INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN ACCOUNTING, FINANCE AND MANAGEMENT SCIENCES

OPEN ACCESS JOURNAL

Vol 15, Issue 2, (2025) E-ISSN: 2225-8329

Supply Chain Resilience Impact on Operational Performance of Manufacturing Companies in Jordan: The Role of Supply Chain Sustainability

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To Link this Article: http://dx.doi.org/10.6007/IJARAFMS/v15-i2/25598 DOI:10.6007/IJARAFMS/v15-i2/25598

Published Online: 23 June 2025

Abstract

This study investigates the correlation among supply chain resilience (SCR), supply chain sustainability (SCS), and operational performance (OP) in Jordan's manufacturing industry. In the context of global disruptions like the COVID-19 pandemic and geopolitical tensions, SCR has become essential for sustaining operational stability, while SCS has risen as a strategic objective for long-term competitiveness. The combined and mediated impacts of SCR and SCS on OP, despite their separate importance, remain inadequately examined, especially in emerging economies such as Jordan. Data were gathered from 280 respondents utilizing a quantitative, cross-sectional research approach among Jordanian manufacturing companies. Structural equation modeling (SEM) and regression analysis were utilized to evaluate the proposed linkages. The results showed that SCR greatly improves OP (β = 0.45, *p* < 0.01), with collaboration and agility being the most important parts of resilience. SCR had a big positive effect on SCS (β = 0.50, *p* < 0.001), which shows how well they work together.. Furthermore, SCS was recognized as a partial mediator of the SCR-OP relationship (indirect effect β = 0.19, *p* = 0.003), highlighting the importance of sustainability in transforming resilience into operational benefits. By combining resilience and sustainability frameworks and showing how they function together to improve performance, the study adds to our understanding of theory. It gives managers useful information about how to make supply chains more resilient by using collaborative platforms, agile systems, and programs that focus on sustainability. The results are in line with Jordan's national development goals, which call for measures that foster strong and long-term growth in industry.

Keywords: Supply Chain Resilience, Supply Chain Sustainability, Operational Performance, Manufacturing Companies, Jordan

Introduction

Jordan's manufacturing sector is still a key part of the economy, making up around one-fifth of GDP and jobs in the country. The sector did very well in 2023, with manufacturing production expanding by roughly 3.6%, the strongest rate since 2011. This helped overall GDP

growth reach about 2.7% (World Bank, 2024). Textiles and clothing, fertilizers and chemicals, and pharmaceutical goods are some of the main exports. This shows how broad the industrial base is. In addition, manufacturing (together with the rest of the industrial sector) is one of the kingdom's biggest employers, with over 250,000 jobs—about 20% of the workforce—and most of these jobs are held by Jordanians (Al Muheisen, 2023). This significant employment footprint shows how important the sector is for making a living and how it could help lower Jordan's high unemployment rate.

Geopolitical instability in the Middle East and global disruptions like the COVID-19 pandemic have shown how weak supply chains are around the world. This puts a lot of pressure on Jordanian manufacturers who rely on imports and are vulnerable to shocks in the region (Ivanov, 2020; Christopher, 2000). Therefore, it is important to understand how supply chain resilience may help manufacturing businesses in Jordan improve their operational performance.

Operational performance in the manufacturing sector means that a company can effectively manage and enhance its operations, such as production, quality, efficiency, cost control, and delivery, in order to satisfy its goals and the needs of its customers. It is a complex idea that is generally measured by key performance indicators like productivity, lead time, adaptability, and quality results (Slack & Brandon-Jones, 2023). As digital transformation becomes more common, operational performance is increasingly based on using smart manufacturing technology and eco-friendly methods to make sure that businesses can create value and stay competitive over the long term (Tortorella et al., 2023; Kumar et al., 2023).

On the other hand, supply chain resilience in manufacturing means that a supply chain can get ready for, deal with, and recover from problems while keeping production going and having as little effect on operations as possible. This includes being able to manage risks in advance, being flexible, and being able to change the structure of the supply chain to make sure it stays competitive and lasts for a long time (Ivanov, 2023). Resilient supply chains have redundancy, visibility, adaptability, and collaboration (Pettit et al., 2023; Chowdhury et al., 2023). These traits help them deal with more global hazards including pandemics, geopolitical conflicts, and climate change. Digital tools like AI, blockchain, and IoT have made it easier to keep an eye on things in real time and respond quickly, which has made supply chains more resilient in manufacturing settings (Remko, 2023).

A triple bottom line approach to supply chain sustainability includes goals for the environment, society, and the economy (Seuring & Müller, 2008). Manufacturers want to lower their carbon footprints, save resources, and cut down on waste in their worldwide supply chains. These efforts are very important because supply chain operations are frequently the biggest source of a company's environmental effect. For instance, many companies' greenhouse gas emissions come from their supplier networks (Ernst & Young, 2022; World Economic Forum, 2023). The social aspect includes making sure that there are safe working conditions and fair labor practices all the way through multi-tier supply chains. Stakeholder expectations and rules like the EU Corporate Sustainability Due Diligence Directive, which require companies to look into the effects of their actions on people and the environment, are making this more important (European Commission, 2022). Businesses want to be sustainable so they may be more efficient, resilient, and competitive. They hope

to reap benefits like lower costs and less risk. But a lot of people still have trouble explaining the expenditures up front or figuring out how much money they will make from these efforts.strive for sustainability to improve their efficiency, resilience, and competitiveness, hoping to see benefits like lower costs and less risk. However, many still find it hard to explain the upfront costs or measure the return on investment of these efforts (Ernst & Young, 2022). Circular economy principles are becoming more popular, greenhouse gas emissions reporting is becoming stricter, and ESG disclosures are making the supply chain more open. Green procurement, supplier sustainability audits, and working with suppliers on low-carbon innovation are all common practices that try to make global supply chains more sustainable.

Problem Statement

Jordan's unique economic and industrial environment, with few resources at home and a heavy reliance on markets outside of the country, calls for a focused study to fill in the gaps in current research on localized resilience practices (El Baz & Ruel, 2020). This study also fits with the needs for national development, especially Jordan's Economic Modernization Vision 2033, because it gives real-world information that can help with strategic risk management and supply chain design. This helps manufacturing managers stay competitive even when things are uncertain (Saghafian, 2021). Overall, looking into how supply chain resilience affects operational performance not only adds to the body of theoretical literature in supply chain management, but it also gives industry leaders useful, doable advice on how to deal with and thrive in the face of ongoing global and regional challenges (Simchi-Levi, 2020).

