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From Single-point Innovation to Ecosystem Co-creation: A Case Study on JD Logistics' Green Transformation and Its Implications

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Abstract. The explosive growth of China's express delivery industry has driven economic development while also posing severe environmental challenges, such as packaging waste pollution and consistently high carbon emissions. Existing research is mostly limited to the optimization of partial links, lacking discussions on systematic ness and regional applicability. Taking JD Logistics as an example, this paper adopts case analysis and the SWOT method to study the implementation paths and effects of its green logistics system. The study finds that multi-link collaboration can significantly improve emission reduction efficiency; the extended producer responsibility system and deposit-return mechanism can effectively promote the use and recycling of circular packaging; and the differentiated implementation of circular packaging and biodegradable materials, along with the construction of a cross-platform carbon incentive ecosystem, are key paths to solve the "green premium" problem. This study demonstrates that enterprises can convert environmental pressure into sustainable competitiveness through technology output, transparent carbon accounting, and material R&D cooperation, providing a practical basis and strategic reference for the green transformation of the logistics industry in the context of emerging markets.

Keywords: Green Logistics, Circular Economy, Sustainable Transformation, Carbon Emissions Reduction.

1. Introduction

In recent years, the volume of China's express delivery business has maintained sustained and rapid growth. In 2022, the annual number of express parcels exceeded 110 billion, accounting for more than 50% of the global total [1]. This explosive growth has brought about severe environmental challenges: the annual carbon emissions of the entire industry account for approximately 3% of China's total carbon emissions [2]; the packaging waste generated reaches nearly 10 million metric tons, which can circle the Earth's equator 200 times if connected end to end [3]. More notably, the polyethylene plastic film commonly used in express packaging takes 200–400 years to degrade naturally [4], imposing long-term pressure on the ecological environment.

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Existing research mainly explores solutions from three dimensions: the replacement of new energy vehicles in the transportation link, the innovation of packaging materials, and the intelligent optimization of logistics routes. However, it often overlooks the systematic synergy among various links. Especially in emerging markets like China, factors such as urban-rural gaps, consumer habits, and the intensity of policy implementation make it difficult to directly apply the experience of developed countries.

This paper selects JD Logistics as a typical case, as it has built the most comprehensive green logistics system in the industry. Its self-operated model ensures the observability of the implementation process, and its carbon neutrality goals have obtained international certification, providing a quantifiable evaluation benchmark.

This study focuses on two core questions: which environmental protection measures can achieve the optimal emission reduction effect? How to solve the dilemma of "green premium"? Through the analysis of enterprise operation data, it is found that when multiple green measures are used in synergy, the emission reduction effect is significantly better than that of single measures; in regions where the extended producer responsibility system is implemented, the adoption speed of recyclable packaging is significantly accelerated; and the deposit-return mechanism can effectively improve the packaging recycling rate. These findings provide new ideas for developing countries to balance logistics efficiency and environmental protection and offer operable practical paths for enterprises to practice the concept of "Creating Shared Value (CSV)."

This study aims to propose a "graded promotion" implementation plan: giving priority to promoting recyclable boxes in first-tier cities, using biodegradable materials in rural areas, and establishing a "green credit" cooperation mechanism; and drawing on the points reward model of Ant Forest to build a diversified incentive system. Through case empirical evidence and theoretical reflection, this study provides new evidence in the Chinese context for green logistics theory and offers policy references for the industry’s transformation and upgrading [5].

2. Three-phase evolution of JD.com’s green logistics transformation

JD.com’s green transition began with efforts to reduce packaging waste at the source. In 2017, JD launched the “Green Stream Initiative,” whose core measure was the promotion of the “Reusable Box”—a reusable plastic container capable of being reused more than 20 times, used alongside biodegradable tape [6]. However, the initial phase encountered significant challenges: due to insufficient recycling points and inconvenience for consumers to return the boxes, their adoption rate fell far short of expectations. By 2021, Reusable Boxes had been used only about 5 million times, a significant gap from the initial target of 10 billion uses [6]. This early setback highlighted the limitations of innovation focused on a single link [7] and provided a crucial lesson for subsequent systematic transformation. Although the initial exploration did not meet expectations, it accumulated valuable experience for the implementation of a systemic emission reduction strategy, particularly offering important data insights into consumer behavior and recycling network construction [8].

