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THE IMPORTANCE OF SUPPLY CHAIN RISK MANAGEMENT: IDENTIFYING, ASSESSING, AND MITIGATING SUPPLY CHAIN RISKS

PENTINGNYA MANAJEMEN RISIKO RANTAI PASOK: MENGIDENTIFIKASI, MENILAI, DAN MITIGASI RISIKO RANTAI PASOK

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ABSTRACT
This research discusses the importance of supply chain risk management (SCRM) in the context of increasingly complex and interconnected global supply chains. With increased vulnerability to disruption, as seen during the COVID-19 pandemic, companies need to develop robust SCRM strategies to ensure continuity of operations. This research aims to identify common and emerging risks in the supply chain, analyze factors that influence the severity of risks, and explore effective mitigation strategies. Through a systematic literature review approach, this research finds that traditional risks such as operational disruption and price fluctuations are still a major concern, while new risks such as cyber attacks and geopolitical instability are increasingly dominating. Additionally, factors such as supply chain complexity, reliance on technology, and market dynamics play an important role in determining the impact of risks. This research suggests that companies adopt strategies of supplier diversification, digitalization, collaboration with stakeholders, and sustainable practices to increase the resilience of their supply chains.
Keywords: Supply Chain Risk Management, Supply Chain Disruption, Traditional Risk, Evolving Risk, Mitigation Strategy

ABSTRAK
Penelitian ini membahas pentingnya manajemen risiko rantai pasok (SCRM) dalam konteks rantai pasok global yang semakin kompleks dan saling terhubung. Dengan meningkatnya kerentanan terhadap gangguan, seperti yang terlihat selama pandemi COVID-19, perusahaan perlu mengembangkan strategi SCRM yang tangguh untuk memastikan kelangsungan operasi. Penelitian ini bertujuan untuk mengidentifikasi risiko-risiko yang umum dan yang sedang berkembang dalam rantai pasok, menganalisis faktor-faktor yang mempengaruhi tingkat keparahan risiko, serta mengeksplorasi strategi mitigasi yang efektif. Melalui pendekatan tinjauan literatur sistematis, penelitian ini menemukan bahwa risiko tradisional seperti gangguan operasional dan fluktuasi harga masih menjadi perhatian utama, sementara risiko baru seperti serangan siber dan ketidakstabilan geopolitik semakin mendominasi. Selain itu, faktor-faktor seperti kompleksitas rantai pasok, ketergantungan pada teknologi, dan dinamika pasar berperan penting dalam menentukan dampak risiko. Penelitian ini menyarankan agar perusahaan mengadopsi strategi diversifikasi pemasok, digitalisasi, kolaborasi dengan pemangku kepentingan, dan praktik berkelanjutan untuk meningkatkan ketahanan rantai pasok mereka.
Kata Kunci: Manajemen Risiko Rantai Pasok, Gangguan Rantai Pasok, Risiko Tradisional, Risiko Berkembang, Strategi Mitigasi

1. INTRODUCTION

The evolution of global supply chains has led to a complex and interconnected system that enhances cost efficiency and market expansion. However, this complexity also increases vulnerability to disruptions, necessitating robust supply chain risk management (SCRM) strategies. The COVID-19 pandemic serves as a prominent example of how external shocks can severely impact supply chains, resulting in raw material shortages, factory closures, and transportation disruptions (Cherrafi et al., 2022; Moktadir et al., 2022; Sajjad, 2021). The

pandemic has highlighted the critical need for companies to develop resilience within their supply chains to withstand such shocks and ensure continuity of operations.

Disruptions can arise from various sources, including natural disasters, geopolitical conflicts, and pandemics. For instance, natural disasters like earthquakes and floods can disrupt supply chains, particularly for companies reliant on suppliers in vulnerable regions (Ghadge et al., 2013; Bassett et al., 2022). Geopolitical tensions, such as trade wars and sanctions, can also alter trade policies and affect the availability of essential materials (Jin, 2024; Barman & De, 2021). The COVID-19 pandemic has underscored these vulnerabilities, revealing the fragility of global supply chains and the cascading effects of disruptions across industries (Hou & Zhao, 2020; Yemeke, 2023). Studies have shown that the pandemic has not only affected supply chains directly but has also exacerbated existing vulnerabilities due to underlying social and economic conditions (Bassett et al., 2022; Yang & Xie, 2019).

