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How Companies Manage Risk in the Supply Chain Through an ESG Approach?

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ABSTRACT

This study explores how companies manage risks in their supply chains through the integration of Environmental, Social, and Governance (ESG) principles. Using a systematic literature review of 10 SCOPUS-indexed journal articles, the research identifies key ESG practices and their roles in mitigating environmental, social, and governance-related risks. The findings show that ESG-driven supply chain management enhances organizational resilience, reduces vulnerabilities, and builds stakeholder trust. Environmental risks are addressed through sustainable sourcing and green logistics; social risks are mitigated via ethical labor practices, supplier audits, and community engagement; and governance risks are managed through transparency, compliance frameworks, and technological solutions such as blockchain. However, implementation challenges remain, including inconsistent ESG standards, limited supplier visibility, and resource constraints, particularly for SMEs. The review concludes that while ESG integration is still evolving, it serves as a strategic tool for sustainable and resilient supply chain management in a globally uncertain environment.

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1. INTRODUCTION

In today's volatile and interconnected global economy, managing risks in the supply chain has become a critical strategic priority for companies, as disruptions—whether caused by environmental catastrophes, labor unrest, political instability, or ethical violations—can severely impact operational continuity, financial performance, and corporate reputation. Traditional risk management approaches, which often focus narrowly on financial and operational indicators, are increasingly inadequate in addressing the complex, multidimensional nature of modern supply chain risks. To respond effectively, companies are adopting more comprehensive and proactive strategies, such as holistic risk identification that encompasses operational, financial, environmental, and geopolitical factors to better understand diverse sources of risk and develop mitigation strategies [1]. Technological investments in AI, IoT, and blockchain are enhancing visibility, predictive capabilities, and real-time monitoring, enabling proactive risk identification and strengthening supply chain resilience [1], [2].

Furthermore, supplier diversification and collaboration—through varied sourcing strategies and robust partnerships—improve problem-solving capacity and help maintain continuity in the face of disruptions [1], [3]. Organizationally, effective supply chain risk management depends on leadership commitment and fostering a culture of resilience, adaptability, and continuous learning [1], supported by training and simulation exercises that prepare employees to manage disruptions efficiently [1].

In response to the growing complexity of supply chain risks, many organizations are turning to the Environmental, Social, and Governance (ESG) framework as a more comprehensive and proactive approach to risk management. ESG principles offer a holistic perspective that not only supports economic value creation but also integrates the broader impacts of business activities on the environment, society, and governance structures. By embedding ESG considerations into supply chain operations, companies aim to enhance resilience, ensure compliance with global standards, and meet the rising expectations of stakeholders, including investors, regulators, and consumers. ESG integration helps companies adapt to regulatory changes and manage risks associated with environmental and social factors, thereby strengthening organizational resilience [4], [5]. It also enables firms to maintain competitiveness by ensuring compliance with evolving international standards and aligning operations with investor expectations [6], [7]. As stakeholder awareness of corporate social responsibility and environmental stewardship increases, ESG frameworks become vital in addressing these concerns and fostering sustainable development [5], [6]. Prominent examples like Unilever and Tesla demonstrate that ESG integration can lead to enhanced stakeholder trust and improved brand value, contributing to long-term business success [5]. Furthermore, the adoption of advanced technologies such as AI, big data, and blockchain within logistics operations supports the implementation of ESG principles by promoting transparency and sustainability [8]. Smart logistics solutions, including AI-driven route optimization and the use of electric vehicles, also contribute to reducing carbon emissions and improving energy efficiency, thus aligning supply chains with ESG goals [8].

The application of ESG in supply chain management is gaining traction across industries, yet scholarly understanding of how ESG principles function as risk mitigation tools remains fragmented. While some studies underscore environmental practices such as sustainable sourcing and carbon footprint reduction as critical in minimizing climate-related risks, others emphasize social dimensions including labor practices, supplier welfare, and community engagement as vital to maintaining supply chain integrity. Additionally, governance mechanisms—such as transparency, adherence to ethical standards, and regulatory compliance—are recognized for their role in reducing corruption, fraud, and legal liabilities. Given the growing academic and practical interest in this area, this paper aims to analyze how companies manage supply chain risks through ESG strategies by conducting a literature review-indexed academic article. The objective is to synthesize the current state of research, identify common ESG-based risk management practices, and highlight gaps and future directions for both scholars and practitioners, thereby contributing to the broader discourse on sustainable and resilient supply chain management in an era of heightened global risk and stakeholder scrutiny.