JD. com came to recognize that true emission reduction effects come from technological integration and synergy across multiple segments such as warehousing and transportation [9]. At this stage, JD became the first logistics company in China to receive certification from the Science Based Targets initiative (SBTi), committing to a 50% reduction in carbon emissions by 2030 [10]. The company deployed 20,000 new energy vehicles, resulting in an annual reduction of 40,000 tons of carbon emissions [6]. Simultaneously, it constructed a 9 MW rooftop photovoltaic project at the “Asia No. 1” smart industrial park in Xi’an, successfully creating its first “zero-carbon park” [3, 6].

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This marked a shift in its emission reduction strategy from isolated packaging innovation to a systematic effort encompassing energy structure optimization and transport electrification. A defining feature of this phase was the transition from single-point technological breakthroughs to a comprehensive green restructuring of operational processes, achieving significant advances particularly in warehousing and transportation—the two most carbon-intensive links [9].

The current focus of transformation has expanded from internal optimization to building a cross-enterprise, cross-industry green logistics ecosystem [11]. JD began piloting "battery-swapping heavy-duty trucks," which allow for a full battery swap within five minutes and reduce carbon emissions by 35% compared to traditional diesel trucks [6]. More notably, in 2023, JD launched a "cross-brand reusable box program," opening its circular packaging solutions to external brands [12]. This initiative signifies a strategic evolution from "self-operated green logistics" to "platform-based green logistics," aiming to tackle the core issue of high costs in circular economy models through scale effects [7]. The essential value of this ecosystem expansion phase lies in reducing the overall cost of green transition for the entire industry through open collaboration, thereby realizing economies of scale [11].

3. SWOT analysis of JD.com's green transition

3.1. The synergy derived from a closed-loop supply chain is JD's core strength in implementing its green strategy

This synergy is JD's core strength in implementing its green strategy. JD's self-operated model controls the entire process from order placement and warehousing to delivery and recycling, enabling green measures (such as reusable boxes and AI box recommendation systems) to be implemented efficiently under unified standards. For example, its self-developed AI box recommendation system matches the most suitable packaging based on product volume, reducing material waste at the source [13]. This technology can be seamlessly deployed within JD's internal ecosystem, whereas its effectiveness might be diminished in an open-platform environment due to data barriers. The self-operated system ensures data integrity and operational consistency across all stages, forming a competitive advantage that platform-based logistics firms find difficult to replicate. This closed-loop ecosystem not only improves the implementation efficiency of green measures but also creates a sustainable cycle of environmental value [7].

3.2. High operational costs and limited consumer engagement are the primary weaknesses constraining the scalability of JD's model

The recycling, cleaning, disinfection, and logistics management of reusable boxes incur significant additional costs [2]. Moreover, the limited standardization of reusable box sizes makes it difficult to accommodate all product categories, restricting their applicability. More importantly, consumers are accustomed to the convenience of traditional disposable packaging; surveys show that 68% of consumers refuse to participate in environmental packaging recycling programs due to habit and perceived hassle [8]. Behavioral inertia has become a major obstacle to adoption. This reflects a contradiction between the "positive externality" of environmental actions and the "negative cost" borne by individuals. Corporate incentive mechanisms aim to internalize this "positive externality" and offset the user's "negative cost." Cost structure analysis indicates that the per-use cost of reusable boxes must fall within 1.5 times that of traditional cartons to enable large-scale commercial adoption—a threshold that has not yet been reached [7].

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3.3. Strong national policies and continuous technological advancement have created an unprecedented window of opportunity for green logistics

China's "Dual Carbon" goals are driving the legislative process for green standards in the express delivery industry, and local governments (e.g., Beijing) have introduced strict plastic reduction regulations, providing policy incentives for enterprises adopting eco-friendly solutions [14]. Meanwhile, advances in AI and big data technologies are opening new pathways for emission reduction. For instance, AI route optimization algorithms have helped JD reduce unnecessary travel distance by up to 25%, which not only cuts emissions but also directly lowers operational expenses [9]. The dual drivers of policy and technology are accelerating the shift of green logistics from a cost center to a value creator, with efficiency gains from smart algorithms already generating direct economic returns [9, 15].

3.4. Fierce industry competition and consumer price sensitivity constitute major external threats

Fierce industry competition and consumer price sensitivity constitute major external threats. Competitors are also actively expanding their green initiatives: Alibaba's Cainiao has launched a "Zero-Carbon Park" certification, while SF Express has achieved lower carbon intensity through aviation network optimization. This challenges JD's first-mover advantage. The greatest threat comes from the market: 73% of consumers are unwilling to pay a premium of more than 2% for green packaging [1]. This lack of a "green premium" makes it difficult to translate environmental investment directly into economic benefits through the consumer end, creating long-term financial pressure on sustainable green investment [1, 8]. While industry competition is evolving from pure price wars to comprehensive competition that includes environmental values, low consumer willingness to pay remains a shared challenge across the sector [1].