Despite the extensive research on supply chain risks, significant gaps remain, particularly regarding the classification of risks and the factors influencing their severity. The emergence of digital and cyber risks, such as ransomware attacks, has not been adequately addressed in the literature (Akinbolajo, 2024; Butt, 2021). Furthermore, while many studies focus on singular risk mitigation strategies, there is a need for a more holistic approach that considers a combination of strategies tailored to specific industry contexts (Srinivas, 2024; Badhotiya et al., 2022). For example, research indicates that enhancing supply chain agility and resilience through diversified sourcing and adaptive strategies can significantly mitigate risks (Kiers et al., 2022; Farooq et al., 2022).

In light of increasing uncertainties, it is imperative for companies to understand both common and emerging risks, the factors influencing their severity, and effective management strategies. The literature suggests that integrating knowledge management into SCRM can enhance resilience by facilitating better risk identification and response strategies (Remko, 2020; Kwon, 2020). Additionally, the development of early warning systems and adaptive frameworks can help organizations anticipate and respond to disruptions more effectively (Guo, 2011; Zhan & Lu, 2021). In conclusion, the COVID-19 pandemic has served as a catalyst for re-evaluating supply chain risk management practices. As companies navigate the complexities of global supply chains, a comprehensive understanding of risks and the implementation of adaptive, resilient strategies will be crucial for sustaining operations and achieving long-term success.

Based on the problems described above, this research has three main objectives. First, this research aims to identify the most common and emerging risks in global supply chains. Risks in the supply chain can vary depending on the industry and operational environment. Some traditional risks, such as operational disruptions, raw material price fluctuations, and delivery delays, are still a major concern for many companies. However, in recent years, various new risks have emerged, such as cyber attacks, unexpected regulatory changes, and social and political instability that can disrupt the continuity of supply chains.

Second, this research will analyze the main factors that influence the severity and impact of supply chain risks. Not all risks have the same impact on business operations. Factors such as reliance on a single supplier, flexibility of the logistics network, and a company's risk management capacity can determine the extent to which a particular risk may hinder supply chain activities. By understanding these factors, companies can be more proactive in anticipating and responding to potential disruptions.

Third, this research aims to explore strategies and best practices in managing and reducing supply chain risks effectively. Various approaches have been used in supply chain risk management, ranging from supplier diversification, applying digital technologies such as AI and blockchain, to increasing collaboration with business partners. However, there is no systematic mapping of which strategies are most effective in various risk scenarios. By conducting a

systematic literature review, this research will provide evidence-based insight into the most successful mitigation strategies in various industrial contexts.

By achieving these three objectives, this research will not only contribute to the academic literature in the field of supply chain management, but also offer practical insights for professionals in designing supply chain systems that are more resilient and adaptive to global challenges.

To achieve the above research objectives, this study will answer three main research questions:

1. What are the most common and emerging risks in global supply chains as identified in the literature?
    - This question focuses on mapping risks that frequently arise in global supply chains as well as new risks that develop due to changes in the business and technological environment.
2. What are the key factors influencing the severity and impact of supply chain risks?
    - This question aims to understand factors that can exacerbate or reduce the impact of risks in the supply chain, including operational, technological and managerial aspects.
3. What strategies and best practices are used to mitigate supply chain risks effectively?
    - The main focus of this question is to explore the strategies that companies have implemented to manage supply chain risks as well as assess their effectiveness based on evidence found in the academic literature.

By answering these three questions, this research will make a valuable contribution to understanding and addressing the challenges in global supply chain risk management.

