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A Systematic Literature Review on Supply Chain Risk Management

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- Risk mitigation strategies
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Abstract: Supply chain risk management (SCRM) has become a critical and strategic component of organizational operations, particularly for manufacturing firms that aim to ensure operational continuity and deliver high-quality products to meet customer demands. Supply chain risks have become much more serious because of rising uncertainty, global disruptions, and structural complexity. This shows how important it is to have effective and evidence-based risk management solutions. The objective of this study is to systematically review and synthesize the existing literature on supply chain risk management, with a particular focus on risk identification, mitigation, and management strategies within manufacturing supply chains. This study adopts a systematic literature review methodology conducted in accordance with established review protocols. A structured search strategy was applied using relevant keywords and Boolean operators across major academic databases. Peer-reviewed journal articles published between 2011 and June 2025 were screened and analyzed to identify dominant themes, theoretical foundations, and practical approaches to SCRM. The findings indicate that supply chain risks are inherently dynamic and context-dependent, making contingency theory a particularly relevant theoretical lens for understanding and managing these risks. Additionally, to receive support, feedback, and training, companies are encouraged to join the Supply Chain Council and utilize the provided models. By obtaining this council membership, company managers can enhance organizational resilience by adopting appropriate risk management strategies.

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INTRODUCTION

People usually understand the concept of risk naturally, and it is often associated with the possibility of bad or unwanted outcomes. Despite the fact that risk is a well-known concept, its definition and interpretation differ based on the situation and viewpoint in question. Uncertainties about supply, demand, operations, and outside disruptions give rise to risks in the context of supply chains. According to the Society for Risk Analysis, risk is "the potential for realization of unwanted, adverse consequences to human life, health, property, or the

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environment" (SRA, 2012). Effective supply chain risk management (SCRM) is a crucial managerial concern since exposure to these risks has increased due to the complexity and global interconnection of modern supply chains. Globalization, reliance on technology, geopolitical instability, and unforeseen disruptions have made supply chains increasingly vulnerable for businesses. Reduced organizational resilience, financial losses, and operational failures can result from inadequate supply chain risk identification and mitigation. Many businesses still have trouble methodically identifying critical risks and choosing suitable mitigation strategies that fit their operational context, despite the growing recognition of SCRM as a strategic necessity. This difficulty emphasizes the necessity of methodical and useful approaches to SCRM (Abdulatifu, 2025).

An effective SCRM system increases organizational resilience, protects overall performance, and improves business continuity. The COVID-19 pandemic, which seriously disrupted global supply chains and revealed their structural fragility, made the significance of SCRM especially clear. Therefore, improving SCRM procedures is crucial for both managing everyday uncertainties and effectively handling major emergencies. By providing insights that can help decision-makers create more resilient and flexible supply chain strategies, this study advances both theory and practice (Ivanov et al., 2021).

While many studies have looked at supply chain risks and suggested different ways to mitigate them, current research frequently treats theoretical frameworks and real-world application independently. While academic research mostly concentrates on conceptual models and empirical analyses, professional organizations like the Council of Supply Chain Management Professionals (CSCMP, 2024) offer helpful advice. For instance, Langat and Karanja (2021) showed that during the COVID-19 pandemic, supply chain disruptions had a substantial impact on East African Breweries Limited's customer service performance, highlighting the need for better resilience strategies. Comprehensive studies that coherently and empirically ground established academic frameworks with practitioner-oriented guidelines are still lacking, though. Organizations' capacity to convert theoretical insights into practical, successful SCRM practices is hampered by this gap.

In order to close this gap, the current study suggests an integrated strategy that combines CSCMP-recommended practical mitigation techniques with current academic SCRM frameworks. The study intends to create a structured process that is both practically applicable and scientifically rigorous by combining knowledge from previous research and professional guidelines. The growing need for practical risk management solutions that help businesses better manage uncertainty and improve supply chain resilience justifies this integration.

In particular, the following research questions are the focus of this study:

1. What are the types of risks and the most critical uncertainties within a firm’s supply chain?
2. What are the risk mitigation strategies used in supply chain management?

3. What factors can influence the choice of risk mitigation strategies in a supply chain?

To address this question, we conducted a thorough analysis of academic publications from 2011 to June 2025. The study concentrated on how the terms "risk," "supply chain," and "risk mitigation strategies" appeared in various supply chain scenarios. This review emphasizes how managing uncertainties in intricate supply chain networks is receiving more scholarly attention.

RESEARCH METHOD

To analyze the body of knowledge on supply chain risk management (SCRM), this study employs a systematic literature review. Figure 1 provides an overview of the research methodology. The literature review includes journal articles published between 2011 and June 2025. The research methodology presented in Figure 1 is as follows: A structured search strategy was implemented based on search terms and keywords, including 'risk', 'supply chain', 'risk management', and 'risk mitigation strategies'.

Boolean operators (AND/OR) were used to combine these keywords, which were then applied to several reliable academic databases, including Scopus, ScienceDirect, Emerald, OpenAlex, and Google Scholar. One hundred scholarly articles were found in the first search stage. Conference papers, master's and doctoral dissertations, book chapters, notes, and textbooks (except for Hopkin, 2012) were not included in this review. The abstracts were reviewed to determine whether they addressed one or more aspects of supply chain risk management (SCRM), such as types of supply chain risks, contributing risk factors, risk management strategies, and the identification of research gaps. Articles that did not satisfy any of the established screening criteria were excluded. Thirty-one articles were discarded for insufficient relevance to the research scope following the abstract screening and application of inclusion and exclusion criteria. Consequently, 69 articles that were closely associated with the keywords, authored in English, and published in international journals were retained for full-text review and included in the final analysis.

