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Research Article

The role of supply chain collaborative in enhancing sustainability through supply chain risk management

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Abstract

Paper aims: The study aims to provide actions and research directions in the area of supply chain collaboration and sustainability, with a focus on the effect of supply chain risk management.

Originality: The findings provide a theoretical bridge between supply chain collaboration literature and sustainability theory by demonstrating that collaboration fosters sustainable performance through risk management, and emphasizes collaboration as a sustainability driver.

Research method: The study employed a stratified sampling technique with a total of 288 completed questionnaires were received from seven manufacturing firms, using a 5-point Likert scale. The sample was those practitioners who are exposed to supply chain management and sustainability.

Main findings: The results find that supply chain collaboration positively influences sustainability, and that information sharing, resource sharing, collaborative communication, and joint knowledge creation—as components of supply chain collaboration—also positively influence sustainability.

Implications for theory and practice: The research adds to the body of knowledge by integrating collaboration as a critical enabler of effective risk management. For practitioners, the study highlights that sustainability should not be viewed separately from risk management. Managers should integrate collaborative risk management practices to achieve sustainability.

Keywords

Information sharing. Resources sharing. Collaborative communication. Joint knowledge creation. Social sustainability. Economic sustainability. Supply chain risk management.

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The authors declare that this research does not require ethical approval as it did not involve any experiments on humans or animals.

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1. Introduction

In the global and complex economy, today's organizations are increasingly realizing the growing significance of having a resilient supply chain that can adapt to changes and disruptions, mitigate potential risks, **and** contribute toward achieving broad sustainability goals (Zhang et al., 2021). As these organizations face escalating uncertainties due to economic volatilities, environmental challenges, and social dynamics, it is essential for businesses to embrace an effective and collaborative approach to supply chain risk management and multidimensional sustainability (Akhavan & Philsoophian, 2023). This call seeks to highlight the necessity of fostering collaboration among supply chain partners not only to ensure business continuity but also to achieve long-term environmental, social, and economic sustainability.

Building resilience through collaborative risk management requires recognizing that supply chain risks are diverse and multifaceted; they range from natural disasters and geopolitical instability to supply shortages and technological failures (Chowdhury et al., 2023). In order to effectively control and manage these risks, organizations should focus on enhancing information sharing by establishing transparent communication channels. This allows companies to share real-time information related to potential disruptions, risks, and threats, ensuring better preparedness and faster response times (Baah et al., 2022). On the other hand, the aim of organizations to develop contingency plans for collaborative risk management includes jointly improving these plans so they can be activated across supply chain operations when unforeseen conditions occur (Nayal et al., 2021). This also involves clearly identifying alternative suppliers, production sites, and transportation routes.

Adopting technological solutions—alongside leveraging technologies like artificial intelligence (AI), blockchain, and big data analytics—can allow key supply chain partners to monitor risks effectively and make data-driven decisions to mitigate them (Men et al., 2023). Sustainability is no longer just an environmental or social concern but also refers to multidimensional challenges that encompass environmental, social, and economic dimensions. Advancing multidimensional sustainability while considering supply chains has the potential to promote sustainability in multiple forms through collaboration (Chin et al., 2015).

For environmental sustainability, today's companies prioritize reducing carbon footprints, energy consumption, and waste by working with many suppliers to implement green technologies, promote the circular economy, and adopt eco-friendly practices in sourcing, production, and distribution operations (Schaltegger & Burritt, 2014). To promote social sustainability, companies collaborate within the supply chain to improve working conditions, offer fair wages, and foster workforce diversity. This enables companies to engage with suppliers on social responsibility initiatives to ensure ethical practices and respect for human rights throughout the entire supply chain (Jadhav et al., 2019). Economic sustainability refers to collaborative efforts that aim to ensure suppliers are financially viable, foster economic development in underserved regions, and invest in innovation to drive sustainable profitability and reduce the risk of business shocks (Miemczyk & Luzzini, 2018).

Sustainability concern and supply chain risk management are not fully integrated in the collaboration studies. Few studies empirically test a cohesive model where collaboration mitigates supply-chain risks and that risk reduction is the mechanism driving improved environmental social and economic sustainability outcomes (Chauhan et al., 2022). Many reviews look at supply-chain collaboration/sustainability and supply chain risk management themes. Thus, differently there is insufficient evidence to support the mediator role of supply chain risk management. fragmented discussion of the various forms of collaboration (internal versus external) (Emrouznejad et al., 2023). To address the research gap that many reviews demand present an empirically supported framework that demonstrates how collaborative supply chain enhance multifaced sustainability and risk reductions result in which sustainability outcomes, this responds to the literature gap that some reviews call for. The following research question triggers this study: To what extent supply chain collaboration improves sustainability issue through the effect of supply chain risk management?

