaders, (Makadok, 2001).

Beyond internal capabilities, RBV acknowledges the critical role of external networks and strategic partnerships in securing a competitive advantage. Establishing exclusive relationships with supply chain partners enables firms to access valuable resources, markets, and technologies, fostering economies of

scale and reducing operational risks, (Arya & Lin, 2007). Supplier collaboration, particularly in product development, ensures early commitment and uninterrupted supply chains, enhancing competitive positioning, (Idris, 2017). Moreover, information sharing within supply chain networks strengthens strategic vision and long-term performance, (Bernardes, 2010). Lavie (2006) further highlights that robust supplier relationships contribute to improved operational efficiency and overall supply chain performance. Therefore, while RBV primarily focuses on the firm internal resources, it also recognizes the indispensable role of external partnerships in sustaining superior market performance.

2.2 Literature Review and Development of Hypothesis

The previous literature has described supply chain integration (SCI) and performance in diverse ways, with each interpretation tailored to the specific study context, industry, and research objectives. SCI encompasses internal integration, supplier integration, and customer integration, fostering collaboration among different supply chain participants to enhance the overall performance of any firm. The following section will explore the concepts of SCI and firm performance, as well as the relationship between them.

2.2.1 Supply Chain Integration

The concept of SCI is a relatively recent area of research, despite extensive studies on unidimensional supply chain relationships that explore collaboration between manufacturers and either their customers or suppliers, (Flynn et al., 2010; Hendijani & Saeidi Saei, 2020). Some studies emphasize dyadic relationships with supply chain partners, (Lee & Whang, 2001), while others advocate for managing the supply chain as a cohesive system rather than optimizing individual subsystems separately, (Flynn et al., 2010; Vickery et al., 2003; Naylor et al., 1999). While certain definitions of SCI highlight the movement of materials and components, others focus on the exchange of information, financial resources, and operational assets, (Flynn et al., 2010). Although these perspectives capture key aspects of SCI, they often adopt a broad approach and tend to overlook its strategic significance.

Supply Chain Integration (SCI) builds upon existing research by incorporating internal integration within a manufacturer and extending in both directions to include supplier and customer integration. It also addresses gaps in the literature to establish a more precise definition of SCI. The term "integration" is traditionally defined as “the unified coordination of multiple sequential or related economic and industrial processes that were previously managed independently,” (Webster, 1966). In the context of supply chains, SCI refers to the extent to which a manufacturer strategically collaborates with its supply chain partners while jointly managing both internal and external organizational processes, (Flynn et al., 2010). The primary objective is to facilitate seamless and efficient flows of products, services, information, finances, and decision-making, ultimately delivering maximum value to customers at minimal cost and high speed, (Flynn et al., 2010; Naylor et al., 1999).

According to Flynn et al. (2010), SCI consists of three key dimensions: customer integration, supplier integration, and internal integration. Customer and supplier integration, known as external integration, refers to the extent to which a manufacturer collaborates with external partners to align inter-organizational strategies, practices, and processes into a unified and synchronized system, (Stank et al., 2001). Customer integration focuses on developing core competencies through close coordination with key customers, while supplier integration involves building core competencies by working closely with critical suppliers, (Bowersox et al., 1999). On the other hand, internal integration pertains to activities within the manufacturer itself. It reflects the extent to which a company structures its internal strategies, processes, and operations into a cohesive and synchronized system to effectively meet customer

demands, (Flynn et al., 2010; Hendijani & Saeidi Saei, 2020; Li, 2015) while maintaining seamless interactions with suppliers.

2.2.2 Firm Performance

Firm performance refers to the ability of a company to achieve both market-driven objectives through competitive performance and financial objectives through financial performance, (Yamin et al., 1999). It is typically measured by evaluating profitability and market growth. Competitive performance (CP) focuses on enhancing organizational goals by improving operational efficiency and reducing costs relative to competitors, thereby gaining a competitive advantage. Ataseven et al. (2017) conducted a meta-analysis to assess the relationship between supply chain integration and operational performance. In line with Huo et al. (2014), this study evaluates firm performance using two key indicators: financial performance (FP) and firm performance (FP).

