

Strategies and Practices of Green Third-Party Logistics

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Abstract

As global ecological conservation concepts gain widespread acceptance and environmental regulations continue to evolve, third-party logistics providers must adapt to sustainable operational models. To overcome challenges and seize market opportunities, enterprises must implement environmental measures-the core focus of this study. Through systematic exploration of the drivers and potential barriers to green transformation in the logistics industry, this study analyzes both internal and external factors motivating enterprises to adopt environmental strategies while revealing significant obstacles that may arise during the transition. Core areas include energy conservation and pollution reduction, innovations in eco-friendly packaging technologies, and the development of low-carbon logistics models. The research comprehensively summarizes multiple methodologies and strategic frameworks available to enterprises. Theoretical and empirical research demonstrates that adopting eco-friendly logistics strategies enables enterprises not only to comply with current regulations and standards while reducing the ecological impact of their operations, but also to significantly increase market share and brand reputation, thereby achieving sustained economic benefits and social value. Building upon existing research, this study outlines feasible pathways to accelerate the industry's ecological transformation, providing theoretical foundations and practical guidance for third-party logistics enterprises to establish sustainable business models.

Keywords

Green Logistics; Third-Party Logistics; Sustainable Development; Energy Conservation and Emission Reduction; Green Packaging; Environmental Regulations; Corporate Competitiveness; Brand Image

1. Research Background, Objectives, and Significance

Amid dual pressures of global ecological deterioration and resource scarcity, the logistics sector-noted for high energy consumption and emissions-faces widely recognized international demands for sustainable transformation. As global environmental policies tighten, regulations like the EU Green Deal and China's "dual

carbon" strategy present unprecedented compliance challenges for third-party logistics enterprises, compelling them to accelerate operational adjustments to meet new environmental requirements. Heightened public ecological awareness and the business sector's strong advocacy for low-carbon, transparent logistics solutions have transformed environmental measures from passive compliance into proactive planning. Third-party logistics plays a vital role in supply chain systems, and its environmental performance directly impacts the long-term development of the entire chain. Driven by regulatory constraints and market demands, third-party logistics organizations urgently need to systematically implement environmental initiatives, a task of significant practical importance.

Amidst an increasingly stringent environmental regulatory framework, this study delves into the core drivers and external constraints faced by third-party logistics providers as they evolve toward eco-friendly operational models. Key topics include energy conservation, emissions reduction, eco-packaging innovation, and the development of low-carbon logistics models. Simultaneously, it will summarize diverse action plans and strategic frameworks employed by enterprises during implementation. Grounded in theoretical deduction and empirical research, this argument aims to reveal that proactively adopting eco-friendly logistics strategies not only helps organizations meet compliance standards and reduce operational impacts on ecosystems but also significantly enhances their competitive edge and corporate reputation in the market, thereby achieving sustainable economic returns and social value.

2. Drivers and Challenges of Green Transformation in Third-Party Logistics Amidst Tightening Environmental Regulations

2.1. Evolution of Domestic and International Environmental Regulatory Systems and Their Impact on the Logistics Industry

Since the turn of the century, global environmental legal frameworks have become increasingly stringent and integrated, delivering widespread practical impacts on supply chains. Advanced economies, led by the European Union, have established comprehensive environmental logistics legal systems worldwide.

China's implementation of the "dual carbon" strategy marks a new historical phase in environmental protection. To achieve the strategic goals of carbon peaking by 2030 and carbon neutrality by 2060, regulatory bodies at all levels have successively introduced numerous environmental support policies targeting the logistics sector. These include subsidies for energy conservation and emission reduction, incentives for purchasing new energy vehicles, and standards for constructing eco-friendly logistics parks. These policies compel third-party logistics providers to reevaluate and transform their existing business structures through both mandatory regulations and incentive-based approaches. The development of green logistics requires a robust

institutional framework. Research indicates that establishing such a system lays the foundation for industry growth by clarifying the scope of authority, responsibilities, and profit-sharing mechanisms among all participants.

The third-party logistics industry faces multidimensional impacts from environmental policy changes, with compliance expenditures and operational model adjustments proving most significant. Companies must deploy specialized measurement and assessment facilities to fulfill carbon emissions disclosure obligations. To mitigate carbon tax burdens or secure fiscal incentives, they must accelerate the phase-out of high-pollution transport vehicles and transition to low-carbon energy sources. Regulatory mandates drive eco-friendly coordination across the supply chain, fostering collaborative, sustainable development throughout the entire value chain. The green performance of logistics service providers increasingly becomes a key factor for shippers in selecting partners. This transforms environmentally friendly logistics practices from passive compliance into a strategic advantage that helps businesses expand market opportunities and build customer trust. The advent of the low-carbon era presents unprecedented challenges to the logistics industry. Surveys indicate that logistics organizations must strengthen eco-friendly operational models to meet increasingly stringent requirements. Moreover, the continuous refinement of environmental regulatory frameworks is profoundly reshaping the competitive landscape and developmental trajectory of third-party logistics.