2. Literature review

Sustainable value creation **leads** organizations to establish strategic partnerships for supply chain collaboration that can be truly effective in managing risks and achieving sustainability objectives. Strategic partnerships should be prioritized by identifying shared goals, as organizations should work together to align and define these objectives in light of sustainability and risk mitigation (Adobor & McMullen, 2018). This essential alignment can ensure that all supply chain parties are fully committed to the common objectives. Supplier engagement and development **also enable** businesses to engage their partners as suppliers by investing in supplier development practices, which focus on enhancing sustainability practices, risk management capabilities, and innovation to maintain long-term, mutually beneficial relationships (Alzoubi et al., 2020).

In terms of collaborative innovation, **evidence shows** that companies are beginning to focus on co-creating solutions for supply chain disruptions, whether by adopting new technologies, creating sustainable products, or developing alternative logistics solutions. Collaborative innovation can also drive a competitive edge and resilience by advocating industry-wide policies (Zavala-Alcívar et al., 2020). To scale collaborative supply chain efforts, companies need consistent industry standards. These can help standardize sustainability metrics by establishing universally accepted benchmarks that assist organizations in measuring and comparing development across supply chains and encouraging transparency (Yun & Ülkü, 2023). **Governments and regulatory bodies should be encouraged to support** sustainability initiatives by providing incentives and regulations that promote collaborative, responsible supply chain practices. Thus, the study formulates the following hypothesis:

H1: supply chain collaboration influences positively sustainability

The effectiveness of supply chain collaboration lies in the collective actions of various stakeholders—from raw material suppliers to end users. Working together **enables** businesses to clearly drive systemic changes and address global challenges such as climate change, inequality, and resource depletion (Sauer & Seuring, 2018). The intersection of supply chain risk management and multidimensional sustainability **encourages** a collective, integrated approach to ensure resilience, growth, and ethical practices in the industry (Piprani et al., 2022). As companies, stakeholders, and policymakers come together to promote collaboration, share knowledge, and drive innovation, they can build supply chains that are not only risk-resilient but also socially and environmentally responsible. This is not just a competitive advantage; it is a shared responsibility that can shape a sustainable future for generations. According to literature discussion, SMEs journey towards business survival could be viewed as beginning with economy methods. They work efficiently and are prepared to adopt supply chain finance and enlisting the help of supply chain participants to facilitate the adoption of circular economy practices (Lusiantoro et al., 2025).

The intricate webs of global supply chains are the backbone of modern commerce. However, their complexity also makes businesses more vulnerable to disruptions ranging from natural disasters and pandemics to unforeseen geopolitical shifts and increasing consumer awareness of ethical and environmental concerns (Li et al., 2015). Concurrently, the imperative of sustainable practices has become undeniable, so focusing on profit maximization is no longer sufficient, as current businesses operate with a deep understanding of their effects on people and the planet (Duhamel et al., 2016). The literature explores how seemingly distinct challenges—such as risk management and sustainability—are fundamentally interconnected, and how supply chain collaboration emerges as a critical tool to achieve resilience and responsibility (Yen & Zeng, 2011). Collaboration facilitates information sharing, enhances transparency, and drives joint innovation—all of which are vital for navigating uncertainties and fostering multidimensional sustainability. Thus, the study formulates the following hypothesis:

H2: information sharing influences positively sustainability

Understanding supply chain risk management is a proactive process of identifying, evaluating, controlling, and monitoring the potential vulnerabilities that could disrupt the flow of products and services across a supply chain. Further, disruptions can stem from numerous sources categorized as operational risks, such as disruptions in production, transportation, or logistics (Zeng & Yen, 2017). The arguments also indicate financial risks, encompassing fluctuations in exchange rates, goods prices, and credit availability. In the same vein, reputational and ethical risks—such as human rights abuses and environmental damage—are consistent with compliance risks related to violations of regulations and laws (Wicaksana et al., 2022). Leite et al (2024) indicated when supplier selection processes take into account the risks involved and how they relate to supply chain, the risk management can help improve supply chain performance. This can be used to determine which risk criteria are most challenging for suppliers to develop a strategy for reducing the risks that are more difficult to eradicate.

