Research on Green Supply Chain Construction Strategy from the Perspective of Sustainable Development: Taking JD Logistics as an Example

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Abstract

A green supply chain is an inevitable choice for enterprises pursuing high-quality development. This paper conducts a detailed analysis of JD Logistics, a leading company in China's logistics industry. By exploring JD Logistics' green supply chain construction strategy, implementation path, and coordination mechanism, this paper analyzes JD Logistics' actual measures in five major areas: procurement, warehousing, transportation, packaging, and digitalization and technology collaboration. It finds that the main reason why JD Logistics has achieved breakthrough progress in both energy conservation and emission reduction, and resource recycling is that it has utilized scientific and technological empowerment methods and process reshaping measures. On this basis, it has integrated the forces of multiple parties within and outside the industry and supply chain, and actively promoted the energy- and resource-saving green supply chain system achieved through the "Green Flow Plan" and "Carbon Neutrality" actions. This practice has made positive contributions and provided useful reference for the green development and transformation of China's logistics industry and even China's manufacturing industry.

Keywords

sustainable development, green supply chain, supply chain collaboration, JD Logistics

1. Introduction

Seriously climate change and environmental pollution become increasingly serious, the world is paying attention to the issue of sustainable development. Enterprises are the main consumers of resources and the generators of pollutants. The operation of their supply chains has a significant impact on the environment. Therefore, it is necessary to use green supply chain management to achieve efficient resource utilization and maximize ecological benefits. This is the inevitable way for enterprises to achieve sustainable development. It is also a key means for enterprises to reduce their environmental pollution responsibilities, avoid environmental pollution risks, reduce costs, and gain differentiated competitive advantages (Bag et al., 2022).

As a leading domestic e-commerce logistics company, JD Logistics boasts a massive business volume, long supply chains, and complex processes, making it a key industry benchmark for green supply chain transformation. However, the logistics industry's fundamental strategic position and its role in supporting national economic development necessitate high energy consumption and carbon emissions, making green transformation a pressing need. In recent years, JD Logistics has seamlessly integrated its "Green Flow Plan" with its "Carbon Neutrality" initiative to build a comprehensive green logistics system encompassing

packaging, transportation, warehousing, and digital carbon management. Publicly disclosed data and research-based estimates indicate that JD Logistics' full-chain green transformation will result in cumulative carbon reductions exceeding 500,000 tons by 2024, according to the report "JD Logistics' Low-Carbon Practices and Industry Implications. " Regarding transportation, rail freight volume is expected to increase by over 30% year-on-year in 2024, helping to reduce carbon emissions during long-distance transport. Regarding carbon footprint calculation accuracy, JD Logistics' "Jingtanhui" platform integrates 140 types of transport vehicles and over 2,000 carbon emission factors, utilizing models such as LightGBM to achieve a carbon footprint calculation accuracy of 99.5%. As for packaging carbon reduction, its packaging carbon reduction measures have reduced carbon emissions by approximately 69,515 tons by the end of 2023. According to its 2022 ESG report, JD Logistics plans to invest RMB 1 billion between 2022 and 2026 in developing a green, low-carbon, integrated supply chain, and has achieved significant results in the application of green technologies and collaborative management.

However, numerous systemic issues remain. As China's leading provider of intensive supply chain solutions, JD Logistics boasts a nationwide network, a long business chain, and cutting-edge technology research and development, playing a prominent role in industry representation and leadership in the greening of enterprises. Existing research focuses more on the macro-value of green supply chains, with less attention paid to the development of green practices centered on systematic strategic coordination and the implementation of technological innovations. Furthermore, little attention is paid to case studies of large enterprises building systematic strategic frameworks and implementing core technology solutions in the Chinese context. These studies are limited to macro-policies and individual technologies, lacking in-depth case analysis based on system integration and collaboration.