4. Discussion and strategic implications

The "Three-Phase Model" of JD's green transition constructed in this study demonstrates that its sustainability strategy follows an evolutionary logic progressing from point-based innovation and systemic optimization to ecological co-creation [7, 11]. This pathway reveals that the key to successful corporate green transformation lies in transcending internal operational boundaries and turning one's own challenges into opportunities to build industry-level solutions. Therefore, JD's future strategy should be anchored in its new role as an "ecosystem builder," leveraging the core capabilities accumulated through the three phases to drive collective transformation across the industry. Based on these insights, the following four systemic strategic recommendations are proposed.

JD should actively leverage carbon neutrality policy subsidies to expand its own photovoltaic coverage while commercializing mature technological solutions [3, 15]. JD could modularize its proven effective AI packaging recommendation system and carbon management system, offering technology licensing or SaaS (Software as a Service) to small and medium-sized logistics enterprises [13]. This would not only amortize R&D costs and diversify revenue sources but also amplify emission reduction effects at the industry level, turning its advantages into industry standards. The key to a technology export strategy lies in balancing standardization with customization—maintaining technological advancedness while adapting to the actual needs and payment capacity of smaller firms [13].

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JD should collaborate with authoritative third-party institutions to establish an industry-recognized carbon data white paper to enhance public credibility [10]. It is recommended that JD partner with organizations such as the China Environmental United Certification Center (CEC) to regularly publish carbon reduction achievement reports based on unified standards, transparently disclosing its emission reduction calculation methodologies. This would help effectively address potential accusations of "greenwashing," establishing an indisputable image as an environmental leader in a competitive landscape and turning threats into brand trust advantages [10]. Transparent carbon accounting is not only a means of demonstrating social responsibility but also an important management tool for internally optimizing emission reduction measures and identifying areas for improvement.

JD could establish a carbon inclusion alliance to translate low-carbon behaviors into tangible consumer incentives [8]. Drawing inspiration from the "Ant Forest" model, JD could take the lead in building a cross-platform carbon points system where users earn points for using reusable boxes or opting for green delivery. These points could be redeemed for benefits across multiple platforms, such as Meituan bike-sharing coupons or video streaming memberships. This approach effectively overcomes the limitations of single-company incentives; by expanding the value pool of benefits, it significantly enhances user willingness to engage in low-carbon activities and fosters loyalty, fundamentally alleviating the weakness of behavioral inertia [8]. Constructing a cross-platform ecosystem requires establishing unified value measurement standards and benefit exchange mechanisms, necessitating collaboration and standard-setting among key industry players.

The most fundamental defensive strategy is to break cost barriers at the material level through collaborative R&D [2]. To address the disadvantages of fluctuating chemical raw material prices and high recycling costs, JD could partner with universities and research institutions to develop low-cost, high-performance bio-based biodegradable materials [2]. This would not only reduce dependence on traditional plastic supply chains and secure cost initiatives but also, in the long run, build a core competitive barrier through material innovation to counter external competition and cost threats. Material R&D requires long-term investment and deep industry-academia-research collaboration, but a breakthrough could disrupt the industry and fundamentally reshape the economic calculus of green packaging [2].

5. Conclusion

This study examined the three-phase evolution and SWOT structure of JD Logistics' green transformation, revealing that through systemic synergy and dual drivers of policy and technology, the company has achieved emission reduction and operational efficiency. Evidence indicates that extended producer responsibility and deposit-return mechanisms can enhance the adoption rate of reusable packaging, while cross-platform carbon inclusion initiatives can alleviate resistance caused by the "green premium."

However, as a single case study, this research has inherent limitations in terms of generalizability. The findings require further validation across logistics enterprises of varying scales and business models. In addition, the social return on investment (SROI) of shared packaging models necessitates longer-term data for robust quantitative assessment.

Future research should adopt quantitative methods to precisely calculate the return on investment of different green measures, thereby providing more concrete references for corporate decision-making. Furthermore, the psychological motivations and decision-making mechanisms underlying consumer behavior warrant deeper exploration to facilitate the design of more effective incentive strategies.

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