Sustainability in supply chains is not limited only to environmental concerns, but also encompasses a broad set of interconnected dimensions. Economic sustainability, for example, focuses on long-term profitability, efficient resource utilization, and equitable value distribution within supply chain management (Giannakis & Papadopoulos, 2016). Social sustainability also addresses ethical sourcing, fair labor policies, and societal well-being within the supply chain. Environmental sustainability focuses on minimizing environmental effects by reducing emissions, waste, and resource consumption (Marshall et al., 2015). These dimensions form a truly sustainable supply chain that requires a holistic approach, integrating various aspects of sustainability into strategic decision-making. However, achieving this requires deep collaboration among stakeholders to address conflicting priorities and create synergistic solutions. Thus, the study formulates the following hypothesis:

H3: resource sharing influences positively sustainability

Supply chain collaboration encompasses the establishment of coordinated, strategic relations among different stakeholders—e.g., suppliers, manufacturers, logistics providers, retailers, and consumers. This goes beyond transactional exchange and involves information sharing, joint planning, and collaborative problem-solving (Hida Syahchari et al., 2022). The key benefits of effective supply chain collaboration for both risk management and sustainability include enhanced information sharing through open communication channels, which facilitate the early detection of potential risks and the swift implementation of corrective actions (Xu et al., 2024). Transparency enables better visibility into the entire supply chain for identifying vulnerabilities and ensuring ethical sourcing.

The findings of studies indicated that improved risk mitigation requires collective efforts to strengthen supply chain resilience and enable coordinated contingency plans and diverse sourcing approaches (Ahmed et al., 2020). In addition, working together allows various stakeholders to pool resources and expertise, leading to more robust risk mitigation strategies. The shared responsibility for sustainability through collaboration facilitates joint actions on issues like ethical sourcing, fair practices, and reducing environmental impact (Chen et al., 2013). Stakeholders can leverage their collective influence to promote responsible behaviors across the entire supply chain. **Fostering** innovation through collaborative relationships also drives innovative solutions for resource efficiency, sustainable product development, and circular economy initiatives. Thus, the study formulates the following hypothesis:

H4: collaborative communication influences positively sustainability

Building a trusted and long-term relationship is an outcome of effective collaboration among stakeholders, creating a foundation for shared success and increased supply chain resilience. The interconnectedness and integration of supply chain risk management with multidimensional sustainability are essential for long-term success (Mafini & Muposhi, 2017). A sustainable supply chain, on the other hand, is inherently more resilient and less susceptible to disruptions caused by ethical breaches, social or environmental disasters, or unrest. Conversely, robust supply chain risk management can significantly contribute to sustainability by identifying and mitigating risks related to unethical practices and environmental impact (Kache & Seuring, 2014). Thus, a collaborative structure allows organizations to proactively address both risk and sustainability simultaneously.

An approach of joint risk assessments, through collaborative analysis of risks across supply chain practices, enables targeted mitigation plans. For ethical sourcing programs, collective efforts ensure ethical practices and compliance with labor standards (Meng, 2021). As a result it is essential to recognize and reduce risks for organizations in relation to their supply chain. Performance management thus emerges as a key component of risk mitigation and usually implemented to track goal attainment performance management systems that should be taken into consideration of the problems that managers frequently face (Mohammad et al., 2022, 2025b; Senna et al., 2023). The arguments highlight potential barriers such as lack of trust and transparency, traditional hierarchical relationships, and information hoarding, which can hinder open communication. Conflicting priorities also require balancing cost-efficiency with ethical and environmental considerations (Martins & Pato, 2019). Thus, the study formulates the following hypothesis:

H5: joint knowledge creation influences positively sustainability

Inadequate technology and infrastructure make the implementation of secure and efficient platforms for data sharing and collaboration essential. Overcoming these challenges requires companies to foster a collaborative culture, expand and promote transparency, and invest in technology to enable secure and efficient data and information sharing (Kurniawati & Cakravastia, 2023). The literature on future research orientations focuses on developing standardized frameworks for collaboration and sustainability reporting. To explore the role of blockchain technology in enhancing transparency and trust, companies are investigating the effect of digitalization on collaborative risk management (Mohammad et al., 2025a; Rajeev et al., 2017). This also involves developing metrics to measure the effectiveness of collaborative initiatives in driving sustainable outcomes.