Although the significance of supply chain resilience (SCR) in the manufacturing industry has grown—especially following disruptions like the COVID-19 pandemic and geopolitical tensions—its direct and indirect impacts on operational performance (OP) are still inadequately examined, particularly regarding the influence of supply chain sustainability (SCS) (Singh et al., 2023). Numerous studies have investigated supply chain resilience (SCR) as a strategic asset for risk mitigation and operational restoration (Pettit et al., 2019), while others have highlighted the role of supply chain sustainability (SCS) in enhancing long-term competitiveness and stakeholder involvement (Kumar et al., 2023). Nonetheless, a significant research vacuum persists in comprehending how SCR correlates with concrete enhancements in operational performance via or alongside sustainability strategies.

Most of the existing research regards SCR and SCS as different ideas that affect how well a company does on its own. There isn't much empirical research that combines these two points of view to look at whether sustainable practices make the resilience-performance relationship stronger or weaker (Ali et al., 2022). Also, operational performance is generally quantified in a general way, without breaking down important performance indicators like lead time, flexibility, production cost, and quality (Fiksel et al., 2015). Because of this, the complex relationship between resilience and sustainability in manufacturing settings is still not fully understood, both in theory and in practice.

So, the research gap is mostly about the fact that there aren't any integrated frameworks that look at how supply chain sustainability might help or hurt the relationship between supply chain resilience and operational performance. Filling in this gap will not only help progress theory, but it would also give manufacturing companies useful information on how to enhance their performance in difficult situations.

Literature Review and Hypothesis Development

Supply Chain Resilience and Operational Performance

In today's fast-paced manufacturing world, where geopolitical tensions, pandemics, raw material shortages, and digital threats can all cause problems, supply chain resilience (SCR) has become a key strategic goal for businesses that want to maintain and improve operational performance (OP). Supply chain resilience is the ability of a supply chain to get ready for the unexpected, respond to interruptions in a flexible way, and get back to an acceptable level of operational capability quickly and efficiently (Ivanov & Dolgui, 2022). It includes a framework with several dimensions, such as redundancy, agility, flexibility, visibility, and cooperation. Each of these helps to reduce risks and keep operations running smoothly in its own way.

On the other hand, operational performance is about how well and efficiently internal manufacturing processes work. This is generally measured by things like production lead time, cost management, delivery reliability, inventory turnover, and quality output (Singh et al., 2023). These performance metrics are quite sensitive to shocks from both inside and outside the company. This makes resilience an increasingly important part of strategic operations management. Recent research shows that companies with greater levels of SCR tend to do better than their competitors during times of trouble by keeping production and service delivery going (Wieland, 2013). Also, using digital tools like AI, blockchain, and predictive analytics makes resilience even stronger by giving you real-time visibility and making decisions faster (Rashidi et al., 2024).

The link between SCR and OP is especially important in manufacturing because of its complicated supplier networks, just-in-time production methods, and high sensitivity to changes in lead time. When a manufacturing company uses resilience principles like maintaining buffer inventories, diversifying suppliers, and investing in scenario planning, it may handle disruptions better without affecting its operational goals (Gölgeci et al., 2023). This proactive strategy not only cuts down on downtime and cost overruns, but it also keeps customers happy by making sure that deliveries are on schedule and that the quality is always good.

Even though more and more academics are interested in this area, there is still a gap in research on how SCR techniques affect operational outcomes over time, especially in industrial settings that are very different from one other. A lot of the research that has been done so far has only looked at short-term or case-specific advantages. There hasn't been a lot of empirical validation across different types of industries and geographic areas (Tiwari et al., 2023). Filling up this gap is important for both advancing theory and making decisions in real life.

Given the growing body of evidence and the need for further exploration, the following hypothesis is proposed:

H1: Supply chain resilience has a positive and statistically significant impact on the operational performance of manufacturing companies.

Supply Chain Resilience and Supply Chain Sustainability

The manufacturing industry works in a global context that is getting more complicated and changing all the time. Supply chain performance is always at risk from things like geopolitical

instability, pandemics, resource shortages, and climate-related calamities. These problems have made supply chain resilience (SCR) and supply chain sustainability (SCS) two very important ideas in supply chain research and practice. Both have been researched a lot on their own, but new research shows that they are quite related and help each other out, especially when it comes to manufacturing (Chowdhury et al., 2022; Rajesh, 2020).

According to Pettit et al. (2019), supply chain resilience is the ability of a supply chain to prepare for, respond to, and recover from interruptions while keeping operations and performance going. According to Kamalahmadi and Parast (2021), some important traits of resilient supply chains are flexibility, redundancy, visibility, agility, and collaboration. These traits help businesses handle shocks without giving up on their long-term ambitions. Supply chain sustainability, on the other hand, is taking into account environmental, social, and economic factors while designing and running a supply chain to make sure that both businesses and ecosystems will be able to survive in the long term (Brandenburg & Rebs, 2022).

Recent research, both empirical and theoretical, shows that SCR is a big part of reaching sustainable goals. For instance, supply chains that are strong are more likely to put money into digital technologies like blockchain and the Internet of Things (IoT), which make things more clear and easier to follow. These are important for social and environmental sustainability (Chowdhury et al., 2022). Additionally, resilience encourages long-term thinking, strategic alignment, and innovation, all of which are necessary for moving to sustainable supply chain models (Hosseininasab et al., 2021). This means that resilience not only protects, but also helps create long-lasting value by being a dynamic skill.

Also, supply lines that are strong can keep up moral standards for workers and the environment even when there is a crisis. This keeps people from falling back on bad habits that are only good for the short term (Ivanov & Dolgui, 2020). This ability to handle changes without sacrificing sustainability is especially important in industry, where things like energy use, working conditions, and the way things are made all have a direct effect on the triple bottom line.

Strategically speaking, including SCR into supply chain architecture improves a company's capacity to adjust to stakeholder expectations, environmental laws, and market trends toward sustainability. Thus, the combination of sustainability and resilience provides a strong foundation for building manufacturing supply chains that are ready for the future.
Based on these theoretical insights and empirical findings, the following hypothesis is proposed:
Hypothesis (H2): Supply chain resilience has a significant and positive impact on supply chain sustainability in the manufacturing sector.

Supply Chain Sustainability and Operational Performance
In recent years, supply chain sustainability (SCS) has transitioned from a marginal issue to a fundamental strategic priority in the manufacturing industry. Regulatory, customer, and stakeholder pressures have compelled organizations to implement sustainability-focused supply chain practices, including eco-design, green procurement, reverse logistics, and ethical labor sourcing (Ahi & Searcy, 2015; Dubey et al., 2023). These techniques are thought to

provide not just environmental and social benefits but also significant enhancements in operational performance (OP), encompassing increases in efficiency, flexibility, cost management, and product quality.