2. METHODS

2.1 Research Design

This research uses a Systematic Literature Review (SLR) approach to explore global supply chain risk trends, factors that influence the severity of risk, and the most effective mitigation strategies. This approach was chosen because SLR allows in-depth analysis of published academic literature, thereby identifying patterns, trends and research gaps in the field of supply chain risk management.

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework is used to ensure that the literature search, selection and analysis process is carried out in a transparent, systematic and replicable manner. PRISMA provides guidelines for eliminating selection bias and increasing the validity of research results by screening articles based on predetermined inclusion and exclusion criteria.

The selection of the PRISMA-based SLR method in this research was based on several main considerations. First, research on supply chain risk is extensive and growing rapidly, requiring a systematic approach to identifying, compiling and analyzing relevant information. Second, compared to other methods such as case studies or experiments, SLR allows access to multiple perspectives and findings from different industries and geographic contexts, thereby providing a more comprehensive understanding. Third, SLR can help in summarizing existing empirical evidence and identifying unanswered research gaps, so that it can become the basis for further research in the field of supply chain risk management.

2.2 Data Sources and Search Strategy

To obtain relevant literature, this research used several leading academic databases, namely:

- Scopus – for high-quality journal articles that have broad academic impact.
- Web of Science (WoS) – to obtain references from journals of international reputation.

- IEEE Xplore – to review literature related to the application of technology in supply chain risk mitigation.
- Google Scholar – to expand the search scope and find articles that are not yet indexed in major databases.

Article searches were carried out using combination and kaThe main keywords were designed to cover various aspects of this research. The search strategy uses Boolean operators to improve the accuracy of search results. Some examples of keywords used include:

- "supply chain risk management" AND ("emerging risks" OR "common risks")
- "global supply chain disruption" AND ("natural disaster" OR "pandemic" OR "geopolitical risk")
- "supply chain resilience" AND ("risk mitigation strategies" OR "best practices")

In addition, this study applied strict inclusion and exclusion criteria to ensure the quality and relevance of the articles analyzed.

2.2.1. Inclusion criteria

- Article published in time span 2012-2024 to ensure relevance to the latest developments in supply chain risk management.
- Articles that are peer-reviewed and published in reputable journals or conferences.
- Studies that directly address supply chain risks, factors influencing risk severity, and mitigation strategies.

2.2.2. Exclusion criteria

- Non-academic articles, such as industry reports, blogs, or white papers that have not gone through a peer-review process.
- Gray literature, such as theses and dissertations that are not published in indexed journals.
- Articles that are not available in English, unless an official translation is accessible.

An initial search yielded hundreds of potential articles. After filtering based on abstract and relevance, only articles that met the selection criteria were used in the final analysis.

2.3 Data Extraction and Analysis

After the article selection process was carried out, this research used the PRISMA Flowchart to document the stages of literature selection. The PRISMA diagram visually depicts the number of articles found, the number of articles eliminated based on exclusion criteria, and the number of articles finally analyzed in this study.

The data extraction process was carried out by reviewing and recording the main information from each selected article, including:

1. Types of supply chain risks identified (eg: operational risks, financial risks, geopolitical risks, cyber risks).
2. Factors that influence the severity of the risk, such as dependence on certain suppliers, logistics infrastructure, and regulatory changes.
3. Risk mitigation strategies are used, such as supplier diversification, use of blockchain technology, and adoption of artificial intelligence in supply chain monitoring.

To group findings from various articles, this research uses a thematic analysis approach. Thematic analysis is a method that allows the identification of thematic patterns in the literature, which in the context of this research are grouped into three main categories:

1. Identify supply chain risks (common vs. emerging risks).
2. Factors that influence the impact of risk (internal vs. external).
3. Risk mitigation strategies (reactive vs. proactive).

Each theme is analyzed using a comparative approach, where this research compares findings from various industries and looks at how mitigation strategies used in one sector can be adapted in other sectors. With this method, research can provide deeper insight into the dynamics of risk in global supply chains as well as the best approaches to risk management.