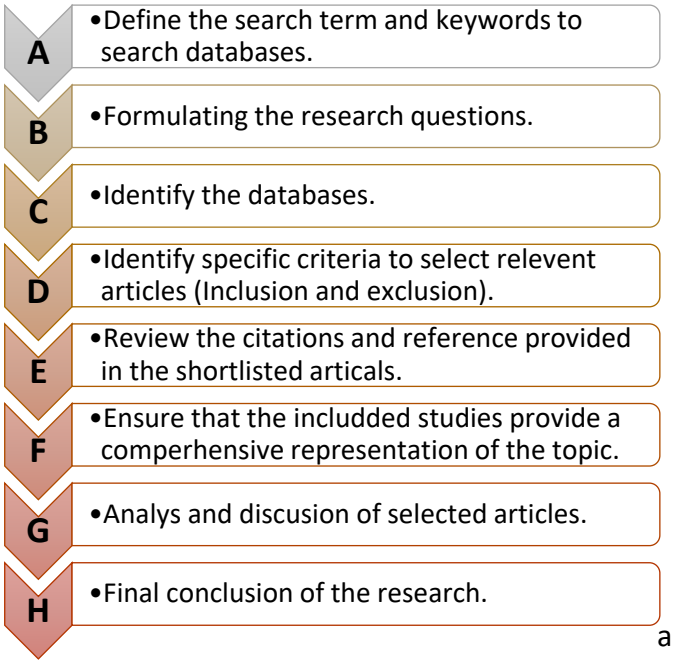


Figure 1. *Research methodology flowchart*

FINDINGS

The literature indicates that research into SCRM strategies could take a contingency theory perspective, which holds that there is no single method for managing all aspects of supply chain management within an organization (Chang et al., 2015). Strategies for supply chain risk management may adopt a relational exchange theory perspective. Considering contingency theory, Siba and Omwenga (2015) express that effective organizational management strategies should be designed and adapted according to the specific circumstance at hand, and the contingency theory is crucial to supply chain risk mitigation strategies as it offers the framework that allows firms to anticipate and reduce the impact of disruption in the supply chain. In the supply chain, it highlights the importance of both external and internal situational factors in the decision-making process for selecting the most suitable supply chain. It argues that a mismatch between environmental characteristics and strategic approaches in the supply chain is associated with poor organizational performance (Chang et al., 2015).

Kumar and Sahoo (2025) describe supply chains as complex systems designed to control the flow of goods, information, and financial resources from the point of initial production to the final consumer. Supply chain risks are unforeseen events that can disrupt the smooth flow of materials (Surya et al., 2017). Munyuko (2015) looked into how SCRM tactics affected the supply chain of Nairobi City County-based logistics firm Andy Forwarders Services Limited. Based on responses from 50 participants, the study concluded that risk mitigation techniques significantly enhanced the firm's resilience and overall performance.

Additionally, the literature shows that researchers hold diverse perspectives on supply chain definitions and risk management approaches. Several researchers have studied supply chain risk management, which makes it challenging to present their opinions in detail in this paper. However, a summary table has been created and is presented in Table 1 to succinctly present their findings as literature in this field. The table identifies the researchers, findings of their research, the specific themes of their studies related to supply chain risk management, and the main aspects they emphasized to mitigate risks and enhance supply chain effectiveness and resilience.

Table 1. *Summary of the researcher's perspectives, findings, and highlights on supply chain management*

Authors	Articles	Findings and Highlights
(Piyush Singhal et al., 2011)	Supply chain risk management: review, classification, and future research directions	The study highlights the need to integrate behavioral factors into risk management models to develop more realistic solutions. And emphasizes the need for tailored SCRMs for diverse industries, given varying business environments.
(Iris Heckmann et al., 2013)	A Critical Review of Supply Chain Risk – Definition, Measure, and Modeling	The paper identifies gaps in existing approaches to supply chain risk management, particularly in operational effectiveness and in strategic outcomes such as product quality. It emphasizes the need for integrating risk management into corporate systems and existing regulations.

(William Ho et al., 2015)	Supply chain risk management: a literature review	The paper reviewed 224 journal articles, of which 208 employed quantitative or qualitative methods for SCRM processes. It identified and classified SCRM methods across four major processes: risk identification, assessment, mitigation, and monitoring.
(Rajagopal et al., 2017)	Decision-making models for supply chain risk mitigation: A review	The paper identifies key research concepts in supply chain risk (SCR) mitigation, including robust SC network design and risk-propagation analysis. It highlights that disruption, demand, and supply risks are well addressed, while reputation, credit, exchange rate, and information risks are less well studied.
(Surya et al., 2017)	A critical analysis of supply chain risk management content: A structured literature review	The research reveals that operational risks in supply chains are underexplored, particularly in areas such as processes and security. The findings encourage the adoption of systematic literature review methodologies to synthesize SCRM literature effectively.
(Saptya Prawitasari, 2019)	Assessment and Risk Mitigation of Arabica Ijen Coffee Supply Chains	It highlights that farmers' knowledge and skills in cultivation techniques are the primary risks that need attention. Mitigation strategies suggested include improving cultivation practices, focusing on pest and disease management, and providing technical education and training for farmers.
Pradeep Kumar Tarei (2020)	Benchmarking the relationship between supply chain risk mitigation strategies and practices: an integrated approach	The study explores the relationship between risk management strategies (RMS) and risk management practices (RMP) for effective SCR mitigation. Three underlying dimensions were identified: risk adaptability, resource capability, and the sophistication of RM practices, which explained 83% of the variance. Risk avoidance strategies include supplier evaluation and technology adaptation, while risk sharing involves revenue sharing and collaboration.
(Gurtu et al., 2021)	Supply Chain Risk Management: Literature Review	The research highlights the importance of risk management in supply chains amid growing business uncertainties. It emphasizes the importance of proactive risk reduction to enhance supply chain agility in uncertain environments.
(Abeer Aljohani, 2023)	Predictive Analytics and Machine Learning for Real-Time SCR Mitigation and Agility	The study identifies several predictive analytics methods, including time-series analysis and anomaly detection, for identifying supply chain risks.
(Jacobus D. Nel, 2024)	The role of SCR mitigation strategies in managing supply chain disruptions	Effective supply chain risk management strategies significantly contributed to managing disruptions during the COVID-19 pandemic. Agile and flexible firms that collaborated more were better prepared for disruptions.
(Rahul Kumar et al., 2025)	A Bibliometric Analysis of Agro-Based Industries: Trends and Challenges in SCM	The study highlights the need for interdisciplinary research and global collaboration to enhance resilience in agro-industrial supply chains. Limited participation from emerging nations indicates a need for deeper regional cooperation in supply chain management.
(Chen et al., 2025)	Supply chain risks for SMEs in construction projects: A structured literature review and research agenda	The study identifies eight distinct SC risks to provide a comprehensive framework for SMEs to identify and categorize risks in management, operations, and sustainability. and emphasizes the vulnerability of construction SMEs due to financial constraints compared to larger firms.