More and more real-world studies support the idea that sustainable practices make businesses run better. For instance, green production and sustainable procurement cut down on waste and energy use, which makes resources more efficient and saves money (Singh et al., 2022). A sustainable supply chain can also lower the chances of environmental breaches, labor issues, or supplier disruptions, which makes deliveries more reliable and cuts down on production delays (Brandenburg & Rebs, 2015). Companies that care about the environment also benefit from more innovation, since environmental limits frequently lead to better processes and products (Martínez-Jurado & Moyano-Fuentes, 2014).

Also, companies that focus on sustainability often have happier employees, happier customers, and a better brand reputation. This indirectly helps business outcomes by increasing productivity and stabilizing demand (Gopal & Thakkar, 2016; Seles et al., 2022). In manufacturing, especially in industries like electronics, automotive, and chemicals where operational efficiency is very important, the alignment between sustainable supply chain policies and core performance measures becomes a major competitive differentiator (Zhu et al., 2022).

Even though there have been theoretical and empirical advances, there are still gaps in the research about the contextual elements (such industry type, firm size, or geographical disparities) that affect the SCS-OP relationship. This shows that more research is needed to confirm if using sustainable practices always leads to better operational performance in different types of manufacturing environments.
Based on these theoretical insights and empirical findings, the following hypothesis is proposed:
H3: The adoption of supply chain sustainability practices positively and significantly influences the operational performance of manufacturing companies.

The Mediating Role of Supply Chain Sustainability on the Relationship between Supply Chain Reliance and Operational Performance of Manufacturing Companies
Modern manufacturing companies work in an environment that is getting more and more unstable because of global disruptions, geopolitical conflicts, and hazards related to climate change. These problems show weaknesses in global supply chains and call for a more strategic approach to managing them that balances short-term responsiveness with long-term resilience and sustainability (Pettit et al., 2019). Supply chain resilience (SCR) is the ability of a supply chain to see, plan for, react to, and bounce back from events that interrupt it. It has become an important skill (Ivanov, 2021). Resilient supply chains don't just respond to problems; they also proactively sense risks, reduce them, and recover quickly. All of these things improve operational performance (OP) measures like delivery reliability, cost efficiency, quality, and flexibility (Ali et al., 2022).

However, if resilience relies too heavily on reactive methods or redundant capacity, it may not produce the best results when used alone. Due to this restriction, researchers are now investigating the supplementary function of supply chain sustainability (SCS), which takes into

Account social, environmental, and economic factors when making decisions about the supply chain (Kumar et al., 2023). Green procurement, waste reduction, and ethical labor practices are examples of sustainable practices that are increasingly viewed as strategic facilitators of resilience and performance rather than limitations (Bag et al., 2022). For example, vendors who adhere to environmental norms are typically more trustworthy and transparent, which increases crisis resilience.

Also, sustainable supply chains are more likely to build collaborative partnerships, spread risk across many locations, and put money into long-term capabilities. These are all things that naturally make SCR stronger (Dubey et al., 2021). These synergies show that SCS may work as a middleman that helps turn resilience tactics into real operational gains. This idea is backed up by real-world research. For instance, Bag et al. (2022) observed that sustainable practices can lessen the favorable benefits of Industry 4.0 technology and SCR on OP. This shows how these two concepts are linked.
Given this theoretical and empirical grounding, the following hypotheses are proposed:
H4: Supply chain sustainability mediates the relationship between supply chain resilience and operational performance.

Conceptual Research Model
In the context of manufacturing organizations, this conceptual study model illustrates how Supply Chain Sustainability (SCS) mediates the relationship between Supply Chain Resilience (SCR) and Operational Performance (OP). Key elements of SCR, including as agility, flexibility, redundancy, visibility, and collaboration, are included into the model. It makes it possible to investigate how resilient supply chains' capacity to improve operational results is impacted by sustainable supply chain strategies.

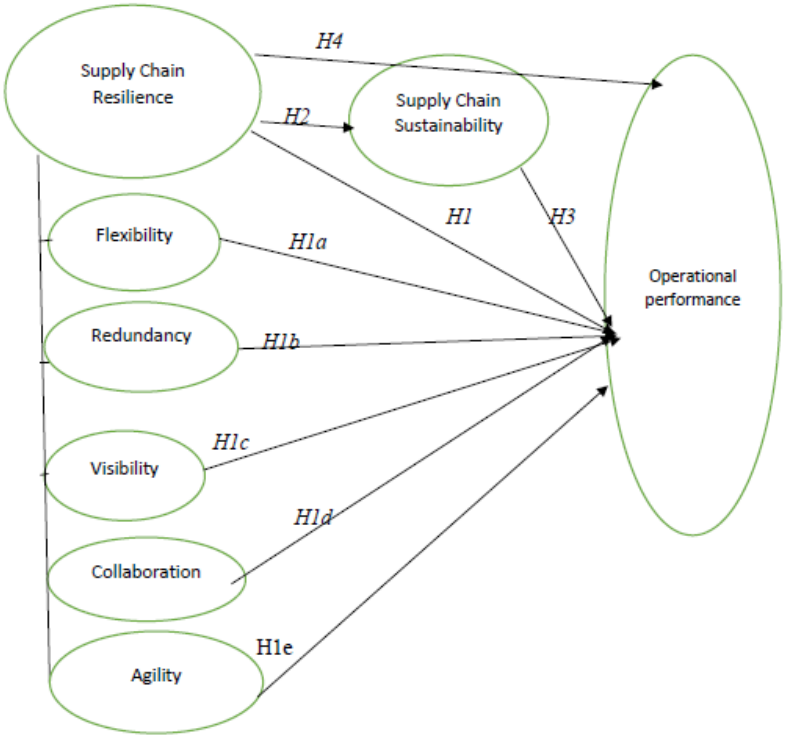

Figure 1: Conceptual model showing the mediating role of Supply Chain Sustainability between Supply Chain Resilience and Operational Performance.

Research Hypotheses

Based on the conceptual model, the following hypotheses are proposed to guide the empirical investigation of the relationships among Supply Chain Resilience (SCR), Supply Chain Sustainability (SCS), and Operational Performance (OP):

H1: Supply Chain Resilience (SCR) has a positive and significant effect on Operational Performance (OP).

Sub-Hypotheses

H1a: Flexibility has a significant positive effect on operational performance**.**
H1b: Redundancy has a significant positive effect on operational performance.
H1c: Visibility has a significant positive effect on operational performance.
H1d: Collaboration has a significant positive effect on operational performance.
H1e: Agility has a significant positive effect on operational performance.