2.3 Hypotheses Development

2.3.1 Relationship between SCI and Firm Performance

SCI positively influences firm performance and enhances communication, coordination, and efficiency, (Li, 2015; Hendijani & Saeidi Saei, 2020; Tarifa-Fernandez & De Burgos-Jiménez, 2017). From the perspective of the Resource-Based View (RBV) theory, SCI strengthens collaboration between a company internal teams and external partners, leading to improved decision-making and overall effectiveness. Furthermore, SCI facilitates timely access to critical information related to demand trends, technological advancements, and strategic planning. This enables firms to synchronize operations more effectively, minimize waste, and deliver products at greater speed and reduced costs, (Li, 2015). Internal integration optimizes internal workflows by eliminating redundant and non-value-adding activities, thereby enhancing efficiency and reducing production costs while improving product quality, (Flynn et al., 2010). Meanwhile, external integration (suppliers and customers' integration) ensures the seamless flow of supply chain information, including supplier activities and customer demand. This strengthens collaboration and coordination among supply chain members, reducing inefficiencies and enhancing overall supply chain performance, (Swink et al., 2007).

Empirical studies have demonstrated the positive impact of SCI, including both internal and external integration, on a firm operational and financial performance, (Hendijani & Saeidi Saei, 2020; Kumar et al., 2017; Flynn et al., 2016; Vickery et al., 2003). Kumar et al. (2017) indicated that SCI enhances supply chain performance by improving operational efficiency, production flexibility, inventory turnover, order fulfillment rates, and reducing total logistics costs. Similarly, Othman et al. (2016) found that SCI contributes to better logistics performance, reinforcing its role in streamlining supply chain operations. Moreover, Li (2015) observed that internal and product integration positively impact operational performance in industries such as transportation, electronics, and machinery. Hendijani and Saeidi Saei (2020) further confirmed that SCI—encompassing internal integration and external collaboration with suppliers and customers—significantly improves both financial and operational performance. Moreover, internal integration alone has been shown to enhance operational efficiency, (Zailani & Rajagopal, 2005). These findings underscore the critical role of SCI in improving operational and financial performance.

Beheshti et al. (2014) conducted a study on Swedish manufacturing firms and found that all dimensions of SCI, including internal integration and external collaboration with suppliers and customers, contributed positively to financial performance. This suggests that companies with higher levels of SCI

tend to achieve better financial performance. Likewise, Flynn et al. (2010) established a positive link between external integration with suppliers and customers and improvements in operational performance. Fazli and Amin Afshar (2016) also reported that SCI positively influences both operational and financial performance. Furthermore, research has indicated that internal integration enhances external integration, and both forms of integration—internal and external (suppliers and customers integration)—contribute directly and indirectly to improving firm performance, (Huo et al., 2014; Hendijani & Saeidi Saei, 2020). Based on the background of the above, the key hypotheses are formulated as follows.

H1- Customer integration positively and significantly affects firm performance.
H2- Internal integration positively and significantly affects firm performance.
H3- Supplier integration positively and significantly affects firm performance.

Based on foundational theory and previous studies we developed this model:

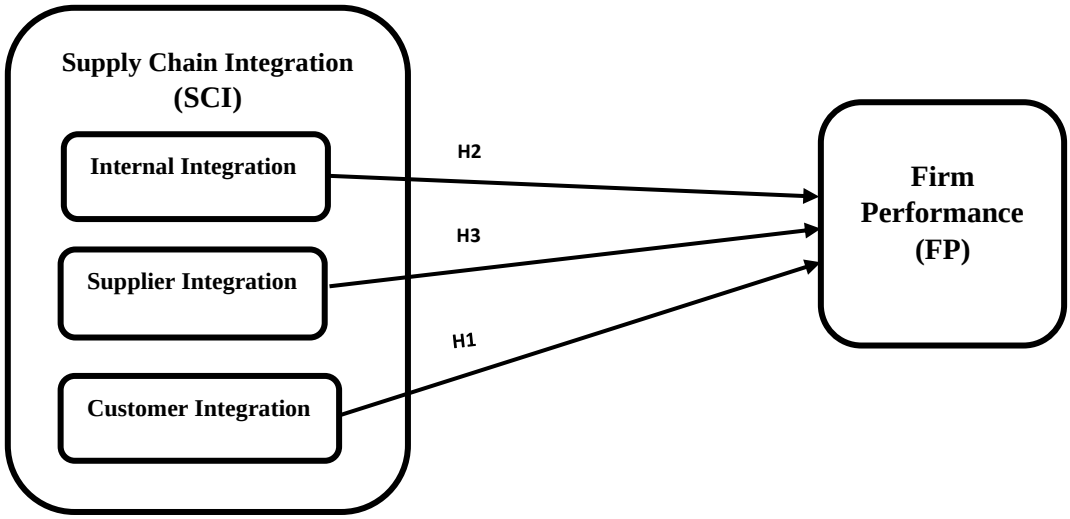

Figure (1) Conceptual model.