Several studies have examined the factors influencing firms' supply chain management across regions. For example, Neboh and Mbhele (2021), as well as Naude and Badenhorst Weiss (2011) analyzed supply chain design elements that strengthen resilience within South Africa's retail sector. Their findings revealed that factors such as environmental shifts, transportation infrastructure, targeted supply chain outcomes, economic conditions, and technological advancements were key design dimensions affecting resilience. In a related study Simba et al (2017) examined SCRM strategies within South African grocery firms to understand how these strategies supported supply chain resilience. Through semi-structured interviews with 12 senior supply chain managers, the research found that firms employed risk-mitigation tactics to manage disruptions. Although most companies applied these SCRM strategies informally, they still contributed to enhancing resilience. The study recommended that grocery industry managers in South Africa formalize their SCRM practices to improve organizational resilience further.

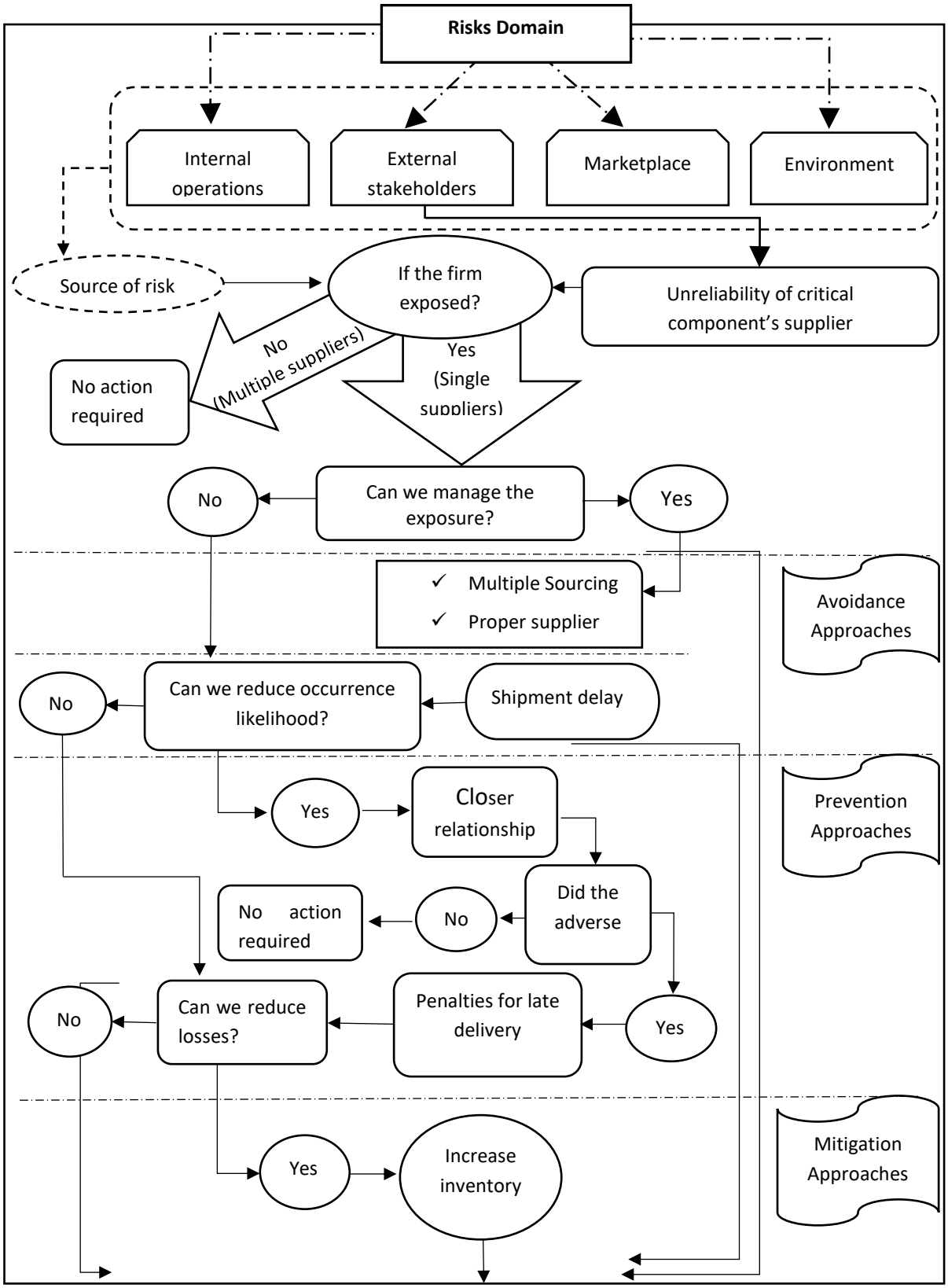
Nyaga and Moronge (2018) explored the impact of SCRM strategies on the performance of Unga Group Limited, a flour milling company based in Kenya. The study used a case study methodology to evaluate the impacts of supplier rating, lean management, Just-In-Time (JIT) delivery, and single sourcing strategies. Single sourcing was assessed based on how effectively a sole supplier could reduce purchasing workloads, improve supplier performance, and streamline problem tracking. The supplier evaluation was conducted based on quality management, supplier proficiency, and financial viability.