Successfully navigating the complexities of global supply chains drives a paradigm shift beyond individual organizational goals toward a more holistic and collaborative approach. This notion argues that supply chain collaboration is a critical enabler of effective risk management and a vital ingredient for fostering multidimensional sustainability (Govindan et al., 2014). By embracing collaborative strategies, organizations can build more resilient, socially responsible, ethical, and environmentally sustainable supply chains, securing their long-term viability and contributing to a more just and sustainable future. The aim toward excellence in the supply chain is a shared responsibility that demands all stakeholders work together to transform and drive critical networks into positive change (Mani et al., 2016).

3. Method

Data from manufacturing firms in Jordan is being collected through a survey. According to the approach of Douglas & Craig (2007), after a professional translator translated the initial version of the questionnaire into Arabic, a different translator and a group of professionals worked together to reach an agreement on a final version of the questionnaire. By interviewing two manufacturing firms, the study conducted a pilot test and collected preliminary data along with additional feedback to evaluate the clarity of the questionnaire. A questionnaire was designed for supply chain practitioners in manufacturing firms in Jordan. The study initially benefit from the relevant studies (e.g., Zavala-Alcívar et al., 2020; Rajeev et al., 2017; Kache & Seuring, 2014) to design the instrument that was self-administered distributed applying five-point Likert measure.

The independent variables of this study were the dimensions of supply chain collaboration, including information sharing, resource sharing, collaborative communication, and joint knowledge creation. The dependent variable—sustainability—was measured based on social and economic dimensions. In addition, supply chain risk management is rolled as a mediator in the study's model. To analyze collected data, the study applied path analyses approach by using the SmartPLS software in order to test the associations between research variables and conduct hypotheses testing. By testing the reliability, the study conducted Cronbach's Alpha test of research constructs, and Average Variance Extracted (AVE) for validity testing with descriptive statistics of those constructs.

Utilizing a database provided by the Chamber of Commerce in Jordan among manufacturing firms in Jordan, the study distributed the finalized questionnaire to 300 participants who are contact via email and in-person meeting. Overall, the study received a total of 288 completed questionnaires from different manufacturing firms in Jordan. This sample size ($n > 271$) (response rate 90%) is sufficient for exploring relationships, including marginal effects, at 0.8 statistical power with a 0.05 significance level (Verma & Goodale, 1995). The respondents' positions included CEOs, managers, and other full-time employees within manufacturing firms. The study used the method proposed by Armstrong & Overton (1977) to estimate potential late-response bias. The T-test revealed no significant difference between early and late respondents at the 0.05 level, indicating that response bias was minimal.

Using a stratified sampling technique, all firms in the sampling frame were grouped by industry before randomly selecting from each group. Multiple businesses could be selected from each group (stratum), and a smaller quota was applied to industries with fewer than 50 units.

Harman's one-factor test was then used to check for common method bias. A principal component factor analysis including all study items revealed five distinct factors with eigenvalues greater than 1, accounting for 55.6% of the total variance, with the largest factor contributing only 13.7%. The unrotated factor structure did not show a single dominant factor, indicating that common method variance is negligible.

Finally, the study performed multi-group confirmatory factor analysis (CFA) to cross-validate the model, ensuring that key structures are cross-sectorially stable since samples were collected from different manufacturing firms. The model produced an acceptable fit to the data, indicating that measurement invariance (i.e., configural invariance) is supported—meaning that the same items load on the same factors with comparable loadings.

4. Results

In this study the partial least squares (PLS) method was utilized with SmartPLS 4, which enables sophisticated statistical analyses like the bootstrapping technique for hypothesis testing with 5000 samples. By selecting examples from the research sample this method generates a significant number of resamples. PLS analysis can handle highly predictive models and is suitable for a range of sample sizes. As is well known PLS is an appropriate technique for analyzing structural and measurement models.

4.1. Measurement model

A confirmatory factor analysis was performed in this study mainly to evaluate the measurement model that was assessed using discriminant validity reliability and convergent validity. Factor loadings average variance extracted (AVE) and composite reliability (CR) were used to investigate convergent validity. According to Table 1 the composite reliability values for each study construct ranged from 0.798 to 0.867 meeting the analysis requirements. The item factor loading results fell within the acceptable range of 0.70 (Hair et al., 2019a). For every study construct the AVE values were higher than the suggested cutoff of 0.50 (Hair et al., 2019b). Cronbachs alpha (i. e. the scaled values of means standard deviations and results) are also included. e. internal consistency) in order to confirm dependability. From 0.751 to 0. 910 the alpha scores were above 0.70 which is suitable and meets the standard criterion of 0.70. Thus the constructs and items reliability and convergent validity were validated (See Figure 1).