2. LITERATURE REVIEW

2.1. Environmental Risk Management in Supply Chains

Green Supply Chain Management (GSCM) is increasingly recognized as a vital strategy for mitigating environmental risks in supply chains, which are often exacerbated by climate change, resource scarcity, and stringent environmental regulations. By integrating environmental considerations into every stage of the supply chain, companies can address these challenges while enhancing

their sustainability performance through practices such as carbon footprint reduction, renewable energy sourcing, and waste minimization. These GSCM practices enable firms to anticipate and mitigate environmental disruptions, thereby reducing long-term operational and reputational risks. Specifically, companies are focusing on reducing carbon emissions through energy-efficient processes and renewable energy adoption, aligning with both climate goals and regulatory requirements [9], [10]. Waste minimization through recycling and reuse contributes to resource conservation and cost efficiency [11], while eco-design principles ensure that products are environmentally friendly throughout their lifecycle, thus reducing environmental hotspots [12]. To support these efforts, tools and certifications such as ISO 14001 provide frameworks for evaluating and improving suppliers' environmental performance, allowing early identification of risks [13], and life-cycle assessment tools help companies assess the environmental impact of their products and processes, supporting informed decision-making and comprehensive risk management [9].

2.2. Social Risk Mitigation Strategies

Companies are increasingly adopting strategies to address social risks in global supply chains, with a strong emphasis on labor rights, working conditions, and community relations. These strategies include implementing supplier codes of conduct, conducting social audits, and promoting supplier training programs to ensure compliance with labor standards and foster ethical practices among supply chain partners. For instance, supplier codes of conduct are used to enforce adherence to labor norms by leveraging collective buyer power [14], while social audits provide mechanisms for monitoring and verifying compliance, thereby enhancing accountability and transparency [15]. Training programs like Tchibo's 'Worldwide Enhancement of Social Quality' engage both workers and managers in participatory dialogue to address human rights challenges and encourage co-creation and empowerment within the supply chain [16]. Building long-term relationships with suppliers promotes mutual capacity building and trust, reducing conflict risks [14], while community development initiatives help companies build social capital and mitigate potential opposition from local communities [17]. Moreover, stakeholder pressure—from consumers and investors—has been a critical driver for firms to adopt socially responsible supply chain practices, often resulting in the implementation of comprehensive human rights due diligence processes [15], [17].

2.3. Governance and Ethical Supply Chain Practices

Companies are increasingly embedding governance frameworks into their supply chain operations to mitigate risks such as corruption, fraud, and non-compliance, utilizing tools like internal compliance systems, third-party audits, and whistleblower mechanisms to uphold transparency and accountability. The integration of Environmental, Social, and Governance (ESG) metrics into supplier evaluation and procurement decisions further reinforces these governance efforts, ensuring ethical standards throughout the supply chain. Firms with robust governance mechanisms—characterized by higher institutional ownership and strong board dynamics—are generally less exposed to corporate risks [18], while industries such as energy rely heavily on comprehensive procurement policies and supplier evaluation frameworks aligned with international regulations like ISO standards for compliance and safety [19]. The use of blockchain-based governance models plays a pivotal role in decentralizing control, enhancing data integrity, and combating corruption [20], with digital tools such as blockchain and AI significantly improving transparency and traceability, thereby reducing fraud and regulatory breaches [19]. Furthermore, supplier codes of conduct serve as key instruments in promoting ESG objectives and governance transparency by defining clear ethical expectations and operational standards across supply chains [21], collectively contributing to increased investor

confidence and sustainable corporate performance.

3. METHODS

This study adopts the systematic literature review framework by Tranfield et al. (2003), ensuring a structured and replicable process through the phases of planning, conducting, and reporting the review. Data were exclusively sourced from the SCOPUS database due to its credibility and relevance to business, sustainability, and supply chain research. Articles were selected based on inclusion criteria such as peer-reviewed status, focus on ESG in supply chain risk management, English language, and publication years between 2012–2024. Non-peer-reviewed sources, book chapters, and articles lacking detailed ESG analysis were excluded. A keyword search using Boolean operators yielded 74 documents, from which 10 articles were selected after careful screening.

A thematic analysis was applied to synthesize the selected articles, with manual coding used to extract data consistently. The analysis focused on identifying ESG practices in supply chains, their role in mitigating environmental, social, and governance risks, implementation challenges, and strategic trends. The insights were grouped into ESG-related themes and examined for their impact on risk management. This process provided a concise understanding of how ESG strategies contribute to more resilient and sustainable supply chain operations.