Lean management was defined through continuous raw material flow, equipment reliability, and waste reduction, while JIT delivery focused on production flow, scheduling, and quality compliance. Drawing on data from 124 respondents within the firm, the study found that while supplier rating had no significant effect on performance, the other three strategies, JIT delivery, single sourcing, and lean management, positively influenced the company’s performance. Based on these findings, the study recommended that other manufacturing firms adopt these three strategies to improve their operational performance.

The impact of SCRM strategies on supply chain system performance in Kenyan food and beverage manufacturing companies was investigated in a different study . Based on data from 187 companies, the study found that these strategies positively influenced firm performance, leading to notable improvements in supply chain resilience (Nyang et al., 2016).

Similarly, Bandaly et al (2011) studied the supply chain risk management framework and planning process and reported that, if the firms are unable to avoid the risk, supply chain managers implement suitable measures to mitigate them by lowering the probability of their occurrence, and this forms the second level of risk management strategies in firms, which is shown in Figure 2. This figure identifies the previously mentioned SCRM strategies as risk prevention methods. If supply chain managers in a firm cannot prevent risks, they implement risk mitigation strategies to minimize negative impacts on the supply chain and the organization as a whole, forming the third level of risk management strategies in the firm.

Ultimately, the process is repeated until the risk is reduced, prevented, or mitigated, thereby strengthening and increasing the firm's resilience. It can specify methods to minimize supply chain risks, lessening their detrimental effects and likelihood. Figure 2 identifies risk mitigation strategies as the third level of SCRM practice to reduce the impact of supply chain risks, as eliminating them is not always possible.



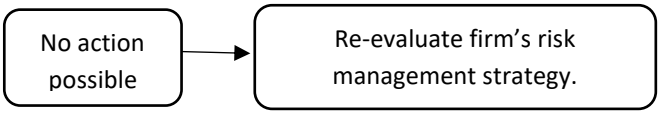


Figure 2. *Illustrative example of the risk management planning process in three different approaches*

DISCUSSION

This section aims to address the three mentioned research questions by conducting and critically analyzing the synthesized findings in relation to existing literature. In addition, this section discusses Supply Chain, Supply Chain Risks, Supply Chain Risk Management, Supply Chain Operation Reference Model, Supply Chain Risk Management Process, and Supply Chain Risk Mitigation Strategies, which are essential for a comprehensive understanding and deeper analysis of supply chain risk management.

When a supplier dispatches materials to a customer, there exist inherent risks that the delivery may be delayed beyond the promised timeframe, the goods may sustain damage or become lost, incorrect products may be sent, or wrong quantities may be delivered, the shipment may be directed to an erroneous location, the invoice may contain inaccuracies, the customer may default on payment – in addition to numerous other complications that could arise (Raihan et al., 2020). These immediate manifestations can precipitate more extensive ramifications throughout the supply chain. Supply chains play a crucial role in the global economy by enabling trade, supporting consumption, and driving economic development (Gurtu, et al., 2021). A comprehensive understanding of the primary components of the supply chain is essential to analysis, assessment, and coordination, an area that has garnered significant attention from researchers. As a result, various researchers offered different definitions of supply chain, as summarized in Table 2.

Table 2. *Definition of supply chain according to reviewed articles*

Authors	Definitions
(Abhijeet Ghadge et al., 2012)	A network of organizations and processes involved in the sourcing, production, and delivery of goods/services to end customers
(Jie Chen et al, 2013)	A supply chain is a network of organizations that, through upstream and downstream linkages, produce value for consumers.
(Mohamed & Omwenga, 2015)	A supply chain is a network of organizations that, through upstream and downstream linkages, produce value for consumers.
(Dina Azhgaliyeva et al., 2023)	A supply chain is a set of functions and processes that link producers and suppliers across multiple tiers with distributors and consumers, focusing on optimizing the flow of products, services, and information.
(Anshika Kalshan, 2024)	It encompasses the motion of goods and services across borders and continents, highlighting the complexity and interconnectedness of global supply chains.
(Jacobus Nel, 2024)	A supply chain consists of all firms involved in the buying and selling of goods and services to fulfill customer requests, including suppliers, manufacturers, transporters, warehouses, and retailers.

(Rahul Kumar & Sushil Kumar Sahoo, 2025)	Supply chain refers to the flow of goods, information, and funds from agricultural production to end consumers, encompassing tasks such as obtaining raw materials, production, processing, packaging, distribution, and retailing of farm products.

A commonly accepted definition makes it easier to identify and assess the likelihood of risks and their effects on supply chains (Diehl & Spinler, 2013). Consequently, this facilitates the implementation of the best Supply Chain Risk Management (SCRM) techniques. Hence, having standardized definition is essential, Association for supply chain management (ASCM, 2025) define that “Risk refers to the potential for loss or damage resulting from various uncertainties, including economic threats and supply chain disruptions, which are recognized as significant concerns in risk management practices” As well as researchers have expressed different definitions regarding to risks in supply chain. Each definition with their comprehensive content is very valuable, which is summarized in table 3.

Table 3. *Definition of risk from different perspectives of researchers*

Authors	Definitions
(Rao & Tobias, 2011)	Risk is a combination of the probability or frequency of occurrence of a defined hazard and the magnitude of its impact.
(Abhijeet Ghadge et al., 2012)	Risk is the potential for unwanted negative consequences arising from an event or activity.
(Jie Chen et al., 2013)	Risk is a combination of the probability or frequency of occurrence of a defined hazard and the magnitude of that occurrence.
(Faisal Aqlan & Sarah, 2014)	Risk is defined as the probability of a risk event occurring multiplied by its impact on the supply chain.
(William Ho et al., 2015)	Risk is conceptualized as the potential deviation from the expected value of a specific supply chain performance measure.
(Surya et al., 2017)	Risk is defined as "the variation in the distribution of possible supply chain outcomes, their likelihoods, and their subjective values," indicating that risk involves quantifiable measures of uncertainty.
(Raihan et al., 2020)	Risk is "an unwanted deviation from some expected level of performance that creates unfavorable situations for business organizations, highlighting its negative impact on operations.
(Gurtu Amulya & Jestin Johny, 2021)	Risk is defined as the probability of differences in expected outcomes, indicating uncertainty about an outcome that cannot be quantified.
(Soukaina Sahab & Salah Oulfarsi, 2024)	Risk refers to incidents that negatively impact operations and performance metrics, such as cost and service levels, or that are associated with unwanted loss or unfavorable outcomes, linked to uncertainty.
(Abdulatifu Hemed, 2025)	It encompasses a range of factors, including geopolitical shifts, natural disasters, and operational challenges, that can impact organizational performance.