Drawing on the case of JD Logistics and drawing on authoritative international literature, this article analyzes and explores the strategies and implementation results of JD Logistics' green supply chain. Through this case study, we address the following questions: What is the architecture and key strategies of JD Logistics' green supply chain? What is the effectiveness of these strategies when implemented? What challenges exist during implementation? What are the directions for optimizing these strategies by integrating cutting-edge theories? We also hope to enrich green supply chain management theory and provide constructive implementation paths and lessons for Chinese enterprises' green transformation.

2. Current Status of JD Logistics' Green Supply Chain Development

2.1 Overview of JD Logistics

Since establishing its own logistics operations in 2007, it has grown into a comprehensive, high-tech logistics service provider offering comprehensive warehousing, transportation, distribution, large-scale shipments, cold chain, cross-border, and supply chain services. Currently operating over 1,000 warehouses and dozens of highly automated "Asia No. 1" smart logistics parks, JD Logistics manages nearly 10 million square meters of space nationwide, covering virtually every county and district in China. JD Logistics is also rapidly expanding its international presence. As a technology-driven enterprise, JD Logistics adheres to its vision of "leading global efficient logistics and sustainable development through technology." By deeply integrating green and intelligent approaches, JD Logistics has built a resilient, efficient, and environmentally friendly supply chain system for the future.

2.2 Development History of JD Logistics' Green Supply Chain

JD Logistics' green development has evolved from local exploration to systematic advancement. Its landmark initiative was the "Green Flow Plan" launched in 2017. Initially focused on reducing express packaging waste, the project pioneered green packaging exploration through initiatives such as electronic waybills, slimming tape, and reusable express boxes. As society's environmental demands continue to rise, JD Logistics' strategic understanding of the "Green Flow Plan" has gradually deepened. This deepening of strategic awareness has led to the expansion of the Plan's scope to encompass green transportation, green warehousing, and other areas.

In 2020, JD Logistics elevated green initiatives to a new strategic level, officially announcing its participation in the Science Based Targets initiative and setting a 2030 carbon neutrality goal, pledging to reduce its total carbon emissions by 50% by 2030 compared to 2019 levels. During this phase, green supply chain development evolved from a single environmental protection project to a multifaceted, systematic program. In recent years, JD Logistics has continuously invested in many cutting-edge areas, continuously improving its green supply chain system.

2.3 JD Logistics Green Supply Chain Architecture

Built an innovative and forward-looking multi-layered, full-chain green supply chain system. This system, incorporating sustainable development concepts and a digital management platform, encompasses core operational links such as procurement, warehousing, transportation, distribution, packaging, and reverse logistics. Through green procurement, JD Logistics selects environmentally friendly raw material suppliers upstream in the supply chain and develops intelligent and efficient green warehousing to reduce energy consumption and improve operational efficiency. JD Logistics also reduces energy and fuel consumption by developing and utilizing energy-efficient, new-energy delivery vehicles. Furthermore, JD Logistics has established a digital collaborative platform, integrating advanced technologies such as big data, the Internet of Things, and artificial intelligence to ensure that each link operates rationally and plays its due role, ultimately achieving improvements in both environmental performance and operational effectiveness.

3. Analysis of JD Logistics' Green Supply Chain Construction Strategy

3.1 Green Procurement Strategy

Green procurement is the starting point of the overall green supply chain and has a leverage effect on the environmental performance of the upstream supply chain. JD Logistics has established a supplier environmental performance evaluation system, which includes key environmental indicators such as environmental qualifications, hazardous substance management, carbon emission data, and the proportion of recycled materials used in the supplier access and regular assessment system (Green Jr et al., 2012).

While screening its partners, JD Logistics conveys clear green values to the upstream of the supply chain. By reducing the frequency of purchases, centralizing purchases, and strengthening long-term strategic cooperation agreements with core suppliers, it not only reduces procurement costs but also improves JD Logistics' own bargaining power on the procurement side. However, there are still challenges. Among the huge supplier group, there are a large number of small and medium-sized enterprises, which have a large gap in green management awareness and technology and capital investment, which leads to uneven greening levels in the entire supply chain (Geng et al., 2023).