4. RESULTS AND DISCUSSION

4.1. ESG Integration as a Risk Management Framework

Across all reviewed articles, there is a strong consensus that integrating ESG into supply chain management functions as a strategic framework for risk mitigation and resilience. ESG is no longer considered a peripheral or compliance-based activity, but rather a core element in ensuring supply chain robustness. Studies by Klassen & Vereecke (2012) and Ivanov & Dolgui (2020) highlight that ESG-oriented firms are more capable of anticipating, absorbing, and recovering from disruptions such as environmental disasters, social unrest, or governance breakdowns. This resilience is achieved through practices such as embedding ESG criteria into supplier selection, integrating ESG risks into enterprise risk management systems, and developing ESG-based Key Performance Indicators (KPIs) aligned with operational goals.

Specifically, companies are increasingly applying ESG standards in supplier selection processes to ensure adherence to sustainability and ethical norms, thereby reducing environmental and social risk exposure [22], [23]. Additionally, incorporating ESG risks into broader enterprise risk management systems enables proactive identification and mitigation of potential disruptions [24], [25]. The formulation of ESG KPIs further ensures that performance metrics are not only operationally relevant but also sustainability-driven, reinforcing accountability across supply chain tiers and offering competitive advantages in innovation and market positioning [22], [26].

4.2. Environmental Risk Mitigation Practices

Environmental risks such as climate change, carbon emissions, and natural resource depletion are prominently discussed in the literature as critical concerns in supply chain management. To address these risks, companies are adopting strategies such as sustainable sourcing and supplier certification, which involve eco-friendly procurement practices to reduce environmental impact. Certifications like FSC and ISO 14001 ensure supplier compliance with environmental standards, helping to mitigate risks related to resource depletion and pollution [27], [28]. Supplier initiatives are often driven by strategic purchasing decisions and the perceived consequences of inaction, motivating environmentally responsible behavior [28]. Additionally, life-cycle assessments (LCAs) are widely used to evaluate the environmental footprint of products from production to disposal, enabling companies to identify hotspots and reduce carbon emissions and resource usage [13], [29]. LCAs are particularly relevant in

manufacturing sectors through the implementation of closed-loop supply chains that decrease reliance on virgin materials [29].

Circular economy models further support environmental risk mitigation by promoting waste reduction, resource efficiency, and material reuse. These models are key to shifting from traditional linear supply chains to more sustainable and regenerative systems [29]. In sectors like food and agriculture, circular economy practices include water usage monitoring, biodiversity preservation, and climate-resilient sourcing, all of which reduce environmental exposure and build ecological resilience [30]. Scholars argue that companies reduce environmental vulnerabilities through the combination of sustainable sourcing, LCAs, and circular models, which together contribute not only to risk mitigation but also to improved operational efficiency and stronger brand reputation in environmentally conscious markets.

4.3. Social Risk Management Strategies

The review identifies labor rights, health and safety, and supplier diversity as critical components of social risk in supply chains. Companies are increasingly relying on tools such as supplier codes of conduct, social audits, legal frameworks, and technology solutions to mitigate these risks. Supplier codes of conduct have evolved to include more explicit provisions on human rights violations, encouraging collaborative resolution rather than immediate termination of partnerships with non-compliant suppliers [31]. In response to incidents like the 2013 Bangladesh garment factory disaster, social audits and third-party inspections have gained prominence to ensure compliance with ethical labor practices, particularly in high-risk regions [32]. Legal concepts such as vicarious liability are also being explored to extend corporate accountability up the supply chain, while voluntary frameworks like the International Accord for Health and Safety complement regulatory efforts to improve working conditions [33].

In addition, technology solutions aimed at empowering workers and addressing human rights risks are being developed, though many have yet to reach significant scale or impact [34]. Companies are also implementing capacity-building programs, enforcing supplier codes aligned with ILO standards, conducting regular site inspections, and promoting gender equality and fair labor through supplier development initiatives. These practices are designed to reduce exposure to social risks, safeguard worker rights, and enhance supply chain integrity. Furthermore, fostering long-term relationships with local suppliers and investing in community engagement are key to building social trust, which in turn helps companies avoid reputational damage, supply disruptions, and legal consequences stemming from non-compliance in social responsibility.