Table 1. Analysis of reliability and convergent validity.

Factor	Item	Loadings	Alpha	CR	AVE
Information sharing	Q1	0.882	0.888	0.809	0.690
	Q2	0.861			
	Q3	0.630			
Resources sharing	Q4	0.871	0.910	0.876	0.504
	Q5	0.884			
	Q6	0.865			
Collaborative communication	Q7	0.714	0.891	0.799	0.564
	Q8	0.906			
	Q9	0.885			
Joint knowledge creation	Q10	0.965	0.806	0.847	0.600
	Q11	0.708			
	Q12	0.947			
Social sustainability	Q13	0.946	0.831	0.798	0.587
	Q14	0.768			
	Q15	0.941			
Economic sustainability	Q16	0.907	0.751	0.821	0.611
	Q17	0.930			
	Q18	0.881			
Supply chain risk management	Q19	0.836	0.760	0.869	0.643
	Q20	0.781			
	Q21	0.817			
	Q22	0.874			

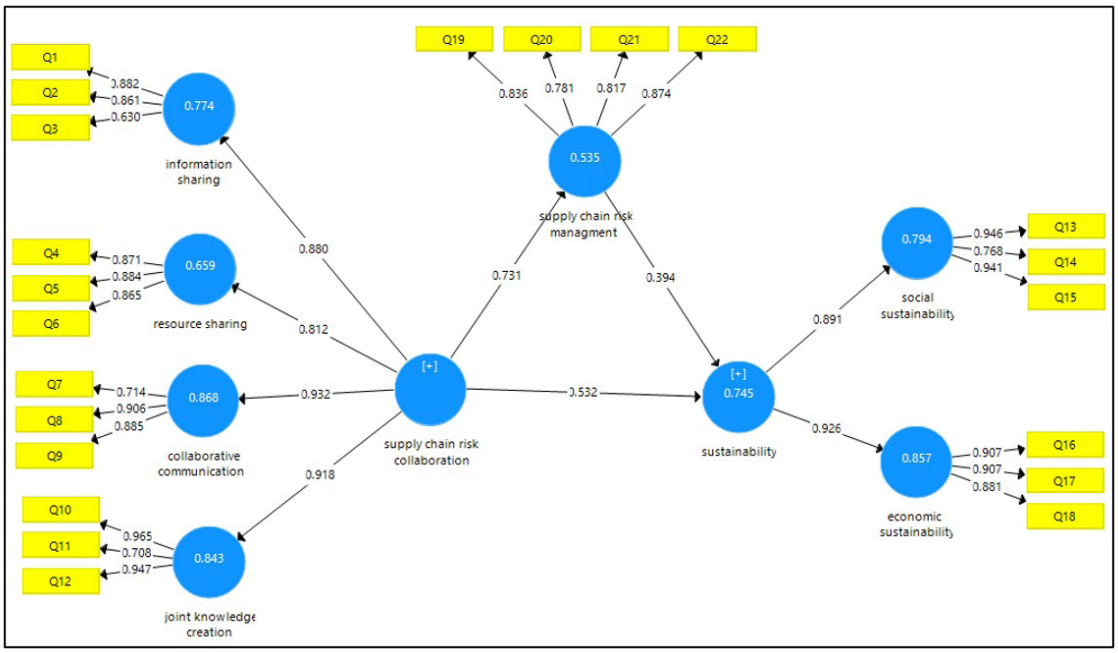

Figure 1. Measurement Model.

The results of the discriminant validity analysis indicate that the square root values of all constructs' AVEs were higher than the correlations with other constructs. In this study, the square root values exceeded the inter-constructs correlation that represents good indication of the discriminant validity. To validity analysis, an issue of multicollinearity was also checked to identify possible large correlations among study variables. The values in bold diagonal indicates square root of the AVE at significance level $p < 0.01$ as shown in Table 2.

Table 2. Analysis of discriminant validity.