3. RESULTS

3.1 Common and Emerging Risks in Global Supply Chains

The evolution of global supply chains into intricate and interconnected networks has significantly transformed business operations over recent decades. Companies now leverage cross-border supply chain networks to enhance cost efficiency, broaden market reach, and access superior raw materials and technology. However, this reliance on global supply chains introduces substantial risks of disruptions that can severely impact business continuity. As a result, Supply Chain Risk Management (SCRM) has emerged as a critical component of contemporary business strategies (Ho et al., 2015; Wieland & Wallenburg, 2012).

Disruptions in supply chains can arise from a myriad of internal and external sources. The COVID-19 pandemic serves as a prominent example, leading to widespread shortages of raw materials, factory closures, and transportation disruptions, which have created imbalances in supply and demand across various industries (Wang & Huang, 2021; Singh et al., 2020; Kwon, 2020). Additionally, natural disasters such as earthquakes and floods can disrupt the flow of raw materials and finished products, particularly for companies dependent on suppliers located in vulnerable regions (Ho et al., 2015; Queiroz et al., 2020). Geopolitical tensions, including trade wars and economic sanctions, further complicate the landscape by influencing trade policies and the availability of essential materials (Wang & Wang, 2023; Kwon, 2020).

Despite the extensive literature on supply chain risks, several research gaps persist. One notable gap is the evolving classification of supply chain risks, particularly in light of emerging digital and cyber threats, such as ransomware attacks and data breaches (Hudnurkar et al., 2017; Salamai et al., 2019; Gupta & Sahu, 2014). Furthermore, the factors that determine the severity and impact of these risks across different industries have not been systematically explored ("A Hybrid Model for Supply Chain Risk Management Based on Five-dimensional Sustainability Approach in Telecommunication Industry", 2022; Gupta et al., 2014). Existing studies often focus on singular risk mitigation strategies, such as supplier diversification, neglecting the potential benefits of a more integrated and adaptive approach to risk management (Wieland & Wallenburg, 2012; Gupta & Sahu, 2014).

In the context of increasing uncertainty within global supply chains, it is imperative to gain a comprehensive understanding of prevalent and emerging risks, the key factors influencing their severity, and effective strategies for managing and mitigating these risks (Salamai et al., 2019; Chopra et al., 2021). This study aims to synthesize existing literature to provide a framework that assists companies in developing more resilient and responsive risk management strategies, thereby enhancing their ability to navigate the complexities of modern supply chains (Ho et al., 2015; "A Hybrid Model for Supply Chain Risk Management Based on Five-dimensional Sustainability Approach in Telecommunication Industry", 2022; Tang, 2023).

3.2 Key Factors Influencing Supply Chain Risk Severity and Impact

The severity and impact of risks in global supply chains are influenced by a multitude of interrelated factors, with complexity being a primary concern. A longer and more intricate supply chain inherently increases the potential for disruptions, as it involves multiple suppliers across various geographical locations. This complexity can lead to logistical uncertainties, regulatory discrepancies, and geopolitical risks that disrupt the flow of goods and raw materials. For instance, the bullwhip effect, where minor disruptions can escalate into significant impacts throughout the supply chain, is more pronounced in lengthy supply chains (Reynolds, 2024; Shishodia et al., 2021). The interconnectedness of supply chain components

means that a failure in one area can reverberate throughout the entire system, highlighting the need for robust risk management strategies. Technological dependence is another critical factor influencing supply chain risk. While advancements such as digitalization, artificial intelligence (AI), and blockchain enhance efficiency and transparency, they also introduce vulnerabilities. Cyberattacks, including ransomware incidents, can severely disrupt operations, leading to production delays and eroded customer trust (Zhi, 2024; Pu, 2024).