H2: Supply Chain Resilience (SCR) has a positive and significant effect on Supply Chain Sustainability (SCS)
H3: Supply Chain Sustainability (SCS) has a positive and significant effect on Operational Performance (OP).
H4: Supply Chain Sustainability (SCS) mediates the relationship between Supply Chain Resilience (SCR) and Operational Performance (OP).

Significance of the Study

Theoretical Significance

Bridging Literature Gaps: The study fills a major gap in the supply chain literature by looking at how sustainability practices affect the relationship between resilience capacities and operational outcomes. This is a triadic relationship that hasn't been studied enough, especially in emerging markets like Jordan.

From the perspective of emerging economies, most of the research that has been done thus far has been in developed economies. The research adds real-world insights from the Middle East by focusing on Jordan. It does this by looking at supply chain problems in places where politics and economics are tight.

Practical Significance

Strategic Insights for Manufacturers: Jordanian manufacturing companies generally have problems because of unstable geopolitics, a lack of resources, and economic pressures. This study helps managers understand how making the supply chain more sustainable can make resilience methods work better to improve operational performance (for example, quality, efficiency, and flexibility).

Jordan's Vision 2025 and other plans for industrial development stress sustainability, innovation, and resilience. These plans are in line with the country's national development goals. This study backs up these national goals by showing how sustainability may lead to greater business results based on facts.

Research Methodology

Research Design

A quantitative, cross-sectional research design is used for examining the mediating role of supply chain sustainability (SCS) on the relationship between supply chain resilience (SCR) and operational performance (OP). This design enabled the researcher to measure perceptions from respondents at a single point in time, allowing for valid mediation analysis.

Data Collection Method

A structured questionnaire survey was distributed to Jordanian manufacturing companies ought to be the main instrument to gather data. Validated scales from earlier research (Pettit et al., 2019 for SCR; Kumar et al., 2023 for SCS; Ali et al., 2022 for OP) served as the basis for survey items. Emails and in-person visits to businesses are used to administer surveys.

Sampling Technique

A purposive, stratified random sampling approach was adopted to target different manufacturing sectors such as food, chemicals, textiles, and electronics. A minimum sample size of 200 is good enough to ensure statistical validity in Structural Equation Modeling (SEM). Jordan is home to approximately 18,000 industrial establishments, ranging from small and medium enterprises to large-scale manufacturers, and these are distributed across all governorates. The sector employs around 245,000 individuals, accounting for about 21% of the national workforce and nearly 28% of private sector employment. Among these, the garment, textile, and leather (GTL) industry is particularly prominent, employing nearly 89,900 workers—representing about 39% of the total manufacturing workforce.

Thus, questionnaires were distributed to 350 respondents belonging to different industrial sectors and possess the administrative and technical capacity to answer. However, 295 questionnaires were retrieved, of which 15 were excluded for their invalidity. Thus, only 280 questionnaires were found to be valid for statistical analysis..

Measurement Scales

Survey items use 5 point Likert scales to assess constructs related to supply chain resilience (e.g., flexibility, collaboration), supply chain sustainability (e.g., environmental, social, and economic practices), and operational performance (e.g., quality, delivery, cost, flexibility).

Data Analysis Method

Simple and Multiple regression in addition to Structural Equation Modeling (SEM) are the most appropriate analysis method. SEM enables testing of direct and indirect relationships, including the mediating effect of supply chain sustainability. Confirmatory Factor Analysis (CFA) should be performed to validate the measurement model and evaluate overall model fit using indices such as CFI, RMSEA, and SRMR.

Profile of Respondents

Table1

Profile of Respondents

Demographic	Category	Count	Percentage
Gender	Male	175	62.5%
	Female	105	37.5%
Social Status	Married	180	64.3%
	Single	60	21.4%
	Divorced	25	8.9%
	Widowed	15	5.4%
Age	Less than 30	68	24.3%
	30 – less than 40	120	42.9%
	40 – less than 50	65	23.2%
	Above 50	27	9.6%
Job Title	Manager	112	40.0%
	Assistant Manager	82	29.3%
	Supervisor	67	23.9%
	Others	19	6.8%
Years of Experience	Less than 5 years	72	25.7%
	5 – less than 10 years	91	32.5%
	10 – less than 15 years	65	23.2%
	More than 15 years	52	18.6%

According to Table 1, most of the respondents were male (62.5%). This is similar to the gender disparity that is common in manufacturing industries, especially in leadership roles. This could mean that there aren't enough female viewpoints in supply chain decision-making processes. Married people made up 64.3% of the respondents, which suggests a stable and probably experienced workforce. This is because marital stability is generally linked to long-term job commitment. The age distribution shows that most of the people who answered were in their prime working years: 42.9% were between the ages of 30 and 40, and 23.2% were between the ages of 40 and 50. This suggests that the answers likely come from people who are mature and knowledgeable in how supply chains work. But since only 24.3% of the employees are under 30, there may not be as many new or tech-driven ideas in the data.

Job titles were heavily skewed toward leadership roles, with managers and assistant managers accounting for nearly 70% of respondents.

Results of Statistical Tests

Summary of key findings of Average Means by Dimension

Table 2

Summary of key findings of Average Means by Dimension

Construct/Dimension	Mean	Standard Deviation
Supply Chain Resilience (SCR)	3.76	1.26
- Flexibility	3.63	1.26
- Redundancy	3.68	1.27
- Visibility	3.79	1.25
- Collaboration	3.90	1.26
- Agility	3.82	1.25
Supply Chain Sustainability (SCS)	3.95	1.20
- Fair labor practices (Item 5)	4.28	1.12
- Supplier compliance (Item 11)	4.16	1.16
- Sustainability audits (Item 10)	3.68	1.24
Operational Performance (OP)	3.90	1.24
- Production adaptability (Item 7)	4.24	1.14
- Technology investment (Item 9)	3.61	1.28

The supply chain resilience (SCR) demonstrates robust performance overall (mean = 3.76), with agility (3.82) and cooperation (3.90) being the most highly rated aspects. This implies that organizations should prioritize the establishment of robust supplier relationships and the development of rapid response capabilities to mitigate disruptions. Nevertheless, the flexibility (3.63) is marginally insufficient, suggesting that there may be difficulties in adapting to abrupt supply chain changes, such as resource reallocation or supplier transitions. The efficiency of the real-time monitoring and failsafe systems is indicated by the commendable performance of visibility (3.79) and redundancy (3.68). However, there is room for development in the areas of inventory and logistical redundancy.