3. Methodology

This study employs a descriptive research approach, focusing on the pharmaceutical industry in Yemen. The target population consists of managers and employees within these pharmaceutical firms who are involved in relevant operational and strategic functions. Given the relatively small size of the population and the potential for non-cooperation from some firms, a census method was adopted, ensuring that all available members of the population were included as research participants, (Salant & Dillman, 1994). In this study we used a simple random sampling method to select respondents.

The survey consists of 20 questions using a 5-point Likert scale to assess supply chain integration (SCI) and firm performance, along with 5 additional questions for demographic information. The SCI-related questions were adapted from Flynn et al. (2016) and Hendijani & Saeidi Saei (2020). SCI was measured across three dimensions—internal integration, supplier integration, and customer integration—each represented by four questions. The questionnaire developed by Flynn et al. (2016; 2010) has been widely used in previous studies, demonstrating strong reliability and validity, (Ding et al., 2017; Huo et al., 2014; Laari, 2016; Ziaullah et al., 2017). In addition, firm performance was assessed using eight questions derived from Hendijani & Saeidi Saei (2020).

As the questionnaires had been widely used in previous studies, their validity was inherently established. To further ensure face validity, they were reviewed by experts in the field, and minor modifications were made. The original questionnaires were translated into Arabic and evaluated by supply chain specialists. Subsequently, another translator retranslated the final version back into English for comparison with the original one. The high degree of similarity between the back-translated and original versions confirmed that the Arabic-translated questionnaire was both reliable and valid for accurately measuring the study variables, (Hendijani & Saeidi Saei, 2020).

The questionnaire used in this study was divided into three sections. The first section focused on the demographic information, including age, gender, education level, years of experience, and job position. The second section comprised 12 questions assessing supply chain integration (SCI) across three dimensions: internal integration, supplier integration, and customer integration. The final section contained 8 questions evaluating firm performance. Also, a web-based version of the questionnaire was created using Google Forms, and the link was distributed to participants via WhatsApp and Email.

Given the number of variables in the model, which includes three independent variables and one dependent variable, a sample size of 97 respondents is adequate for conducting a hierarchical regression analysis to test the research hypotheses, (Hair et al., 2017).

4. Data Analysis

4.1. Descriptive Statistics

To examine the descriptive statistics of the research variables and assess the research model, we used SPSS version 26 and conducted Partial Least Squares Structural Equation Modeling (PLS-SEM) using the SmartPLS 4 software, following the guidelines of Ringle et al. (2005, 2015). PLS-SEM is extensively applied in the management and social sciences due to its various advantages, (Al-Hakimi et al., 2021).

The survey was conducted online and distributed to 375 respondents across four pharmaceutical firms. A total of 97 complete responses were received, resulting in an overall response rate of 25.8%. A review of existing literature in this field suggests that this response rate is consistent with prior studies using similar sample sizes and industry contexts, (e.g., Flynn et al., 2010; Huo et al., 2014; Mora-Monge et al., 2019; Van der Vaart & van Donk, 2008).

The majority of participants were between 41 and 50 years old. Among the respondents, 18 were female, while 79 were male. Educationally, 36.1% held a Bachelor degree, and 35.1% had a Master degree. In terms of job roles, 21 participants were managers, while 76 were employees. Also, the largest portion of respondents (48.5%) had between 5 and 10 years of work experience see Table (1).

Table (1) Sample characteristics.

Demographic information	Categories	Frequency	Percent (%)
Gender	Male	79	81.4
	Female	18	18.6
Age	20-30	1	1.0
	31-40	16	16.5
	41-50	57	58.8
	More than 50	23	23.7

Position	Employees	76	78.4
	Manager	21	21.6
Education	High School	2	2.1
	Bachelor	35	36.1
	Master	34	35.1
	Ph.D	26	26.8
Existence	Less than 5 years	6	6.2
	5- 10 years	47	48.5
	11-15 years	26	26.8
	More than 15 years	18	18.6

4.2 Measurement Model

Convergent validity and differentiation validity are used to examine construct validity. Convergent validity measures the degree of correlation between two different instruments designed to evaluate the same concept, (Hair et al., 2017). In Structural Equation Modeling (SEM), convergent validity is typically assessed using composite reliability (CR) rather than Cronbach's Alpha, (Chin, 2009; Hair et al., 2017). However, both measures should be 0.70 or higher as an acceptable level, (Hair et al., 2017).

