



Green Supply Chain Emission Reduction and Practice in a Dual Carbon Context

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Abstract. In the context of global climate initiatives, achieving dual-carbon targets has become a major priority. Green supply chain practices provide an integrated approach to reducing emissions, integrating sustainable development, and optimizing resource use. This paper explores green supply chain practices to reduce emissions from a stakeholder perspective, focusing on the roles and responsibilities of governments, businesses, suppliers, manufacturers, consumers, and recyclers. Through an assessment of positive and negative factors in green supply chains, the paper explores the effectiveness of current practices and identifies challenges. On the positive side, green supply chain has led to significant reductions in carbon footprints, particularly in the manufacturing and logistics sectors, improving environmental quality and indirectly contributing to economic success by enhancing brand reputation and customer loyalty. However, negative factors such as high initial costs, technological limitations, and the risk of "greenwashing" also present challenges. In addition, conflicts among supply chain partners, due to differing interests and varying levels of environmental awareness, may lead to inefficiencies or unintended social impacts. Finally, the paper provides theoretical support and practical insights into future recommendations for advancing green supply chains in support of the dual-carbon agenda, such as fostering close collaboration among stakeholders and strategically investing in advanced and innovative technologies.

Keywords: Dual Carbon Target, Green Supply Chain, Green Finance, Stakeholder Theory, Emission Reduction.

1 Introduction

With global climate change and environmental protection now widely recognized as critical issues, dual carbon targets—carbon peaking and carbon neutrality—have been proposed to transition economies toward sustainability. Carbon peaking refers to reaching a maximum point in carbon dioxide emissions before declining, while carbon neutrality aims to offset emissions to achieve “net-zero” emissions within a specific region and timeframe [1]. Achieving these goals underscores the importance of the green supply chain as a key strategy, integrating sustainable principles in logistics, information, capital, and knowledge flows across supply chain participants. This

model seeks to enhance environmental protection, resource efficiency, and social responsibility while maintaining economic viability [2].

Currently, green supply chain research in the dual-carbon context mainly focuses on a few key areas. One area is performance assessment, where studies use tools like life cycle assessment (LCA) to gauge environmental and economic impacts [3]. Another focus is on applying green supply chain practices across industries—especially in manufacturing and logistics—where research shows these practices can cut emissions and boost efficiency [4]. There's also a strong emphasis on designing and optimizing green supply chains, with frameworks that help make complex networks more sustainable [5]. These foundational studies have laid important groundwork for understanding how green supply chains contribute to dual-carbon goals.

The purpose of this paper is to deeply explore the emission reduction practice of the green supply chain in the context of dual-carbon, analyze the roles, responsibilities, and interaction mechanisms of each subject in the green supply chain in the process of emission reduction through the perspective of stakeholder theory, and assess its impact and effect, to provide theoretical support and practical guidance for the construction of a more efficient and environmentally friendly supply chain system, and contribute useful references to the promotion of the dual-carbon goal. To provide theoretical support and practical guidance for the construction of a more efficient and environmentally friendly supply chain system, and to contribute to the realization of the dual-carbon goal.

2 Overview of Dual Carbon Targets and Green Supply Chain

China's dual-carbon targets, set in 2020, aim for carbon emissions to peak by 2030 and achieve carbon neutrality by 2060. Internationally, the Paris Agreement similarly commits nations to curb emissions and reach net zero by mid-century, emphasizing the urgency of climate action [6]. In this context, green supply chains have emerged as a key approach, incorporating sustainability principles at each stage of the supply chain—from material sourcing and production to transportation and disposal. This model emphasizes environmental responsibility, resource efficiency, and transparency across all operations. To align with dual-carbon goals, green supply chains are expected to support an energy transition through optimized energy use and low-carbon innovations [7].

3 Green Supply Chain Emission Reduction Practices from Stakeholder Perspective

3.1 Government and Enterprises: Policy Guidance and Emission Reduction Responsibility

In both the Chinese and international contexts, governments are both policymakers and implementers and monitor and play a key role in establishing frameworks that encourage sustainable practices in the supply chain. Policies that promote green tech-

nologies and incentivize emissions reductions are critical. By introducing a series of environmental regulations, standards, and policies, governments provide legal safeguards and institutional frameworks for the development of green supply chains. Empirical studies have shown that government regulation through the enactment of appropriate subsidies as well as tax policies can increase demand and improve green goods in green supply chains, thereby benefiting the environment [8]. In China, the “dual carbon” policy framework includes specific incentives and standards to push firms toward carbon reduction goals [9].

Enterprises are actively responding to the call to reduce emissions under the guidance of government policies and are assuming their responsibility to reduce emissions. Many companies have adopted the sustainability framework, GRI, to set clear emissions reduction targets and provide guidance on measuring and reporting environmental performance, enabling organizations to set specific, measurable goals for reducing greenhouse gas emissions. A growing number of companies are committing to transitioning their operations to a very high percentage of renewable energy, thereby significantly reducing their carbon footprint.