According to Hopkin (2012), three types of risk result in different outcomes: hazard risks, control risks, and opportunity risks. As shown in Figure 3, Hazard risks always lead to adverse outcomes when they occur, so the primary goal is to prevent or mitigate their impact. Control risks involve a degree of uncertainty; effective management requires precise alignment between expected outcomes and actual results. The third type of risk is opportunity risk, which is intentionally positive but can also be negative.

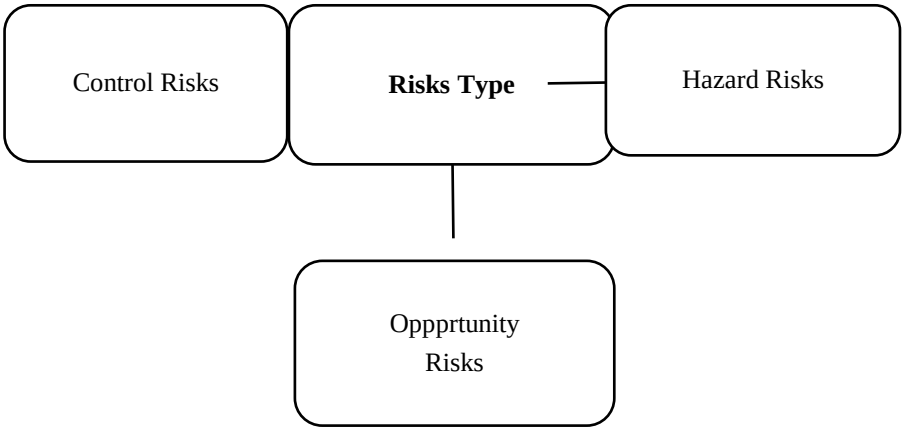


Figure 3. *Three types of risk*

As described previously, various risk classifications are paramount for an organization to consider, particularly hazard risks, which require vigilant monitoring due to their inherent propensity to lead to adverse outcomes. Many factors, including people, products, processes, and premises, can cause disruptions resulting from these hazard risks.

As Pettit et al (2017) and Ho et al (2015) noted, the risks associated with supply chains fall into two broad categories: macro-risks and micro-risks. Macro-risks encompass infrequent yet potentially disruptive external factors that can adversely influence organizations.

These risks are typically categorized into natural events (earthquakes, climate-related disasters) and human-induced events (armed conflicts, acts of terrorism, and political instability). On the other hand, micro-risks are relatively frequent occurrences that result from relationships within the supply chain or from internal business processes. While their impact is usually less severe compared to macro-risks, they still pose significant operational challenges. Micro-risks are commonly classified into four main categories: demand-related, production-related, supply-related, and infrastructure-related risks.

The process of identifying potential risks within the supply chain and developing appropriate action plans to mitigate them is known as supply chain risk management (Tummala & Schoenherr, 2011). The role of supply chain risk management (SCRM) is to detect, evaluate, and mitigate risks to ensure effective control. In pursuit of improved outcomes in sustainable supply chain performance, recent literature emphasizes the value of risk management and mitigation strategies and the critical importance of maintaining balance among the core dimensions of sustainability (Nobanee et al., 2021).

Several researchers define SCRM, summarized in Table 4. And we define SCRM as “Supply chain risk management is a highly systematic approach to identify, assess and analyze risks within the supply chain networks, and it is implemented to prevent threats, to reduce their probability of occurrence, or mitigate their adverse and negative impacts on the supply chain.”

Table 4. *Definition of (SCRM) from different perspectives of researchers*

Authors	Definitions
(Piyush Singhal et al., 2011)	Supply chain risk management integrates the organizations to enhance efficiency and effectiveness in delivering products and services.
(Rao & Tobias Schoenherr, 2011)	Supply chain risk management (SCRM) is the process of identifying potential risks within the supply chain and developing appropriate action plans to mitigate them.
(Ghadge et al., 2012)	(SCRM) It is a structured and systematic approach to identify, assess, and mitigate supply chain risks to maintain performance and resilience.
(Jie Chen et al., 2013)	Supply chain risk management emerged as a strategic approach to aligning entities within the supply chain into a unified whole, contrasting with traditional management methods.
(William Ho et al., 2015)	It involves defining and operationalizing risks and developing strategies to mitigate them effectively.
(Rajagopal V et al., 2017)	SCRM is a systematic, phased approach aimed at identifying, assessing, prioritizing, mitigating, and monitoring potential disruptions in the supply chain to minimize their adverse impacts on operations
(Gurtu Amulya & Jestin Johny, 2021)	Supply chain risk management (SCRM) is a systematic, phased approach to recognizing, evaluating, ranking, mitigating, and monitoring potential disruptions in supply chains.
(Rahul Kumar et al., 2025)	Supply chain management (SCM) involves managing the flow of goods, information, and funds from agricultural production to end consumers.
(Abdulatifu Hemed, 2025)	Supply Chain Risk Management (SCRM) involves identifying, assessing, and mitigating risks that can disrupt the flow of goods, information, and funds within supply chains. It aims to enhance the resilience and efficiency of supply chain operations.

Supply chain risk management is a critical and invaluable principle within corporate operations, where the production of high-quality products to satisfy customer demands is a primary objective of manufacturing entities, and inadequate risk management practices should not compromise this objective.