In PLS-SEM, factor loadings are also used to determine convergent validity. Factor loading measures should be 0.50 and above, (Hair et al., 2017). Factor loadings calculated for each item were above 50%. Also, Cronbach's alpha was calculated for each variable. All alpha coefficients were above 70%. Thus, the study variables have acceptable reliability, (Vogt et al. (2012).

Furthermore, the average variance extracted (AVE) we used to assess the level of variance captured by a construct in relation to measurement errors. A construct is considered to have sufficient convergent validity when its AVE exceeds 0.50, (Hair et al., 2017). Fornell and Larcker (1981) also suggest that AVE can serve as a measure of reliability, though it is more conservative than composite reliability. The results related to these validity measures are presented in Table (2).

Table (2): Factor loading, reliability, and convergent validity

	Code Item		**Factor loading**	**Cronbach's alpha(α)**	**CR**	**AVE**	Convergent validity
Supply Chain Integration	**II**	II1	0.856	0.890	0.924	0.723	Yes
		II2	0.882				
		II3	0.904				
		II4	0.827				
	SI	SI1	0.821	0.823	0.882	0.652	
		SI2	0.794				
		SI3	0.817				
		SI4	0.798				
	CI	CI1	0.713	0.817	0.879	0.646	
		CI2	0.800				
		CI3	0.861				
		CI4	0.832				

Firm Performance	**FP**	FP1	0.751	0.912	0.929	0.620	Yes
		FP2	0.814				
		FP3	0.780				
		FP4	0.767				
		FP5	0.876				
		FP6	0.793				
		FP7	0.791				
		FP8	0.720				

Additionally, the heterotrait–monotrait (HTMT) ratio was employed to evaluate discriminant validity (Henseler et al., 2015). According to Kline (2011), HTMT values should not exceed 0.90, particularly between different constructs. The findings of this study confirm that all values remain below this value, as presented in Table (3). Furthermore, as demonstrated in Tables (2) and (3), all necessary criteria—including reliability, factor loadings, and validity—were satisfied, indicating that the measurement models are valid.

Table (3): Discriminant validity

	CI	**II**	**FP**	**SI**
CI				
II	0.895			
FP	0.863	0.834		
SI	0.895	0.827	0.751	

4.3 Structural Model

The structural model was evaluated following the next-step guidelines of the Consistent PLS (CCA) method, as recommended by Hair et al. (2017). The significance of the model paths was determined using t-statistics, calculated through the bootstrapping technique, as illustrated in Figure (1).

Before testing the hypotheses, we assessed the explanatory power of our research model by examining the variance explained (R^2) for the internal structure. As shown in Table (4), the R^2 value for the model internal structure was 0.650 for firm performance (FP). According to Chin's (1998) size effect criteria (0.67 = strong, 0.33 = medium, 0.10 = weak), this value indicates a moderately strong explanatory power.

Moreover, Cohen's f^2 guidelines were applied to measure the effect size of each predictor, (Cohen, 2013). Based on Cohen's classification—0.02 as small, 0.15 as medium, and 0.35 as large—the effect size of customer integration (CI) on FP was 0.148, internal integration (II) on FP was 0.206, and supplier integration (SI) on FP was 0.020, as presented in Table (4).

Furthermore, the model predictive capability was assessed using the Stone–Geisser's Q^2 test. The Q^2 value for the internal structure (FP) was 0.365 (see Table (4), which is greater than zero, confirming that the model demonstrates adequate predictive relevance, (Hair et al., 2017).

Table (4): R-square, Q-square & F-square

Construct	R^2	Q^2	F^2 in relation to	
				FP
FP	0.650	0.365	**CI**	0.148
			II	0.206
			SI	0.020

The hypotheses results, as presented in Table (5), reveal that the first and second paths were positive and statistically significant, confirming support for **H1** and **H2**. However, the third path was not positive, indicating not support for **H3**.