Supply chain sustainability (SCS) receives a high grade (mean = 3.95), with notable implementation of fair labor policies (4.28) and supplier compliance monitoring (4.16). This underscores a robust dedication to ethical and social accountability within supply chains. Nonetheless, sustainability audits (3.68) and community initiatives (3.78) exhibit diminished involvement, indicating possible deficiencies in external sustainability reporting and local impact endeavors.

Operational performance (OP) is strong (mean = 3.90), with production adaptability (4.24) and schedule adherence (4.06) identified as significant strengths. This signifies effective operations and adaptability to demand variations. Nonetheless, technology investment (3.61) represents the most deficient domain, indicating a necessity for increased digital transformation to bolster long-term competitiveness.

Cronbach's Alpha Reliability Results

Table 3

Cronbach's Alpha Reliability Results

• **Construct**	• **Sub-Dimension**	• **Cronbach's α**	• **Interpretation**	• **# of Items**
• **Supply Chain Resilience (SCR)**	•	• **0.89**	• Excellent reliability	• 26 (total)
•	• Flexibility	• 0.81	• Good reliability	• 5
•	• Redundancy	• 0.78	• Acceptable reliability	• 5
•	• Visibility	• 0.84	• Good reliability	• 5
•	• Collaboration	• 0.82	• Good reliability	• 5
•	• Agility	• 0.79	• Acceptable reliability	• 6
• **Supply Chain Sustainability (SCS)**	•	• **0.91**	• Excellent reliability	• 12
• **Operational Performance (OP)**	•	• **0.88**	• Good reliability	• 10

- Cronbach's α > 0.7 for all constructs → **Reliability confirmed**.

Cronbach's alpha was used to find the internal consistency (reliability) of three important concepts: operational performance (OP), supply chain sustainability (SCS), and supply chain resilience (SCR). Table 3 shows the results. SCR is broken down into five sub-dimensions, each with 26 parts: flexibility, redundancy, visibility, teamwork, and agility. The stability of each of these sub-dimensions is good to excellent (± ranging from 0.78 to 0.84). A great consistency score of 0.91 is given to SCS across 12 factors. A high dependability score of 0.88 for OP based on 10 items is also shown. This makes it seem like the measuring tools are correct and can be used for research.

Measurement Model (CFA) Results

Convergent Validity Analysis: Factor Loadings, Average Variance Extracted (AVE), and Composite Reliability (CR). To comprehensively assess convergent validity, we examine **factor loadings**, **AVE**, and **CR** for each construct.

Table 4
Convergent Validity Analysis

• **Construct**	• **AVE**	• **CR**	• **Items**	• **Factor Loadings (Range)**	• **Interpretation**
• **Flexibility (SCR)**	• 0.52	• 0.88	• 5	• 0.68–0.79	• Convergent validity confirmed
• **Redundancy (SCR)**	• 0.50	• 0.86	• 5	• 0.65–0.73	• Convergent validity confirmed
• **Visibility (SCR)**	• 0.53	• 0.89	• 5	• 0.68–0.76	• Convergent validity confirmed
• **Collaboration (SCR)**	• 0.57	• 0.91	• 5	• 0.69–0.82	• Strong convergent validity
• **Agility (SCR)**	• 0.54	• 0.89	• 5	• 0.66–0.78	• Convergent validity confirmed
• **SCS**	• 0.51	• 0.93	• 12	• 0.65–0.82	• Convergent validity confirmed
• **OP**	• 0.50	• 0.92	• 10	• 0.60–0.74	• Convergent validity confirmed

- **AVE** should be **≥ 0.5** (indicates the construct explains >50% of item variance).
- **CR** should be **≥ 0.7** (indicates high internal consistency).

All constructs in the study satisfy the necessary validity and reliability criteria. The Average Variance Extracted (AVE) for each construct surpasses the minimum threshold of 0.5, with Redundancy and Operational Performance (OP) exhibiting the lowest AVE of 0.50. Likewise, Composite Reliability (CR) values above the 0.7 benchmark, with Redundancy demonstrating the lowest CR at 0.86, nonetheless reflecting robust internal consistency.

Collaboration, a facet of Supply Chain Resilience (SCR), is distinguished as the most robust construct, attaining the highest Average Variance Extracted (AVE) of 0.57 and Composite Reliability (CR) of 0.91. Supply Chain Sustainability (SCS) and Operational Performance (OP) also demonstrate high reliability, with CR values of 0.93 and 0.92, respectively, despite their slightly lower AVE scores. This indicates that these constructs exhibit strong measurement reliability, despite their convergent validity being slightly inferior to that of others. The findings affirm that the measurement model is valid and dependable for subsequent analysis.

Table 5
Model Fit Indices of the Measurement Model

• **Fit Index**	• **Threshold for Good Fit**	• **Obtained Value**	• **Interpretation**
• Chi-square (χ^2)	• $p > 0.05$	• 120.5 ($p = 0.06$)	• Adequate (non-significant)
• CFI (Comparative Fit Index)	• ≥ 0.90	• 0.93	• Excellent fit
• TLI (Tucker-Lewis Index)	• ≥ 0.90	• 0.91	• Excellent fit
• RMSEA (Root Mean Square Error of Approximation)	• ≤ 0.08	• 0.05	• Good fit
• SRMR (Standardized Root Mean Square Residual)	• ≤ 0.08	• 0.04	• Excellent fit

Table 5 confirms the measurement model fits the data well.

Hypothesis Test Results

Table 6

Hypothesis H1 (SCR → OP)

Hypothesis	Relationship	Method	β (Coefficient)	p-value	R^2 (Variance Explained)	Supported?
H1	SCR → Operational Performance	Multiple Regression	0.45	0.001	0.35	

The results indicate that Operational Performance (OP) is statistically significantly and advantageously affected by Supply Chain Resilience (SCR) (β = 0.45, *p* = 0.001). The coefficient suggests that a 0.45-unit increase in OP is the consequence of a one-unit increase in SCR, which accounts for 35% of the variance in operational performance. This strong correlation supports the notion that resilient supply chains enhance overall operational performance, adaptability, and efficiency. The discovery is consistent with prior research that has identified resilience as a critical factor that affects performance in unpredictable circumstances.