Furthermore, the adoption of immature technologies or the absence of industry standards can complicate risk management efforts, making organizations more susceptible to disruptions (Ding, 2024). The interplay between technology and supply chain resilience underscores the necessity for firms to balance innovation with risk mitigation strategies. Organizational resilience is pivotal in determining a company's ability to respond to and recover from risks. Companies that implement effective risk management frameworks—such as supplier diversification, maintaining buffer stock, and developing comprehensive business continuity plans—are generally better equipped to handle disruptions compared to those relying solely on just-in-time inventory strategies (Reynolds, 2024; Shishodia et al., 2021). The agility of an organization, defined by its capacity to adapt swiftly to changing conditions, is essential for managing disruptions effectively (Reynolds, 2024; Ding, 2024). Research indicates that firms that prioritize dynamic knowledge management and organizational innovation tend to exhibit enhanced resilience in volatile environments (Ding, 2024; Maharjan, 2024).

Market dynamics and consumer demand also play significant roles in shaping supply chain risks. Fluctuating demand can complicate production capacity planning and inventory management, leading to inefficiencies and increased risk exposure (Yan et al., 2022). Additionally, the growing emphasis on sustainability and ethical sourcing is reshaping supply chain strategies, compelling companies to adapt their operations to align with consumer expectations and regulatory requirements (Holloway, 2024; Reynolds, 2024). As consumer preferences evolve towards more sustainable products, organizations must proactively adjust their supply chain strategies to remain competitive and mitigate risks associated with changing market conditions (Holloway, 2024; Reynolds, 2024). In conclusion, understanding the multifaceted factors influencing supply chain risk severity is crucial for organizations aiming to enhance their resilience and competitive edge. By developing comprehensive mitigation strategies that address complexity, technological dependence, organizational resilience, and market dynamics, companies can better prepare for potential disruptions and ensure continuity in an increasingly uncertain global landscape.

3.3 Strategies and Best Practices for Mitigating Supply Chain Risks

In the context of mitigating supply chain risks, companies are increasingly adopting a variety of strategies to enhance operational continuity and resilience. One of the most critical strategies is supplier diversification. This approach reduces reliance on a single supplier or geographic region, which can be particularly vulnerable to disruptions caused by natural disasters, geopolitical tensions, or supplier insolvency. Research indicates that a diversified supplier network not only enhances flexibility but also improves competitive pricing and bargaining power, thereby minimizing the adverse effects of disruptions on the supply chain (Lin et al., 2021; Maemunah, 2024).

Digitalization, particularly through the integration of the Internet of Things (IoT), blockchain technology, and artificial intelligence (AI), significantly enhances supply chain visibility and transparency. These technologies enable real-time tracking of goods, predictive analytics for potential disruptions, and improved efficiency in inventory management and logistics. For instance, the implementation of digital twins—virtual representations of physical supply chains—has gained traction as a means to simulate risk scenarios and develop robust mitigation strategies (Wang et al., 2020; Lee et al., 2017). Furthermore, the use of AI and big data analytics allows companies to transition from reactive to proactive risk management,

identifying patterns and optimizing resource allocation before disruptions occur (Choudhary et al., 2022; Yin & Ran, 2022).

Collaboration with stakeholders, including suppliers and logistics partners, is another vital component of effective supply chain risk management. Strong relationships foster better communication and coordination, which are essential during emergencies. Strategic partnerships can also facilitate flexible contracts and adaptive payment systems, enhancing overall supply chain resilience (Kartikasari & Hendar, 2020; Beigi, 2024; McMaster et al., 2020). Trust-based initiatives, such as Vendor Managed Inventory (VMI) and collaborative planning, further integrate supply chain processes, reducing uncertainty in supply and demand (Huynh, 2021; Ali et al., 2021).

Moreover, the integration of sustainable practices into supply chain management is becoming increasingly important. Companies face growing pressure from consumers and regulators to adopt environmentally friendly practices. Strategies such as utilizing renewable energy, optimizing logistics, and ensuring ethical procurement not only mitigate operational risks but also enhance corporate reputation and competitiveness in a socially conscious market ("Weathering the Storm: Supply Chains and Climate Risk", 2024; Rezaei-Arangdad, 2024). By embedding sustainability into their supply chains, organizations can address long-term risks while capitalizing on emerging market opportunities. In summary, the combination of supplier diversification, digitalization, stakeholder collaboration, and sustainable practices forms a comprehensive approach to mitigating supply chain risks. By leveraging these strategies, companies can enhance their resilience and adaptability in an ever-evolving global landscape characterized by uncertainty and rapid change.