Table (5): Regression analysis results

Direct paths	B	T value	P values	Decision
CI -> FP (H1)	0.447	2.658	0.008	**Supported**
II -> FP (H2)	0.429	3.909	0.000	**Supported**
SI -> FP (H3)	-0.020	0.137	0.891	**No Supported**

5. Discussion

Grounded in the Resource-Based View (RBV), this study explores the direct impact of SCI on Firm Performance (FP). Through a survey of managers and employees within Yemeni pharmaceutical industry, the research empirically tested the proposed model and hypotheses, leading to several key conclusions:

First, the findings of this study indicate that both internal integration and customer integration have a significant positive impact on firm performance. These results align with previous research by Flynn et al. (2009), Subburaj et al. (2020), and Ahmed et al. (2020). However, supplier integration did not show a significant effect on firm performance, which is consistent with the findings of Gunawan et al. (2024).

Second, an effective integration system is essential for firms to respond to customer demands efficiently, ensuring timely deliveries, streamlined ordering processes, heightened customer awareness, and prompt assessment of customer needs. Additionally, internal integration within a firm plays a crucial role in facilitating seamless information exchange. Without effective internal integration, firms may struggle to coordinate effectively with both suppliers and customers, ultimately hindering overall performance.

Third, the findings further suggest that pharmaceutical firms in Yemen can leverage Supply Chain Integration (SCI) to enhance their overall performance. This underscores the importance of adopting SCI as a strategic approach to improving firm efficiency and competitiveness. These results align with the studies conducted by Flynn et al. (2009), Subburaj et al. (2020), and Ahmed et al. (2020).

Fourth, the study highlights that pharmaceutical firms in Yemen with well-established internal, customer, and supplier integration demonstrate stronger capabilities in implementing SCI, leading to superior performance outcomes. Effective supply chain integration plays a critical role in shaping a firm's reputation and operational success. More importantly, adopting SCI is no longer optional but essential for these companies to remain competitive and achieve sustainable growth.

6. Conclusion

There is a growing interest in Supply Chain Integration (SCI), which underscores the importance of ongoing research into its role in foretelling firm performance. This study focused on the three key dimensions of SCI—internal, customer, and supplier integration—and their impact on firm performance. Using an empirical research approach, data were gathered through a questionnaire from 97 managers and employees of pharmaceutical firms in Yemen to assess the influence of SCI on their performance. By analyzing the data using SPSS and SmartPLS software, the findings revealed that internal and customer integration significantly impact firm performance, whereas supplier integration did not show a significant effect. Despite this, firms can enhance their overall performance by effectively implementing internal, customer, and supplier integration in their production and marketing processes. Additionally, SCI facilitates direct communication and stronger relationships with customers and suppliers, ultimately leading to improved efficiency and competitiveness.

7. Implications

In this study, we examined the effect of SCI on firm performance. SCI was measured in three dimensions such as internal, customer, and supplier integration. In the following sections, Practical implications, theoretical implications, limitations and future research.

7.1 Practical Implications

This study holds substantial importance for both practitioners and academicians, offering several key implications. For managers, in particular, the research is highly relevant, as supply chain integration relies on teamwork, information sharing, collaborative problem-solving, and joint decision-making. Since integration occurs primarily through interactions between human actors—especially managers—it is largely driven by knowledge exchange processes. Therefore, enhancing human resource capabilities, managerial expertise, and talent development is crucial for strengthening integration efforts, ultimately leading to improved firm performance.

7.2 Theoretical Implications

The current study was grounded in the Resource-Based View (RBV), which suggests that firms gain a competitive edge by possessing unique, valuable, and inimitable resources. Specifically, human and knowledge-based capabilities are recognized as critical assets that drive superior performance and strengthen a firm competitive position.

7.3 Limitations and Future Research

While this study offers valuable contributions to both academic research and practical applications, it has certain limitations that create opportunities for future research. First, the sample size was constrained due to research conditions, and future studies could expand the sample to enhance generalizability. Second, this study focused on three dimensions of SCI—internal, customer, and supplier integration—without exploring other potential dimensions that may influence firm performance. Additionally, firm performance in this study was categorized into financial and operational performance, whereas future research could examine additional performance metrics for a more comprehensive analysis. Finally, future studies should consider the role of mediating and moderating variables, such as information technology, innovation, and brand in shaping the relationship between SCI and firm performance.

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9. Declaration of competing interest
The authors have no conflicts of interest to disclose that could have influenced the work presented in this article.

10. Data availability statement
The data relevant to the findings of this study are available upon request from the corresponding author Aqel Al-hujri.

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