Variable	Information sharing	Resources sharing	Collaborative communication	Joint knowledge creation	Social sustainability	Social sustainability	Supply chain risk management
Information sharing	**0.830**						
Resources sharing	0.621	**0.709**					
Collaborative communication	0.433	0.622	**0.750**				
Joint knowledge creation	0.609	0.531	0.630	**0.774**			
Social sustainability	0.598	0.707	0.532	0.521	**0.766**		
Economic sustainability	0.324	0.593	0.576	0.389	0.620	**0.781**	
Supply chain risk management	0.411	0.611	0.601	0.454	0.387	0.566	**0.801**

4.2. Structural model

SEM analysis of the suggested hypotheses was conducted using 5000 sample and an adaptation of the bootstrapping technique. Consequently the variance was explained by the exogenous constructs was 74.5 for sustainability. As shown in Figure 2, supply chain collaboration influences positively sustainability which supports accepting hypotheses 1 (β = 0.633, t = 8.261, p < 0.001). Furthermore, the information sharing, resource sharing, collaborative communication, and joint knowledge creation influence positively sustainability, accepting hypothesis 2, 3, 4 and 5 (β = 0.541, t = 4.321, p < 0.05), (β = 0.398, t = 2.120, p < 0.05), (β = 0.332, t = 3.876, p < 0.05), and (β = 0.298, t = 2.660, p < 0.001) accordingly. According to the results, the most predictors of supply chain risk collaboration that positively influence the sustainability was the information sharing which indicate a increasing in the information sharing lead to increase in sustainability also. The magnitude (value) of β presents how strong that influence is higher value indicate a stronger influence. On other hand, the least predictor of supply chain risk collaboration that also positively influence the sustainability was joint knowledge creation. Moreover, the results showed the supply chain risk management influenced positively sustainability, accepting hypothesis 6 (β = 0.371, t = 2.209, p < 0.05).

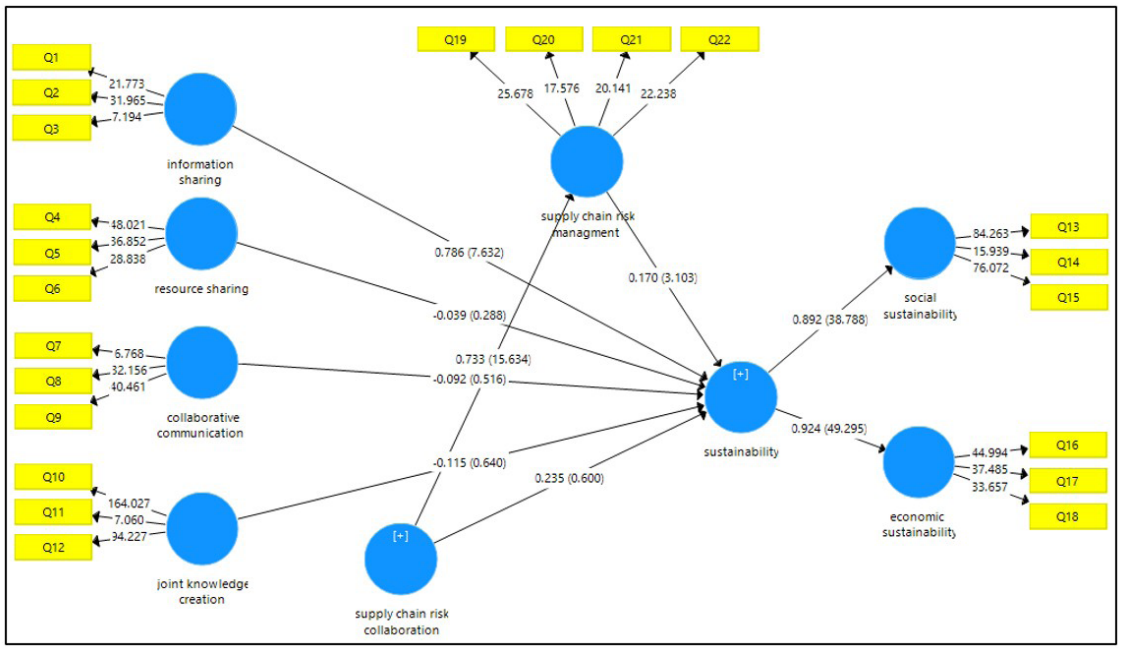

Figure 2. Results of the structural model.