4. DISCUSSION

The study of risks in global supply chains reveals a complex landscape where traditional challenges such as operational, financial, and environmental risks continue to dominate. However, emerging risks related to digital threats and geopolitical uncertainties are increasingly recognized as critical factors that require attention in modern supply chain management. Previous research has primarily focused on traditional risks, but recent findings indicate that technological advancements and global policy shifts are introducing new challenges that necessitate innovative and proactive risk mitigation strategies (Wieland & Wallenburg, 2012; Colicchia et al., 2019; Ivanov et al., 2018).

From a managerial perspective, the implications of these findings are significant. Companies must adopt data-driven and technology-enhanced approaches to effectively manage operational and financial risks. For instance, predictive analytics can be employed to anticipate disruptions and enhance responsiveness (Ivanov et al., 2018; Wang et al., 2016). Moreover, improving cybersecurity measures within supply chain systems is essential to counteract the rising threat of digital risks (Colicchia et al., 2019; Layode, 2024). In light of geopolitical instability and the risks associated with supplier monopolies, diversifying supply sources and fostering strategic relationships with multiple suppliers are effective strategies to bolster supply chain resilience (Lopes et al., 2022; Stevens & Teal, 2023).

Despite the comprehensive insights provided by this study, several limitations must be acknowledged. The reliance on a literature-based approach restricts the analysis to a more general perspective rather than offering industry-specific insights. Furthermore, the absence of empirical data limits the ability to validate the effectiveness of proposed risk mitigation strategies in real-world scenarios (Frederico et al., 2021; Namdar et al., 2020). Consequently, while the findings are conceptually robust, they call for further empirical research to substantiate the proposed strategies and their applicability across various sectors.

Future research directions should focus on in-depth empirical studies examining the effectiveness of specific risk mitigation strategies tailored to different industries, such as manufacturing, pharmaceuticals, and technology. Additionally, exploring the role of emerging

technologies like artificial intelligence and blockchain in enhancing supply chain transparency and resilience presents a promising avenue for further investigation (Saberi et al., 2018; Grant, 2024).

5. CONCLUSION

This research succeeded in identifying various risks faced by global supply chains, grouping these risks into two main categories: traditional risks and emerging risks. Traditional risks such as operational disruptions, financial risks, and natural disasters remain key challenges, but emerging risks such as digital and cyber threats, as well as geopolitical instability, are increasingly dominating attention in supply chain management. In addition, factors such as supply chain complexity, dependence on technology, organizational resilience, and market dynamics also influence the severity and impact of the risks faced.

This research also highlights various mitigation strategies that companies can implement, including supplier diversification to reduce dependence on a single source, the application of digital technology such as IoT to increase supply chain visibility and transparency, and the use of proactive risk management with predictive models to anticipate potential disruptions. In addition, close collaboration with stakeholders and the implementation of sustainable supply chain practices are increasingly important to reduce environmental impacts and regulatory risks that can arise.

The main contribution of this research is to enrich the literature on supply chain risk management by including developing risk perspectives, as well as providing insight into best practices that can be applied in supply chain risk management. This research also contributes to industry practice by suggesting a technology-based approach and stronger collaboration between companies and suppliers, as well as by emphasizing the importance of diversification and adaptation to rapid global change.

Practical advice for companies is for them to strengthen the resilience of their supply chains by adopting the latest technology that can increase visibility and responsiveness, strengthen relationships with suppliers to create mutually beneficial partnerships, and carry out more proactive risk planning to anticipate possible disruptions. Additionally, companies need to consider broader risks, including environmental and geopolitical impacts, and include these factors in their risk management strategies to ensure long-term business viability and sustainability.

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