4.4. Governance Mechanisms for Supply Chain Transparency

Governance risks—such as corruption, lack of accountability, and regulatory non-compliance—pose significant threats to the integrity of supply chains. To address these risks, companies are increasingly adopting governance frameworks that emphasize ethical sourcing, stakeholder engagement, and compliance with regulatory and industry standards. Ethical sourcing is not only a strategy to manage reputational risk but also a response to growing pressure from stakeholders—including customers, governments, and NGOs—to uphold social, environmental, and economic standards [35]. Governance mechanisms such as regulatory frameworks, collaborative initiatives, and industry standards play a vital role in promoting sustainability, transparency, and accountability across supply networks [1]. Supplier codes of conduct further reinforce these efforts by clearly defining ESG objectives and ethical expectations for suppliers [21].

Technological advancements have also become key enablers of governance in supply chain management. Tools like blockchain and AI enhance transparency and traceability, allowing firms to monitor supplier behavior and ensure compliance with ethical and legal standards [22]. These

technologies support the implementation of third-party verification systems and whistleblower mechanisms, contributing to greater accountability. Companies are also aligning procurement decisions with ESG risk scoring models to guide supplier selection and performance evaluation. For instance, major retailers have adopted blockchain systems to trace the origin of goods, ensuring supplier adherence to governance standards. These systems not only mitigate governance-related risks but also provide competitive advantages by enhancing visibility, trust, and operational integrity throughout the supply chain.

4.5. Challenges in ESG-Based Risk Management

While ESG offers substantial advantages for building sustainable and resilient supply chains, the literature highlights several key challenges that hinder its effective implementation. These include the lack of standardized ESG metrics, which complicates comparisons across suppliers and sectors due to disparities in rating systems and frameworks [7], [36]. Additionally, limited visibility beyond Tier-1 suppliers remains a major obstacle, making it difficult for companies to monitor ESG compliance throughout the entire supply network [7], [37]. This issue is compounded by cost and resource constraints, particularly among small and medium enterprises (SMEs), which often lack the financial and technical capacity to implement ESG initiatives effectively [7], [38]. Regulatory variation across countries further exacerbates the situation, creating complex compliance requirements that global supply chains must navigate [37].

Addressing these barriers requires collective action involving governments, industry bodies, and corporations to promote regulatory harmonization and improve ESG coherence across borders. The development of unified global ESG standards is seen as essential to enhance comparability and sustainability performance [7]. Moreover, stronger cross-sector collaboration and transparency are necessary to improve ESG integration, particularly in multi-tier supply chains. Multinational corporations are encouraged to play a leadership role by cascading ESG expectations through their supply networks and supporting smaller partners through technical assistance, funding, or capacity-building programs. These coordinated efforts are vital for overcoming strategic-level constraints and ensuring that ESG principles are adopted widely and effectively across diverse supply chain contexts.

4.6. Strategic Implications and Future Directions

The review suggests that companies can enhance supply chain resilience and value creation by embedding ESG performance into contractual obligations and procurement policies, engaging in multi-stakeholder partnerships to align ESG standards, and leveraging technology for ESG data collection, monitoring, and reporting. Furthermore, future research should explore quantitative modeling of ESG impacts on risk mitigation and financial performance, the development of sector-specific ESG risk frameworks, and the integration of ESG principles in emerging market supply chains where institutional governance remains weak.

5. CONCLUSION

The integration of ESG principles into supply chain management has emerged as a strategic approach to addressing complex and interconnected risks. Based on a review of 10 SCOPUS-indexed articles, this study finds that companies incorporating environmental, social, and governance criteria into their supply chain operations are better positioned to navigate disruptions, uphold ethical standards, and ensure compliance with regulations. Environmental initiatives like sustainable sourcing and waste reduction help mitigate climate-related risks; social strategies involving ethical labor practices and stakeholder engagement reduce reputational and operational vulnerabilities; and governance mechanisms such as compliance audits and digital traceability tools enhance transparency while minimizing the risk of fraud and corruption. Collectively, these ESG-based strategies contribute to

building supply chains that are resilient, responsible, and adaptable to future challenges.

However, the effective implementation of ESG in supply chain risk management still faces notable barriers. Challenges such as the absence of standardized ESG metrics, the high cost of compliance, and limited visibility across multi-tiered supply chains often impede progress. To overcome these hurdles, firms must promote cross-sector collaboration, invest in ESG capacity-building initiatives, and support the harmonization of regulatory frameworks. In conclusion, ESG should not be viewed merely as a compliance obligation but as a long-term value creation strategy for modern supply chains. As global risks continue to escalate, integrating ESG into supply chain operations will be essential for ensuring sustainability, business continuity, and competitive advantage. Future research should prioritize empirical evaluation of ESG's effectiveness, particularly within emerging markets and high-risk industries.

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