5. Discussion

The findings supported the significance of supply chain risk management associated with multidimensional sustainability as a critical topic in today's business environment, as diverse supply chains are vulnerable to a variety of risks that influence the continuity of business operations. Furthermore, the results asserted that to enhance supply chain sustainability and achieve long-term success, organizations should focus on adopting flexible and effective risk management approaches through collaboration among the various stakeholders in the supply chain. Organizations can use supply chain risk management as a process of identifying and assessing potential risks that may affect the supply chain and working to reduce or control those risks which may be economic, environmental, or social and this in line with (Alshourah, 2022; Yun & Ülkü, 2023) findings that highlight how work across disciplines and incorporate climate considerations into supply chain management to improve sustainability.

However, the findings related to multidimensional sustainability in the supply chain indicated that this aspect is not limited to the environmental dimension only, but also includes several key dimensions. Environmental sustainability mainly concerns reducing negative environmental effects, such as carbon emissions and waste management. Economic sustainability aims to ensure the sustainability of economic operations and the achievement of long-term profits. Social sustainability promotes good social conditions for workers at all stages of the supply chain. The importance of collaboration in the supply chain stems from the interaction between different stakeholders (such as suppliers, manufacturers, and customers), which can contribute to achieving better sustainability and more effective risk management. There are several ways in which collaboration can contribute to enhancing sustainability and risk management:

Information sharing focuses on providing accurate and transparent data on potential risks and market needs, which can also contribute to smarter decision-making. In joint planning, collaboration helps develop flexible strategies to deal with potential disruptions in the supply chain. Coordination between parties improves relationships among companies involved in the chain, ensuring the sustainability of operations and the reduction of risks. Thus, collaboration enhances the use of innovative technologies or solutions that contribute to reducing environmental and economic impacts. Strategies to enhance collaboration and manage risks involve diversifying sources and suppliers, which can reduce the risks associated with dependency on a single supplier or a specific geographic region. This consistent with (Xu et al., 2024) result that demonstrates how the application of efficient information sharing and risk management techniques along with supply chain collaboration and collaborative decision-making which are crucial to enhancing supply chain resilience.

Resource sharing through resilience and adaptability enables organizations to build the supply chain's capacity to adapt to crises and sudden changes, such as political or economic shifts. Investing in technology, through the use of modern tools such as artificial intelligence and data analytics, improves resource sharing in risk management and enhances supply chain efficiency. Developing long-term relationships creates strategic partnerships with suppliers and partners to provide a collaborative environment based on mutual trust.

However, the findings shed light on the challenges that companies may face within the complexity of global supply chains. Moving between multiple suppliers and countries can increase the complexity of risk management. Organizations recognize the role of political and economic instability, as crises in some countries may affect the sustainability of the global supply chain. Environmental pressures related to environmental sustainability may require additional investments in technology and innovation. Therefore, supply chain risk management and sustainability require a comprehensive and multi-dimensional approach that promotes collaboration between different parties and ensures the ability to adapt to these challenges. Effective collaboration within the supply chain can enhance companies' ability to manage risks and achieve long-term sustainability, benefiting all stakeholders as Li et al. (2015) stated.

The results indicate that sustainability in the supply chain involves ensuring that all activities in the chain are carried out in a way that promotes long-term benefits and minimizes negative impacts on the environment and society. Sustainability means ensuring that business operations remain viable to achieve lasting profits while reducing costs and improving efficiency. It also includes ensuring the rights of workers in the supply chain, improving working conditions, and contributing to the well-being of communities. Hence, strategies to enhance sustainability include selecting sustainable suppliers and working with those who adhere to sound environmental and social practices. Continuous improvement involves consistently seeking new ways to improve operations and reduce negative impacts through increased collaboration and by building partnerships between companies, suppliers, and consumers to improve sustainable performance across the supply chain.

Integrating risk management and sustainability requires establishing risk management strategies that can be aligned with sustainability goals to reduce risks and enhance sustainability simultaneously. In this context, collaboration between companies, suppliers, and customers can support the reduction of shared risks and the achievement of sustainability objectives. Using advanced technologies such as artificial intelligence and data analytics can improve both risk management and sustainability efforts. Transparency—through the provision of accurate information about the environmental and societal impacts of the supply chain—also helps to improve those impacts. Changes in environmental or economic regulations and policies can influence how risks are managed. Therefore, supply chain risk management and sustainability require an integrated approach, where companies must combine innovative risk management strategies with sustainability goals to enhance operational continuity and long-term success. This confirm with findings of Alzoubi et al. (2020) who also demonstrate how supply chain collaboration and sustainable supply chain strategies are related with businesses seeking to achieve social and environmental goals to develop cooperative strategies with their supply chain partners.