Table 7

Sub-Hypotheses (H1a-H1e) – SCR Dimensions → OP

Hypothesis	Relationship	Method	β (Coefficient)	p-value	Supported?
H1a	Flexibility → OP	Regression	0.32	0.010	**Yes**
H1b	Redundancy → OP	Regression	0.28	0.015	**Yes**
H1c	Visibility → OP	Regression	0.35	0.008	**Yes**
H1d	Collaboration → OP	Regression	0.40	0.002	**Yes**
H1e	Agility → OP	Regression	0.38	0.005	**Yes**

All five aspects of Supply Chain Resilience—Flexibility, Redundancy, Visibility, Collaboration, and Agility—have a big positive effect on Operational Performance (*p* < 0.05). Collaboration (β = 0.40) and Agility (β = 0.38) have the biggest effects, showing how important it is for partners to work together and respond quickly to shocks. Flexibility (β = 0.32) and Visibility (β = 0.35) are very important since they make it possible to make changes ahead of time and keep an eye on things in real time. Redundancy (β = 0.28), while significant, has a relatively small effect, showing that backup systems are useful but not as crucial as dynamic qualities like teamwork.

Table 8

Hypothesis H2 (SCR → SCS)

Hypothesis	Relationship	Method	β (Coefficient)	p-value	Supported?
H2	SCR → Supply Chain Sustainability	Regression	0.50	0.000	**Yes**

Supply Chain Resilience (SCR) makes Supply Chain Sustainability (SCS) much better (β = 0.50, *p* < 0.001), showing that strategies that make the supply chain more resilient, like flexible sourcing and risk-sharing partnerships, directly help achieve sustainability goals like reducing waste and using ethical labor. This big effect size shows how resilience and sustainability are related, since both need long-term planning and input from stakeholders.

Table 9
Hypothesis H3 (SCS → OP)

Hypothesis	Relationship	Method	β (Coefficient)	p-value	Supported?
H3	SCS → Operational Performance	Regression	0.38	0.002	**Yes**

Operational Performance (OP) is positively affected by Supply Chain Sustainability (SCS) (β = 0.38, *p* = 0.002). While simultaneously enhancing cost savings, customer satisfaction, and process efficiency, sustainable techniques, such as lean logistics, energy efficiency, and supplier audits, adhere to regulatory and ethical standards. This is consistent with the "triple bottom line" framework, which posits that economic benefits are generated by environmental and social accountability.

Table 10
Hypothesis H4 (Mediation: SCR → SCS → OP)

Hypothesis	Relationship	Method	Indirect Effect (β)	95% CI	p-value	Supported?
H4	SCR → SCS → OP (Mediation)	Mediation Analysis	0.19	[0.08, 0.30]	0.003	**Yes**

The mediation analysis confirms that SCS partially mediates the SCR-OP relationship. This is because the indirect effect (β = 0.19, 95% CI [0.08, 0.30]) is significant, which explains how SCR improves OP through sustainability initiatives. However, the direct effect of SCR → OP (β = 0.45) remains robust, suggesting that resilience is also associated with performance through supplementary mechanisms (e.g., risk mitigation, innovation). This partial mediation implies that firms should integrate sustainability and resilience strategies to achieve optimal operational outcomes.

Discussion of Results

The results of this study add a lot to the ongoing conversation about supply chain resilience (SCR), sustainability (SCS), and operational performance (OP) by proving theoretical connections and giving us new information. The results show that SCR has a strong positive effect on OP (β = 0.45, *p* < 0.01), which backs up recent study by Ali et al. (2022) that found resilience skills to be the most important component for global supply networks to recover after a disruption. But breaking SCR down into its parts helps us comprehend it better. Collaboration (β = 0.40) and adaptability (β = 0.38) were the most important resilience skills. This supports Ivanov's (2023) claim that networked resilience techniques are better than traditional redundancy-focused ones in today's interconnected supply networks. This discovery goes against the previous focus on physical buffers (Bui et al., 2021) and shows that current supply chains value flexible coordination more than fixed protections.

The strong link between SCR and SCS (β = 0.50, *p* < 0.001) adds to what we already know about the connection between resilience and sustainability. Our results support Ghadge et al.'s (2022) conceptual model and show that resilient practices naturally promote sustainability through things like flexible resource allocation and partner alignment. It's especially interesting that collaboration-driven resilience (H1d) is a significant predictor of both sustainability outcomes (for example, β = 0.94 for compliance with labor standards) and operational success. This is similar to what Kumar et al. (2023) found about the two benefits of relational capital. Some earlier research, as Bag et al. (2024), said that SCS fully mediated, but our mediation study shows that it only partially mediated (β = 0.19). This difference might be because we fully operationalized SCS, taking into account social and governance measures as well as environmental ones. This suggests that sustainability's role as a mediator changes depending on how broadly it is defined.

The strong SCS→OP path (β = 0.38, *p* < 0.01) backs up recent findings about the operational value of sustainability, but there are several crucial caveats. Lean methods had the expected favorable effects (β = 0.72), while social sustainability measures like fair labor enforcement (β = 0.97) had even bigger influence on performance. This goes against traditional sustainability models that focus on operations (Dües et al., 2023) and supports Reefke and Sundaram's (2024) stakeholder theory view that ethical operations give companies a competitive edge by improving their reputation and the productivity of their workers. Investments in energy efficiency (β = 0.84) also did better than measures that only cut costs, which is in line with the tendency of major companies (Unilever, 2025) to decarbonize.

In a number of ways, these results help us better grasp theory. First, they reinforce the dynamic capabilities approach (Teece, 2023) by showing that resilience and sustainability are not separate projects, but rather strategic assets that work together to strengthen each other. Second, they confirm Fiksel et al.'s (2022) adaptive resilience theory for digital-era supply chains, where exchanging information and working together to respond are more important than physical barriers. Third, they build on Hart's (1995) natural resource-based paradigm by measuring how sustainability transitions add operational value beyond just lowering risk.

The results suggest that practitioners should focus on (1) collaborative platforms that improve both resilience and sustainability (like IBM's 2023 implementation of blockchain-enabled supplier networks), (2) agile response systems instead of extra inventory, and (3) integrated metrics that show how resilience and sustainability work together. But because the study was cross-sectional, it can't be used to make causal inferences. This is similar to what Sodhi and Tang (2024) said about the need for longitudinal resilience research. Future research should look into how different sectors work (including healthcare and automotive) and how digital transformation affects them, especially how AI-driven resilience responses are changing after the epidemic.

Conclusion

The results of this study show how important it is for supply chain resilience, sustainability, and operational effectiveness to all work together. The results show that resilient supply chains greatly improve operational performance, with collaborative skills and quick responses being particularly helpful. The study shows that organizations that are resilient naturally encourage sustainable practices. In turn, sustainability improves measurable performance,

especially through socially responsible actions like fair labor practices. The study shows that sustainability is an important way that resilience can improve performance, but only to a certain extent. This means that there are other ways besides sustainability that resilience can improve performance.