In response to such problems, JD Logistics, drawing on advanced industry practices, launched a project called the "Supplier Green Empowerment Program". By providing environmental technology training, sharing best practices, and establishing a green transformation fund, it helps small and medium-sized suppliers overcome their own shortcomings in capabilities and resources, thereby driving the optimization and upgrading of the overall level of the entire chain (Zhu et al., 2022).

3.2 Green Warehousing Strategy

Warehousing is a major energy consumer. JD Logistics' green warehousing efforts are primarily driven by intelligent and energy-efficient technology. JD Logistics' intelligent logistics centers, such as "Asia No. 1," extensively utilize automated high-bay warehouses, autonomous mobile robots, and intelligent sorting systems. These technologies significantly improve warehousing efficiency and space utilization, reducing unnecessary energy and material consumption. Furthermore, JD Logistics' continuous investment and innovation in solar photovoltaics, waste heat power generation, and green buildings have ingrained green energy conservation concepts into its logistics and warehousing operations.

To reduce energy consumption and emissions, JD Logistics is constructing distributed photovoltaic power stations on the rooftops of its logistics parks to generate clean energy for its own use, reducing its use of the

external power grid and carbon emissions. The use of energy-saving and consumption-reducing products and measures, such as LEDs, along with intelligent energy management systems, can significantly reduce energy consumption. However, due to the relatively slow progress in green renovations of older warehouses and the high cost of introducing advanced energy-saving technologies (such as large-scale energy storage systems), JD Logistics' efforts in energy conservation and emission reduction remain bottlenecks.

In the future, we can study the use of green warehouse systems to facilitate rapid deployment and upgrades, continue to deepen and refine data analysis, improve the depth of operational data collection, and continuously improve and enhance warehouse layout, inventory levels, energy scheduling, etc., constantly tap energy-saving potential, and create large-scale and economical green warehousing (Ivanov et al., 2019).

3.3   Green Transportation Strategy

Transportation accounts for the largest proportion of carbon emissions in the logistics chain. JD Logistics' green transportation solution is based on three dimensions: clean tools, intelligent operations, and collaborative models. Clean tools are achieved by increasing the use of new energy vehicles, using more electric trucks in urban distribution scenarios, and piloting the promotion of hydrogen-powered heavy trucks to replace traditional fuel vehicles in trunk transportation scenarios to achieve front-end emission reduction goals. JD Logistics relies on its independently developed intelligent route optimization system, applies big data and artificial intelligence algorithms to calculate the optimal delivery route, and reduces mileage and waiting time by avoiding congested roads, detouring to empty routes, and avoiding idling caused by passengers resting in the vehicle. It achieves the goal of saving fuel (electricity) and reducing carbon emissions while ensuring customer service experience and quality (Wang et al., 2023).

Model collaboration mainly advocates a joint distribution model, integrating the orders of various merchants to increase the loading capacity of each vehicle and reduce the total number of vehicles traveling. The main bottlenecks in the current development are the limited range of electric vehicles, the incompleteness of supporting facilities such as charging and swapping stations, and the high procurement cost of electric vehicles themselves. Strengthening cooperation with the government and energy companies, promoting the construction of basic supporting facilities, and exploring a new path of battery leasing, vehicle-battery separation, and battery cascade utilization to reduce the purchase and use costs of vehicles is also an effective solution (Nocerino et al., 2023).

3.4   Green Packaging Strategy

Packaging waste is one of the major environmental pressures facing e-commerce logistics. JD Logistics promotes the 3R principles of "Reduce, Reuse, and Recycle" for green packaging. Reduction involves using intelligent packaging algorithms to automatically recommend the most appropriate box type based on product size, significantly reducing excessive packaging and filler. Recycling involves launching reusable express boxes like the "Qingliu Box" and establishing a recycling and circulation system to replace traditional disposable cardboard boxes. Recycling involves using biodegradable packaging bags for fresh produce and other categories.