Moreover, the inability to effectively manage suppliers regarding delivery timelines and raw material quality will have a detrimental effect on the overall value of the supply chain. This perspective is corroborated by Muthoni & Mose (2020), who assert that production management encompasses materials management, forecasting customer demand, collaborating with suppliers, and planning production.

Because most respondents used Materials Requirement Planning (MRP) to a moderate degree, the study's descriptive statistics showed that most respondents strongly agreed with the importance of material forecasting. Since supply chain risk management (SCRM) is one of the most essential activities in manufacturing firms and companies. Therefore, many scholars and researchers have conducted studies on (SCRM), and the research in this area is continuously expanding. And each year, a significant number of scholarly articles on this topic are published in very prestigious international journals. Figure 4 presents the most influential journals within the supply chain risk management domain

Figure 4. *The journals with the highest contribution to the field of (SCRM)*

The analysis highlights the diversity of journals contributing to the discourse on Supply Chain Risk Management (SCRM), underscoring the interdisciplinary nature of these subjects. This breadth reflects the strong scholarly engagement with the topics, as demonstrated by the substantial volume of research disseminated across a wide range of academic journals.

With 39 articles on supply chain risk management, the Journal of Supply Chain Management stands out as the top contributor. "Risk management" appeared in the title, keywords, or abstracts of 294 research publications. These articles were published in the Journal of Supply Chain Management between 2011 and June 2025; 292 of these articles were specifically titled "supply chain risk management" (SCRM). The number of articles published in the Journal of Supply Chain Management between 2011 and June 2025 is displayed in Figure 5.

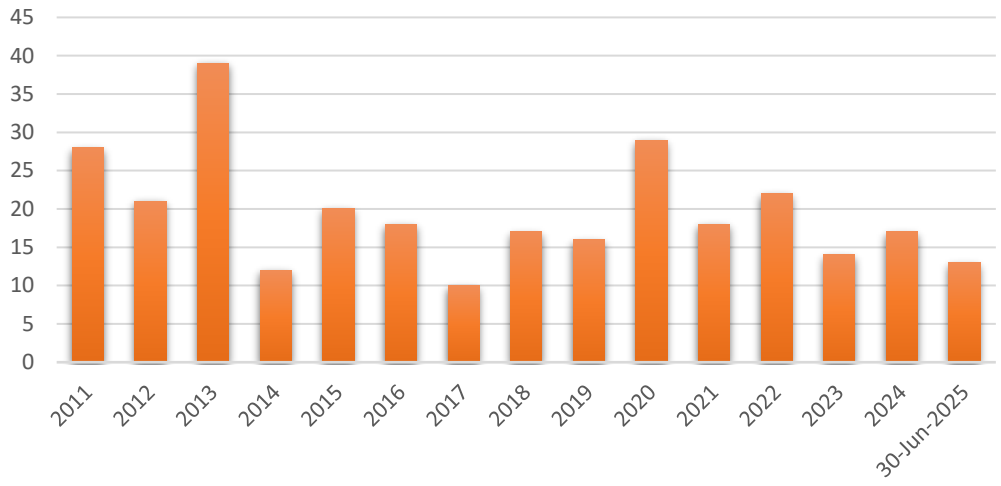


***Figure 5**. Published articles in the Journal of Supply Chain Management from 2011 to June 2025*

Between 2011 and 2013, there was a sustained upward trajectory in scholarly publications, indicating that the significance of Supply Chain Risk Management (SCRM) was increasingly recognized within the academic community. This timeframe may correlate with the escalating complexity of global supply chains, the emergence of innovative technologies, and heightened awareness of vulnerabilities associated with globalization. Throughout these years, considerable supply chain disruptions, exemplified by natural calamities such as the 2011 Japanese earthquake, intensified scholarly investigation into risk mitigation strategies.

Between 2019 and 2021, there was a noticeable increase in publications, especially in 2021, when the number of academic articles almost doubled compared to earlier years. This increase is intrinsically linked to the worldwide repercussions of the COVID-19 pandemic, which underscored inherent deficiencies within global supply networks. Academics responded by probing the dimensions, ramifications, and dynamics of pandemic-related supply chain disruptions.

The 2021 spike, the largest during the specified period, underscores the need to conduct research on supply chain risk management amid major worldwide disruptions and crises. The number of publications decreases slightly in 2022 and 2023 after 2021, but overall output remains higher than before the pandemic. This phenomenon suggests that, even though the pandemic's acute effects have lessened, researchers' interest in creating robust, resilient supply chains remains a top priority.

According to the Supply Chain Council.INC (2025), “The Supply Chain Operations Reference (SCOR) Is the world standard for supply chain management, a model that provides a unique framework for defining and linking performance metrics, processes, best practices, and people into a unified structure.” Supply chain risk management represents the systematic endeavor to instill order within the intricate supply chain framework.

SCOR provides businesses with a basic process modeling tool, an extensive database for benchmarking, and methodological guidelines for evaluating their supply chain operations.

The SCOR model has been used as a fundamental framework for supply chain improvement since its inception in 1996. Over time, a significantly increased number of enterprises, exceeding the original cohort of approximately 70 organizations, have embraced the SCOR model and its associated methodologies. In recent years, the SCOR model has garnered considerable attention in Sweden, leading numerous companies to integrate its principles into their operational practices (Persson, 2011).

The SCOR model has been formulated to articulate the business activities associated with all phases of fulfilling customer requirements. The Plan, Source, Make, Deliver, Return, and Enable processes are the six basic management processes that form the basis of this model, which is divided into multiple sections. The Enable process delineates the methodology for implementing the other five distinct management processes within the framework, as shown in Figure 6.

Figure 6. *Supply chain operation reference process*

For an organization to navigate its supply network effectively, all stakeholders must have a comprehensive understanding of the business's characteristics. The Supply Chain Operations Reference model (SCOR) serves as a conceptual framework for mapping, benchmarking, and enhancing supply chain operations. The Supply Chain Operations Reference model is a product of the Supply Chain Council (SCC), a global entity that permits membership to organizations focused on the systems and practices of supply chain management (Supply Chain Council Inc., 2025).