3.2 Suppliers and Manufacturers: Green Procurement and Production

Suppliers are the starting point of the supply chain as are other firms or individuals that provide the required raw materials, components, products, or services to the manufacturing firms or service providers. Manufacturers, on the other hand, are companies or individual organizations that process, produce, and manufacture products or semi-finished products in the supply chain, are directly involved in the production process of the products, and are responsible for designing and implementing the production strategy, performing quality control, and determining the specifications of the final products.

In green supply chain reduction, there is a close cooperative relationship between suppliers and manufacturers. Both suppliers and manufacturers are important stakeholders in the green supply chain, and they share the responsibility for emission reduction. Suppliers support manufacturers in achieving emission reduction targets by providing environmentally friendly materials and technologies. At the same time, manufacturers push suppliers to improve their environmental performance by optimizing their production processes and procurement strategies. This partnership contributes to environmental protection and emission reduction throughout the supply chain.

In terms of green procurement, green procurement practices, which involve selecting suppliers based on their environmental performance, can significantly reduce emissions. Studies have shown that if companies implement green procurement policies, they can minimize resource waste and reduce emissions along the supply chain. Many companies have established stringent green procurement standards and processes that require suppliers to provide materials and technologies that meet environmental requirements.

In terms of green design, manufacturers can implement eco-design principles to minimize waste and energy consumption throughout the production process. For ex-

ample, Tesla manufacturers reduce the energy consumption and emissions of their vehicles by optimizing the body structure and using lightweight materials [10].

In terms of green production, manufacturers use advanced production processes and equipment to improve energy efficiency and resource utilization. Utilizing renewable materials and energy sources in the production process can significantly reduce the carbon footprint of a product.

3.3 Consumers and Recyclers: Green Consumption and Circular Economy

Consumers and recyclers represent the demand side of green supply chains. As environmental awareness increases, consumers are more likely to purchase products that utilize environmentally friendly materials and technologies with lower energy consumption and emissions, and this demand is an important driver of sustainable practices in the supply chain. Companies are increasingly employing green marketing strategies to appeal to these consumers, which not only boosts sales but also reinforces the importance of environmental responsibility [11]. By educating consumers about the benefits of green products, companies can build loyalty, improve brand reputation, and make green products more attractive.

The role of recyclers in the supply chain is equally important as they contribute to the circular economy by promoting the reuse, recycling and repurposing of materials. Effective recycling systems help to reduce waste, conserve resources and lower emissions, thus aligning with dual carbon goals [12].

4 Effectiveness Assessment and Challenges of Green Supply Chain Emission Reduction Practices

4.1 Actual Effect and Positive Impact of Emission Reduction Practices

Empirical evidence suggests that green supply chain management(GSCM) practices can significantly reduce environmental impacts, particularly in the manufacturing and logistics industries [4]. For example, companies that implement green logistics and production processes report significant reductions in their carbon footprint [13]. By reducing energy consumption and waste emissions, green supply chain mitigation practices help to improve environmental quality and thus mitigate climate change. In addition, green practices indirectly contribute to economic success by being socially responsible, enhancing brand reputation, and fostering customer loyalty.

4.2 Challenges and Negative Impacts of Emission Reduction Practices

Despite the positive outcomes, GSCM implementation faces significant challenges, such as high initial costs, resistance to change, and technological limitations [14]. Green supply chain emission reduction practices require enterprises to have appropriate technological research and development capabilities to develop more environmentally friendly and energy-efficient products and production processes. However, many

enterprises currently have limited investment in technological innovation and lack independent R&D capabilities. Some studies have also emphasized the possibility of “greenwashing,” where firms exaggerate their green practices without achieving substantial emissions reductions in the current context of difficult all-encompassing regulation [15]. In addition, green supply chain emission reduction practices require enterprises throughout the supply chain to act together to achieve consistent environmental protection goals. However, due to the different interests of each enterprise, environmental awareness and management levels vary, resulting in conflicts and contradictions that are likely to arise in the process of cooperation, such complexity may lead to inefficiency in the greening of the supply chain, or even unintended negative social impacts, such as layoffs.

5 Prospects and Development Suggestions

5.1 Development Trend of Green Supply Chain under the Background of Dual Carbon

With dual carbon targets reshaping environmental goals, green supply chains are becoming essential to corporate and governmental sustainability strategies. Emerging trends include the integration of digital technologies, such as the Internet of Things (IoT) and artificial intelligence, which enable real-time emissions monitoring and optimized resource use [16]. The circular economy is also on the rise, as companies adopt practices focused on resource efficiency through reuse and recycling, which not only reduce emissions but also generate economic value [12] Increasing regulatory pressure further encourages businesses to adopt green practices and gain competitive advantages through early compliance [9].

5.2 Development Suggestions and Strategies

Effective development of green supply chains requires coordinated strategies across stakeholders. Strengthening collaboration with suppliers, consumers, and regulatory bodies enhances shared best practices and resource synergies, promoting sustainability throughout the supply chain [4].