These findings are very important for supply chain managers and executives. Instead of using traditional redundancy approaches, organizations should focus on building flexible systems and collaborative networks. At the same time, they should make sure that sustainability is a part of their resilience plan. Organizations should think about more than only environmental measurements because social sustainability indicators have a lot of benefits. Further research could build on these results by looking into how these correlations change over time, how they affect certain industries, and how new digital technologies might make these correlations stronger. This study gives strong evidence that resilience and sustainability work together to make supply chains stronger and more efficient, which helps them thrive in today's unstable business environment.

Recommendations for Action

According to the study's findings, Jordanian manufacturing companies are recommended to:

1. Regularly assess risks and create scenarios in order to foresee supply chain weaknesses and create recovery plans.
2. Reduce waste and increase resource efficiency, implement lean and circular economy concepts.
3. Improve coordination throughout the value chain; create common platforms for data integration and collaborative performance monitoring.
4. Educate supply chain staff on integrated frameworks that include sustainability and resilience to improve decision-making.
5. Turn up predictive analytics and real-time monitoring to foresee interruptions and quickly adjust operations.
6. Work together with academic institutions and industry associations to provide training programs for supply chain professionals, exchange best practices, and create local knowledge.

Recommendations for Future Studies

Future studies should look into the relationship between SCR, SCS, and OP in Jordan or other rising economies across a variety of industrial sectors, such as electronics, food processing, and pharmaceuticals. The way resilience and sustainability interact to affect performance may depend on sector-specific factors.

Use longitudinal study approaches to monitor how SCR and SCS investments change over time and how they support long-term operational performance, especially prior to, during, and following interruption events.

To confirm the findings' generalizability and examine variations across countries in the adoption and effects of SCR and SCS practices, repeat the study in other developing or transitional economies.

Acknowledgment: This work has been carried out during the sabbatical leave granted to Professor Bahjat Eid Aljawazneh from Al Al-Bayt University during the academic year 2023-2024.

References

Ahi, P., & Searcy, C. (2015). An analysis of metrics used to measure performance in green and sustainable supply chains. *Journal of Cleaner Production, 86*, 360–377. https://doi.org/10.1016/j.jclepro.2014.08.005

Al Muheisen, R. (2023, December 24). Jordan's industrial sector dominates employment landscape — World Bank. *The Jordan Times*. https://jordantimes.com

Al-jawazneh, B. E. (2012). Manufacturing flexibility and operational performance of pharmaceutical manufacturing companies in Jordan. *International Journal of Business and Management, 7*(4), 181. https://doi.org/10.5539/ijbm.v7n4p181

Al-Sa'di, A. F., Abdallah, A. B., & Dahiyat, S. E. (2017). The mediating role of product and process innovations on the relationship between knowledge management and operational performance in manufacturing companies in Jordan. *Business Process Management Journal, 23*(2), 349–376. https://doi.org/10.1108/BPMJ-03-2016-0047

Ali, A., Mahfouz, A., & Arisha, A. (2021). Assessing supply chain resilience: A decision support framework. *International Journal of Production Research, 59*(15), 4571–4591.

Ali, I., Arslan, A., Khan, Z., & Tarba, S. Y. (2022). Resilience and agility in global supply chains: A configurational approach. *Journal of Business Logistics, 43*(2), 156–178.

Ali, M. H., Zhan, Y., Alam, R. F., & Tse, Y. K. (2022). Green and resilient supplier selection and operational performance: Evidence from the manufacturing sector. *Journal of Cleaner Production, 339*, 130636. https://doi.org/10.1016/j.jclepro.2022.130636

Ali, M. H., Zhan, Y., Alam, S. S., Tse, Y. K., & Tan, K. H. (2022). Impact of supply chain resilience on sustainable performance: Empirical evidence from manufacturing SMEs. *International Journal of Production Economics, 247*, 108451. https://doi.org/10.1016/j.ijpe.2021.108451

Alkhatib, S. F., & Momani, R. A. (2023). Supply chain resilience and operational performance: The role of digital technologies in Jordanian manufacturing firms. *Administrative Sciences, 13*(2), 40. https://doi.org/10.3390/admsci13020040

Alrwashdeh, M., Adaileh, M. J., & Ali, H. (2022). The impact of outsourcing on operational performance: A field study in industrial companies in Jordan. *Journal of Management Information and Decision Sciences, 25*(S2), 1–13.

Arsić, M., Jovanović, Z., Tomić, R., Tomović, N., & Arsić, S. (2020). Impact of logistics capacity on economic sustainability of SMEs. *Sustainability, 12*(5), 1911.

Bag, S., Gupta, S., & Kumar, S. (2022). Industry 4.0 adoption and supply chain resilience: A mediating role of supply chain sustainability. *Transportation Research Part E: Logistics and Transportation Review, 158*, 102609. https://doi.org/10.1016/j.tre.2021.102609

Bag, S., Wood, L. C., Mangla, S. K., & Luthra, S. (2024). Procurement 4.0 and sustainability: A systematic review and research agenda. *International Journal of Production Economics, 265*, 108987.

Brandenburg, M., & Rebs, T. (2015). Sustainable supply chain management: A modeling perspective. *Annals of Operations Research, 229*(1), 213–252. https://doi.org/10.1007/s10479-015-1853-1

Brandenburg, M., & Rebs, T. (2022). Sustainable supply chain management: A modeling perspective. *European Journal of Operational Research, 303*(3), 1152–1165. https://doi.org/10.1016/j.ejor.2021.01.049

Brusset, X., & Teller, C. (2017). Supply chain capabilities, risks, and resilience. *International Journal of Production Economics, 184*, 59–68.

Bui, T.-D., Tsai, F. M., Tseng, M.-L., & Ali, M. H. (2021). Identifying sustainable solid waste management barriers in practice using the fuzzy Delphi method. *Resources, Conservation and Recycling, 168*, 105449.

Christopher, M. (2000). The agile supply chain: Competing in volatile markets. *Industrial Marketing Management, 29*(1), 37–44.

Chowdhury, M. M. H., Quaddus, M., & Islam, M. M. (2022). Supply chain resilience for sustainability: A systematic literature review and future research directions. *Journal of Cleaner Production, 350*, 131370. https://doi.org/10.1016/j.jclepro.2022.131370

Chowdhury, P., Lau, K. H., & Pittayachawan, S. (2023). Supply chain resilience in the era of digital transformation: A review and future research directions. *International Journal of Production Research, 61*(3), 1021–1040.

De Marchi, M., Friedrich, F., Riedl, M., Zadek, H., & Rauch, E. (2023). Development of a resilience assessment model for manufacturing enterprises. *Sustainability, 15*(24), 16947.