The SCOR model serves as a managerial tool that encompasses the entire supply chain from the supplier's supplier to the customer's customer. Consequently, the SCOR model represents a methodological approach to enhancing an organization's supply chain. This model comprises three primary components (Persson, 2011).

1) A modeling tool that employs standardized processes as foundational elements
2) A collection of key performance indicators (KPIs)
3) A benchmarking instrument that enables companies to evaluate their KPIs against those of other enterprises.

In addition to defining the parameters of its organizational structure, the Supply Chain Risk Management (SCRM) process must specify the resources and capabilities that are intended for use. For instance, the term "mitigation capabilities" can be defined as organizational procedures that enhance the supply chain's capacity to quickly recover from a physical disruption and to detect potential or current disruptions (Sahab & Oulfarsi, 2024).

Implementing a systematic risk management process strengthens supply chain resilience by consistently evaluating potential risks and minimizing weaknesses (Gurtu & Johny, 2021). The following are the steps involved in supply chain risk management, according to Sahab (2024): risk identification, risk assessment, risk mitigation, risk control, and continuous improvement. To increase resilience going forward, continuous improvement focuses on enhancing risk management procedures by leveraging past experiences and outcomes. The supply chain risk management process, including risk identification, assessment, mitigation, and monitoring, is similarly presented by William (Ho et al., 2015). Organizations frequently develop specialized SCRM processes, which encompass four interconnected processes (risk identification, risk assessment, risk mitigation, and risk control) as a response to the many risks and disruptions they may face (Tummala & Schoenherr, 2011; Colicchia & Strozzi, 2012; Wieland et al., 2012; Kirilmaz & Erol, 2017; Soukaina Shaab, 2024). These represent the fundamental stages of structuring an effective SCRM process, which is shown in Figure 7.

As Mohan et al. (2011) describe, the process of supply chain risk management involves: risk identification; detection of diverse risk sources, including environmental, network, and organizational factors; and categorization based on their nature as disruptions or delays. Risk Assessment: involves analyzing the probability and potential consequences of the identified risks. Planning: formulating strategies to effectively address actual risk events to reduce their impact and accelerate recovery. Implementation: It focuses on executing risk response plans and aligning them with operational procedures to integrate risk management into the supply chain. Most research has primarily explored the effectiveness of supply chain attributes such as flexibility, agility, collaboration, and redundancy in reducing the impact of disruptions, providing practitioners with guidance on risk mitigation and resilience-building measures (Pettit et al., 2017).

Figure 7. *Supply chain risk management process*

Some researchers have examined how various Supply Chain Risk Management (SCRM) strategies affect a company's resilience from different perspectives. For instance, Singh & Singh (2019) assessed how big data analytics can strengthen supply chain resilience. By analyzing data from 225 firms across Europe and the USA, the study found that institutional experiences and the use of big data analytics were key factors in improving supply chain resilience.

As well as Wieland and Wallenburg (2013) examined the impact of relational competencies on supply chain resilience. Based on data gathered in Switzerland, Australia, and Germany, they found that collaborative, communicative partnerships between companies and their suppliers positively influenced the strength of supply chains. According to the Cambridge Dictionary, strategy is defined as "a detailed plan for achieving success in a situation such as war, politics, business, industry, or sport, or the skill of planning for such a situation." There is a technical definition of risk mitigation techniques in the supply chain domain, in addition to the previously mentioned Cambridge Dictionary definition. A strategy can be understood as a plan formulated by a company's top management (in line with the corporate strategy) to address and mitigate the harmful effects of risk (Roh et al., 2014).

Various mitigation strategies are available, such as (capacity addition strategy, channel flexibility strategy, inventory addition strategy, and supply chain responsiveness). The selection depends on the specific types of risk a company faces (Mohammad et al., 2015). The most commonly employed method for mitigating supply chain risk involves effective communication and information sharing. This strategy enhances supply chain agility, which in turn contributes to improved organizational performance. Beyond communication and information exchange, companies also adopt additional measures, such as supporting suppliers in strengthening their capabilities to manage supply chain risks.

Another commonly applied strategy involves improving the accuracy of customer demand forecasting, which serves as an effective means to prevent inventory surpluses or shortages (Mustafa et al., 2018). A Risk Management Strategy (RMS) partly reflects an organization's risk appetite. For example, a risk avoidance strategy is used to detect and eliminate the root causes or effects of severe risks that could disrupt business operations. On the other hand, a risk-ignorance strategy is applied when risks are minimal and their occurrence has little impact on the supply chain (Aqlan & Lam, 2015). Siba and Omwenga (2015) assessed the Supply Chain Risk Management (SCRM) tactics used by the Coca-Cola Company in Kenya. The study, based on a sample of 83 senior managers, their deputies, and other supply chain employees, found that all three strategies had a positive impact on the company's supply chain, suggesting they strengthened its resilience. Several studies examine the strategic role of various supply chain processes in enhancing firm resilience. In Nigeria, Olaleye et al (2021) evaluated how strategic nimbleness and innovation contribute to organizational resilience.

Through a case study of tertiary institutions, the research identified strategic agility and innovation as key factors that predict firm resilience. Similarly, In Tanzania, Colon et al (2019) highlighted the importance of a strong transportation sector in mitigating disruptions caused by disasters. The study found that supply chain resilience could be enhanced by building capacity, establishing alternative routes, and improving the quality of essential infrastructure.

Pursuant to Change et al (2015) the risk mitigation strategies can be divided into two main types: flexibility and redundancy, and some of the SCRM strategies include collaboration between the parties involved in the SC, supply chain's agility and flexibility, as well as maintaining strategic emergency stock in the form of buffer stock. By maintaining reserve stock that can be used in the event of disruptions, redundancy approaches aim to mitigate the detrimental effects of risks. Increasing capacity, maintaining safety stock, working with multiple suppliers, and maintaining strategic inventory are among these measures. In contrast, flexibility approaches focus on developing both inter-organization and organizational capabilities to identify threats to the supply chain's continuity and respond to them quickly. These strategies include encouraging communication among supply chain participants to foster information sharing, improving responsiveness, and encouraging cooperation and integration.