6. Conclusion

The study concludes that an enhanced supply chain, achieved through collaboration, fosters better communication, trust, and resource-sharing among key partners. This improved coordination also enables quicker adaptation to disruptions and risks, thereby enhancing the resilience of the supply chain. Based on the findings, better collaboration allows organizations to anticipate and manage risks collectively, reducing the impact of unforeseen events such as market fluctuations or political instability. On the other hand, the integration of sustainability goals is increasingly becoming a key focus in supply chains. Collaborative efforts enable more effective integration of sustainable practices, such as minimizing waste and ensuring ethical sourcing. The findings highlight that through pooling resources and knowledge, supply chain partners can adopt more innovative and efficient sustainability strategies that might not be feasible individually.

6.1. Theoretical implications

By showing that inter-organizational cooperation is not only a source of competitive advantage but also a critical mechanism for managing risks that threaten sustainable performance the study supports and expands upon the relational view. Long-term sustainability objectives are supported by collaborative relationships based on information sharing for example. The findings offer a significant theoretical connection between dynamic capabilities theory and the resource-based view (RBV). One way to think of supply chain collaboration is as a dynamic capability that allows firms to adjust resources and procedures in response to risk and uncertainty. This ability to work together results in better social economic and environmental outcomes through supply chain risk management. As a result, the study enhances the RBV by demonstrating that relational within and between firms produce long-term value when implemented through efficient risk management techniques.

6.2. Practical implications

As a strategic enabler, risk management is essential to supply chain sustainability. Proactive risk identification, assessment, and mitigation strategies help address sustainability challenges early. The discussions further assert that by incorporating risk management frameworks into collaboration efforts, organizations are better equipped to address both operational and environmental risks, thus contributing to long-term sustainability goals. The benefits of collaboration—when paired with risk management—enable cost-effectiveness by reducing the cost of risk mitigation and sustainability initiatives. Moreover, organizations should jointly invest in technology, establish risk-sharing agreements, and engage in shared sustainability efforts, all of which can lead to long-term cost savings. This collaborative approach can also incentivize companies to take more ambitious actions on sustainability and risk management. As transparency and accountability improve, supply chain collaboration increases visibility—crucial for sustainability efforts—by sharing information on sourcing, production practices, and environmental impacts.

6.3. Study limitations

It is difficult to draw conclusions about the causal relationships between supply chain collaboration risk management and sustainability because the study is based on cross-sectional data. The constructs were assessed based on manufacturing firms which could introduce common method bias. Stratified sampling limits how

broadly the results can be applied. To improve external validity random or convenient sampling across industries or nations should be used in future research. Limitations of scope of the constructs, the model does not take into account other potentially significant elements like supply chain agility or environmental uncertainty instead concentrating on cooperation and risk management as the main antecedents of sustainability. Adding these factors into the model could result in a more comprehension.

6.4. Future research directions

This study contributes to the understanding of the interplay between risk management and sustainability. Future research could delve deeper into how supply chain risk management strategies are directly linked to sustainability efforts. By identifying specific risks (e.g., environmental, social, economic), future studies can provide actionable frameworks for integrating sustainability into risk management processes. There is also a need to investigate how digital tools (e.g., blockchain, IoT, AI) can enhance supply chain collaboration and sustainability. A deeper understanding of the role of technology in enabling risk management, tracking environmental impact, and fostering real-time communication among supply chain partners presents a rich area for exploration.

In addition, the long-term impact on corporate reputation is another direction for future research. Scholars can examine how collaborative risk management practices—especially those centered on sustainability—affect long-term brand equity and consumer behavior. Understanding the connection between risk mitigation and consumer perception can also provide insights into the business case for sustainability. Further research could investigate the potential of cross-sector collaborations, where industries with differing practices and supply chain structures work together on sustainability initiatives. This could lead to innovative solutions to global supply chain challenges such as climate change, resource depletion, and ethical labor practices.

Comparative research across different cultural and geographical contexts may offer valuable insights into how risk management and sustainability practices are perceived and implemented globally. Understanding these differences can help design more universally applicable frameworks for collaboration. Overall, integrating supply chain collaboration with sustainability through the lens of risk management offers a powerful framework for enhancing both operational efficiency and achieving long-term sustainability goals.

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Data availability

Research data is only available upon request.

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