Investment in green technologies is essential. By prioritizing IoT-based monitoring, data analytics, and renewable energy, companies can optimize emissions tracking and supply chain performance, making technological innovation a cornerstone of sustainable growth [17]. Comprehensive sustainability metrics for environmental, social, and economic performance further support companies in meeting both internal targets and public transparency expectations [5].

Active involvement in policy discussions allows companies to help shape environmental regulations. By viewing compliance as an opportunity rather than an obligation, forward-thinking companies can enhance both efficiency and brand reputation. With clear frameworks and aligned goals, businesses that adopt these strategies are well-positioned to lead in the transition toward sustainable, low-carbon supply chains.

6 Conclusion

The role of green supply chains in achieving dual carbon targets is critical, as evidenced by the practices and outcomes seen across industries. By integrating sustainability into supply chain operations, companies not only contribute to emission reduction but also enhance their competitive positioning and resilience. Through policy guidance, green procurement, circular economy practices, and transparency, green supply chains are proving to be essential frameworks for reducing environmental impacts while maintaining economic performance. Research shows that government policies, stakeholder collaboration, and digital technologies collectively amplify the effectiveness of these efforts, aligning businesses with global sustainability objectives.

Despite the progress made, there are notable limitations within the current research landscape. Much of the literature focuses on large enterprises, leaving gaps in understanding about how small- and medium-sized enterprises (SMEs) adopt green practices and manage associated costs. Additionally, while technological advancements are widely discussed, there remains limited empirical evidence on their long-term impacts and integration across entire supply chains. Future studies could focus on assessing green supply chain practices in diverse contexts, such as across different industry sectors and geographic regions, to gain a broader understanding of how these practices contribute to dual carbon goals. Research on consumer behavior, regulatory impacts, and new technologies (especially blockchain and artificial intelligence in supply chain management) can also provide insights into the evolving role of green supply chains in sustainability. In conclusion, while green supply chains have made significant contributions to the achievement of the dual-carbon goal, continued research, and innovation are essential to realize their full potential and address the complex challenges involved. By filling these research gaps, future research will help refine best practices and support businesses in achieving comprehensive sustainability to accomplish carbon peaking and carbon neutrality.

Reference

1. IPCC.: Summary for policymakers. Global Warming of 1.5 C. Cambridge University Press, New York, (2018).
2. Khan, M. T., Idrees, M. D., Haider, Y.: Industry 4.0 impacts on operational and green innovation performances with the mediation of green practices. *International Journal of Production and Performance Management*, (2023).
3. Zhu, Q., Sarkis, J.: Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management* **22**(3), 265–289 (2004).
4. Rao, P., Holt, D.: Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations & Production Management* **25**(9), 898–916 (2005).
5. Seuring, S., Müller, M.: From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production* **16**(15), 1699–1710 (2008).

6. About the Sustainable Development Goals, <https://www.un.org/sustainabledevelopment/sustainable-consumption-production/>, last accessed 2024/11/01.
7. Kumar, S., Teichman, S., Timpernagel, T.: A green supply chain is a requirement for profitability. *International Journal of Production Research* **50**(5), 1278–1296 (2012).
8. Barman, A., Das, R., De, P. K., Sana, S. S.: Optimal pricing and greening strategy in a competitive green supply chain: Impact of government subsidy and tax policy. *Sustainability* **3**(16), 9178 (2021).
9. Zhu, Q., Sarkis, J., Geng, Y.: Green supply chain management in China: Pressures, practices and performance. *International Journal of Operations & Production Management* **25**(5), 449–468 (2005).
10. Sustainability Report 2023, <https://www.tesla.com>, last accessed 2024/10/27.
11. Ottman, J. A., Stafford, E. R., Hartman, C. L.: Avoiding green marketing myopia: Ways to improve consumer appeal for environmentally preferable products. *Environment: Science and Policy for Sustainable Development* **48**(5), 22–36 (2006).
12. Ghisellini, P., Cialani, C., Ulgiati, S.: A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production* **114**, 11–32 (2016).
13. Vachon, S., Klassen, R. D.: Environmental management and manufacturing performance: The role of collaboration in the supply chain. *International Journal of Production Economics* **111**(2), 299–315 (2008).
14. Walker, H., Di Sisto, L., McBain, D.: Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors. *Journal of Purchasing and Supply Management* **14**(1), 69–85 (2008).
15. Delmas, M. A., Burbano, V. C.: The drivers of greenwashing. *California Management Review* **54**(1), 64–87 (2011).
16. Wang, Y., Gunasekaran, A., Ngai, E. W. T.: Big data in logistics and supply chain management: An overview. *International Journal of Production Research* **54**(1), 2–31 (2016).
17. Porter, M. E., van der Linde, C.: Toward a new conception of the environment-competitiveness relationship. *Journal of Economic Perspectives* **9**(4), 97–118 (1995).

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