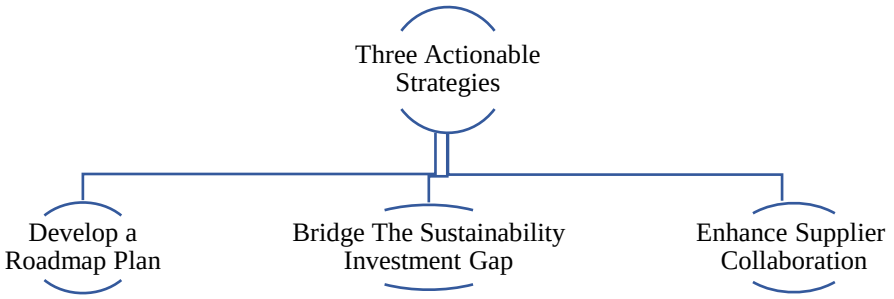


Figure 8. *Three actionable strategies of the Council of Supply Chain Management Professionals*

Um and Han (2021) evaluated the implications of risk mitigation strategies by analyzing a sample comprising 342 firms (159 from Britain and 183 from South Korea). By examining the connection between global supply chain risks and supply chain resilience, they concluded that implementing risk-avoidance strategies greatly increases a company's ability to withstand associated risks. The Council of Supply Chain Management Professionals (CSCMP, 2024) expressed that "To remain competitive, companies must balance embracing cutting-edge technologies and adopting sustainable practices." Additionally, as illustrated in Figure 8, (CSCMP) outlined three practical tactics that businesses can use right now to make sure they stay ahead of the curve.

A. Develop a roadmap and step-by-step plan that integrates supply chain optimization and sustainability (minimizing waste, time, cost, and effort- while still giving the customer what they want) by implementing LEAN practices.

B. Bridge the sustainability investment gap (big difference between how much money companies are planning to spend on sustainability and how much they actually need to pay). Companies should make sustainability a top priority, not just because laws require it, but because it helps them become leaders in a market where customers and partners care about the environment.

C. Strengthen supplier cooperation to promote optimization and sustainability; working with suppliers is crucial to improving the efficiency and sustainability of the supply chain. And companies that work closely with their suppliers are more successful in achieving their sustainability goals.

CONCLUSION

The main objective of the study was to systematically review and synthesize the existing body of knowledge on supply chain risk management (SCRM), with a focus on risk factors and risk mitigation techniques. To accomplish this goal, a systematic screening and inclusion process was used to select and analyze international journal articles published between 2011 and June 2025. The results show that SCRM-related publications increased significantly between 2019 and 2021, with a notable peak in 2020. This rise is closely linked to the COVID-19 pandemic's worldwide disruptions, which revealed serious weaknesses in international supply chains. The findings demonstrate that there isn't a single, universal risk mitigation strategy that works for every organization. Effective SCRM practices rely on a variety of contextual factors, such as risk type and severity, supply chain complexity, organizational size, risk appetite, stakeholder relationships, and geopolitical and environmental conditions, in accordance with contingency theory.

The findings show a strong correlation between risk management strategies (RMS) and risk management practices (RMP). Effective SCRM was found to be primarily driven by three underlying dimensions: risk adaptability, resource capability, and the sophistication of risk management practices. When taken together, these factors account for about 83% of the variation in supply chain risk mitigation performance, demonstrating their significant explanatory power. Furthermore, the findings show that businesses primarily employ risk-avoidance strategies, while risk-sharing strategies are implemented through revenue-sharing agreements and organizational partnerships. These imply that improving supply chain resilience against disruptions requires a well-balanced mix of adaptive capabilities, resource alignment, and cooperative practices.

By offering a more comprehensive and integrated definition of supply chain risk management grounded in prior research, the study contributes to the SCRM literature.

Classifying risks such as hazard, control, and opportunity risks, as well as macro- and micro-level risks, provides a more comprehensible conceptual framework for understanding the different sources of supply chain disruptions. The synthesis of key terms and definitions enhances conceptual clarity and supports future theoretical developments in the field.

Limitations of the Study

Despite its contributions, this study has several limitations. First, the review focused exclusively on English-language publications indexed in a selected set of academic databases, potentially overlooking relevant studies published in other languages or sources. Second, the findings are primarily based on qualitative synthesis, which may restrict their generalizability.

Future research could overcome these limitations by expanding database coverage, employing quantitative meta-analytical methods, and exploring supply chain risks within specific industries or geographic contexts. Moreover, additional empirical investigations are encouraged to assess the effectiveness of various risk mitigation strategies across different organizational and environmental settings. The author recommends that the following areas be explored in future research within this field:

1. Investigating the positive impacts and improvements in organizations that utilize the SCOR model, and comparing them with organizations that do not employ this model.
2. Investigating and analyzing the growth and lagging performance of organizations that are members of the Supply Chain Council, compared to those without membership.
3. Statistically analyze and compare the methods of risk identification and assessment in supply chains across different manufacturing and industrial organizations.

Implications and Recommendations

To receive support, feedback, and training on various business processes, companies are encouraged to join the Supply Chain Council. This membership provides access to best practices outlined in the latest model of supply chain operation reference (SCOR). This model can then be used not only to identify risks by comparing its best practices with the company's current processes, but also to develop mitigation strategies for already recognized risks.

AUTHORS CONTRIBUTIONS

- Mohammad Samim Sharifi was responsible for the conceptualization, design, and writing of this article, including data collection, literature review, and preparation of the initial manuscript draft.
- Aref Naimzad critically reviewed the manuscript, provided substantial feedback, and contributed to revisions that improved the quality and clarity of the final paper.
- The authors reviewed and approved the final version.

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CONFLICT OF INTEREST STATEMENT

The author declares that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

All data analyzed in this study are derived from publicly accessible secondary sources, with full citations, DOIs, and URLs provided within the manuscript.

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