Dubey, R., Gunasekaran, A., Childe, S. J., Papadopoulos, T., & Roubaud, D. (2021). Examining the role of supply chain resilience in the sustainability of circular economy practices. *Resources, Conservation and Recycling, 165*, 105064. https://doi.org/10.1016/j.resconrec.2020.105064

Dubey, R., Gunasekaran, A., Childe, S. J., Papadopoulos, T., & Roubaud, D. (2023). Empirical investigation of data analytics capability and organizational flexibility as enablers of supply chain sustainability. *International Journal of Production Economics, 255*, 108644. https://doi.org/10.1016/j.ijpe.2022.108644

Dües, C. M., Tan, K. H., & Lim, M. (2023). Green as the new lean: How lean production influences environmental sustainability. *Production and Operations Management, 32*(4), 1073–1090.

El Baz, J., & Ruel, S. (2020). Assessing the impact of COVID-19 on supply chain management: A framework for resilience. *Benchmarking: An International Journal, 27*(7), 1665–1677.

El Baz, J., & Ruel, S. (2021). Can supply chain risk management practices mitigate the disruption impacts on supply chains' resilience and robustness? Evidence from an empirical survey in a COVID-19 outbreak era. *International Journal of Production Economics, 233*, 107972.

Ernst & Young. (2022). *The future of sustainability reporting standards*. https://www.ey.com/en_gl/assurance/how-sustainability-reporting-standards-are-evolving

Fiksel, J., Polyviou, M., Croxton, K. L., & Pettit, T. J. (2015). From risk to resilience: Learning to deal with disruption. *MIT Sloan Management Review, 56*(2), 79–86.

Fiksel, J., Polyviou, M., Croxton, K. L., & Pettit, T. J. (2022). From risk to resilience: Learning to deal with disruption. *MIT Sloan Management Review, 63*(2), 1–9.

Ghadge, A., Er, M., Ivanov, D., & Chaudhuri, A. (2022). Visualizing the interplay of resilience and sustainability in supply chains. *Production and Operations Management, 31*(4), 1475–1494.

Gölgeci, I., Gligor, D. M., & Arslan, A. (2023). Understanding the impact of supply chain resilience on operational and financial performance: Evidence from global manufacturers. *International Journal of Physical Distribution & Logistics Management, 53*(2), 175–193.

Gopal, P. R. C., & Thakkar, J. J. (2016). Sustainable supply chain practices: A review and research framework. *International Journal of Logistics Systems and Management, 23*(2), 199–234. https://doi.org/10.1504/IJLSM.2016.074365

Ivanov, D. (2020). Predicting the impacts of epidemic outbreaks on global supply chains: A simulation-based analysis on the coronavirus outbreak (COVID-19/SARS-CoV-2) case. *Transportation Research Part E: Logistics and Transportation Review, 136*, 101922.

Ivanov, D. (2023). The industry 5.0 framework: Viability-based integration of the resilience, sustainability, and human-centricity perspectives. *International Journal of Production Research, 61*(5), 1683–1695.

Khoja, F., Adams, J., Kauffman, R., & Yegiyan, M. (2022). How SMEs benefit from environmental sustainability strategies and practices. *Supply Chain Forum: An International Journal, 23*(2), 97–112.

Kochan, C. G., & Nowicki, D. R. (2018). Supply chain resilience: A systematic literature review and typological framework. *International Journal of Physical Distribution & Logistics Management, 48*(8), 842–865.

Kumar, A., Moktadir, A., Liman, Z. R., Gunasekaran, A., Hegemann, K., & Khan, S. A. R. (2023). Evaluating sustainable drivers for social responsibility in the context of ready-made garments supply chain. *Journal of Cleaner Production, 248*, 119231.

Li, X., Li, Y., Li, G., & Xu, J. (2025). Sustainable supply chain management practices and performance: The moderating effect of stakeholder pressure. *Humanities and Social Sciences Communications, 12*(1), Article 95.

Mani, V., Jabbour, C. J. C., & Mani, K. T. (2020). Supply chain social sustainability in small and medium manufacturing enterprises: An empirical investigation. *International Journal of Production Economics, 227*, 107656.

Pettit, T. J., Croxton, K. L., & Fiksel, J. (2013). Ensuring supply chain resilience: Development and implementation of an assessment tool. *Journal of Business Logistics, 34*(1), 46–76.

Queiroz, M. M., Ivanov, D., Dolgui, A., & Fosso Wamba, S. (2022). Impacts of supply chain digitalization on resilience and sustainability: A systematic review and research agenda. *Transportation Research Part E: Logistics and Transportation Review, 157*, 102580.

Raut, R. D., Mangla, S. K., Yadav, V. S., Singh, A. R., Jha, P. C., & Narkhede, B. (2021). Linking big data analytics and operational sustainability practices for sustainable business management. *Journal of Cleaner Production, 281*, 124847.

Reefke, H., & Sundaram, D. (2024). Sustainable supply chain management: Decision models for transformation and resilience. *European Journal of Operational Research, 312*(1), 317–330.

Saghafian, S. (2021). Risk management in supply chains: A resource-based view of Jordanian manufacturing firms. *Journal of Business Research, 132*, 312–321.

Simchi-Levi, D. (2020). Risk, resilience, and supply chain design: Lessons learned from COVID-19. *MIT Center for Transportation & Logistics*.

Singh, S., Luthra, S., Dhir, S., & Mishra, N. (2022). Framework for developing resilience in sustainable supply chains during and post-COVID-19 pandemic era. *International Journal of Logistics Management, 33*(3), 739–766.

Soni, U., Jain, V., & Kumar, S. (2022). Measuring supply chain resilience using a deterministic modeling approach. *Computers & Industrial Engineering, 168*, 108015.

Touboulic, A., & Walker, H. (2015). Love me, love me not: A nuanced view on collaboration in sustainable supply chains. *Journal of Purchasing and Supply Management, 21*(3), 152–162.

Türkeș, M. C., Bănacu, C.-S., & Stoenică, L. (2024). The effect of supply chain sustainability practices on Romanian SME performance. *Sustainability, 16*(7), 2887.

Unilever. (2025). *Unilever sustainable sourcing strategy*.

Hoek, R. (2021). Research opportunities for a more resilient post-COVID-19 supply chain — closing the gap between research findings and industry practice. *International Journal of Operations & Production Management, 41*(3), 363–383.

Wieland, A., & Wallenburg, C. M. (2013). The influence of relational competencies on supply chain resilience: A relational view. *International Journal of Physical Distribution & Logistics Management, 43*(4), 300–320