The main problem is that consumers currently have little desire to return packaging, and a systematic socialized packaging waste recycling and classification system has not been established, so the closed loop of the circular packaging economy cannot operate. JD Logistics needs to set up an incentive feedback mechanism that is more attractive to consumers. It can give rewards such as points and discount coupons to those who accept recycled packaging to encourage users to actively return recycled packaging. It can also build an industrial alliance with packaging production companies and recycling companies (Huang et al., 2019). Based on the characteristics of recycled packaging, it can design recycled packaging that is easy to disassemble, recycle and reuse, complete the closed loop process from "production-use-recycling-regeneration", and finally realize the resource utilization of packaging waste (Kumar et al., 2023).

3.5   Digitalization and Collaborative Innovation

Digital technology is the key to JD Logistics' ability to achieve coordination and optimization of all links in the green supply chain. JD Logistics has built an intelligent supply chain technology platform based on

cloud computing, the Internet of Things, big data, and artificial intelligence. It transmits data on the entire supply chain, such as warehouse energy consumption and vehicle driving status, to the intelligent supply chain technology platform in real time and performs precise calculation and analysis, thereby ensuring that carbon emissions during transportation can be measured and controlled in real time. At the same time, it carries out intelligent algorithm prediction and other work to effectively reduce the large amount of cost waste caused by inventory backlogs or redundant transportation (Büyüközkan and Göçer, 2023), and maximize resource utilization at the system level. In addition, through the exploration of blockchain technology, product carbon footprint traceability can be achieved, and transparency can be achieved, which improves the coordination level of each supply chain node (Kouhizadeh et al., 2021). To fully and effectively utilize digital technology to maximize its synergistic effect, it is necessary to solve the current problems of inconsistent data standards and interfaces between various internal systems or between external partner systems. The phenomenon of "data islands" cannot break through data barriers and hinders the cooperation and interoperability of data in the entire chain. In the future, JD Logistics can connect more supply chain data and use this as a basis to improve the comprehensive implementation of blockchain and maximize the value brought by blockchain (Choi, 2023).

4. Conclusion

This article explores and researches the path to building a green supply chain within the context of sustainable development, using JD Logistics' green supply chain as an example. The article argues that JD Logistics has systematically integrated green development concepts into key processes such as procurement, warehousing, transportation, and packaging. By leveraging the value of digital technology, JD Logistics has significantly improved the greenness of its supply chain, achieved significant results in emissions reduction and efficiency improvement, and set an example for green development efforts in the logistics industry. While JD Logistics' green supply chain has achieved some success, it also faces numerous challenges, including the difficulty of green management of upstream suppliers, the high investment required to upgrade outdated facilities and equipment, and the sluggish pace of infrastructure development for the rollout of new energy logistics vehicles. This theoretical innovation, based on the exemplary case of JD Logistics, demonstrates the application and innovative practices of green supply chain management theory within a large Chinese platform enterprise, highlighting the role of digital technology as a key enabling factor in promoting green supply chain collaboration.

The green transformation of an enterprise is not an isolated act, but a complete and systematic project. Enterprises should start from themselves to establish a development concept from top to bottom, and implement the top-level design in each business at the strategic level; attach importance to the driving role of technological innovation, increase investment in intelligent and green technologies, and build the core technology of the enterprise; the success of the green supply chain requires the collaboration between ecological partners, and it is necessary to establish a cooperative and shared cooperation model to give partners enough motivation to drive the upstream and downstream to form a holistic green practice. The shortcomings of this study are mainly reflected in the fact that this paper is based on a large number of existing cases with public information. In the future, more first-hand and in-depth data can be obtained through field research and in-depth interviews. This study focuses on the practical experience of a leading enterprise, and there are certain deficiencies in its universality among enterprises. In the future, by selecting more typical enterprises and conducting multi-case comparative studies, we can explore whether the green supply chain practical experience applicable to leading enterprises of different sizes and industries is universal.

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