2.2. Internal and External Drivers and Key Obstacles to Green Transformation in Third-Party Logistics Enterprises

Multidimensional drivers synergistically constrain the ecological innovation of green logistics enterprises while subjecting them to multiple practical bottlenecks. Policy direction and consumer preferences serve as external drivers of development. External mandatory legal provisions—such as the EU's carbon border adjustment mechanism and China's "dual carbon" development vision—play a pivotal role in compelling enterprises to transform their business models to comply with regulations. The widespread adoption of environmental concepts drives supply chain standard innovation, with similar shifts occurring at the consumer end. Brands now treat ecological logistics performance as a mandatory criterion when selecting partners. Empirical analysis indicates that consumer willingness to pay and utility assessments significantly influence enterprises' adoption of eco-friendly logistics strategies. Green logistics implementation carries implicit market promotion benefits: building recognition of ecological responsibility enhances brand reputation, strengthens customer loyalty, and creates differentiated competitive barriers.

A company's intrinsic motivation stems from its strategic self-pursuit. Green transformation is recognized as a necessary investment to withstand unknown risks. Against the backdrop of rapid technological advancement, intelligence and

environmental performance have become indispensable key indicators for measuring the comprehensive strength of third-party logistics providers. Digital innovation is reshaping operational models, and replacing traditional fuel-powered equipment with green-powered vehicles not only achieves the goal of continuously reducing operating expenses but also enhances service levels and optimizes resource allocation efficiency. The elevation of environmental awareness within corporate organizations-particularly the shared growth of eco-consciousness among decision-makers and frontline workers-has become the core endogenous driver of sustainable development. The cognitive framework of green logistics encompasses emotional inclinations, professional expertise, practical actions, and participation motivations. A paradigm shift in organizational members' thinking is a prerequisite for achieving concrete operational implementation.

The path to transformation is fraught with challenges, and the bottlenecks encountered along the way cannot be underestimated. Significant initial investment costs represent a major hurdle-capital-intensive tasks like procuring new energy vehicles, upgrading warehouse space, and establishing energy management systems pose significant headaches for small enterprises with limited capital reserves. Additionally, technological implementation and multi-party collaboration face severe challenges. The green transition hinges on key areas like vehicle electrification, packaging material recycling, and intelligent route optimization. This requires robust technical systems and deep collaboration across departments and enterprises. However, practical implementation often encounters obstacles such as inconsistent standards, communication gaps, and an underdeveloped market-driven mechanism. While some consumers may be willing to pay extra for green services, the industry as a whole lacks sufficient recognition of the economic value of eco-friendly logistics. Market returns alone struggle to fully cover the high investments required for transformation, making external support like fiscal subsidies crucial. The absence of universally accepted standards for carbon assessment and ecological impact evaluation hinders the precise measurement and comparison of corporate environmental investments, thereby limiting the scientific formulation and long-term refinement of environmental strategies.

3. Analysis of Core Strategies and Implementation Pathways for Green Third-Party Logistics

3.1. Energy Conservation, Emissions Reduction, and Sustainable Transportation Solutions: Technology Application and Operational Optimization

In the greening of sustainable logistics, introducing cutting-edge technologies and implementing refined operational management are indispensable for achieving the dual goals of reducing energy consumption and lowering pollution emissions. Intelligent and digital solutions have become the core drivers propelling this

transformation. IoT sensors capture real-time vehicle fuel consumption and operational data, which big data processing systems then analyze to derive complex traffic insights. This enables organizations to make intelligent routing decisions, selecting optimal transport paths based on actual conditions. Consequently, unnecessary travel distances and idle waiting times are drastically reduced, leading to significant decreases in fuel consumption and harmful emissions. Blockchain-based carbon emission visualization platforms ensure precise measurement, storage, and verification of energy consumption and pollutant emissions throughout logistics operations, providing robust data support for organizations conducting ecological performance assessments.

Technical implementation must advance in tandem with refined operational management. The adoption of new energy vehicles represents a core strategy for fleet modernization. By 2026, the penetration rate of new energy commercial transport vehicles—including electric trucks, hydrogen-powered heavy-duty trucks, and hybrid models—will continue to rise in intercity logistics and short-haul freight sectors. Many industry leaders have begun deploying sustainable energy supply networks, such as photovoltaic charging stations, to reduce reliance on conventional grids and traditional energy sources. Multimodal transport has gained widespread adoption as a practical solution for reducing carbon footprints in long-distance transportation. Its integration into transport frameworks has proven crucial for lowering greenhouse gas emissions from distant logistics activities. Through systematic coordination, suitable cargo capacities are shifted from road transport to rail or waterways—modes with lower emission factors—facilitating a green transformation of the entire logistics ecosystem.

The effective implementation of relevant technologies and management strategies aligns closely with increasingly stringent environmental regulations, such as the EU's mandatory carbon disclosure requirements and China's "dual carbon" strategic vision. Moreover, these approaches deliver tangible economic benefits to organizations in practical operations. Intelligent dispatching reduces vehicle wear and fuel consumption, while government purchase subsidies for new energy fleets lower long-term operational costs. Crucially, establishing an environmentally certified logistics system significantly enhances market competitiveness, particularly with prominent buyers prioritizing ecological supply chains as key evaluation factors. Comprehensive integration of advanced technologies into operational systems, coupled with continuous dynamic improvement, remains the sole pathway for third-party logistics providers to achieve low-carbon transportation and sustainable development.

3.2. Green Packaging and Reverse Logistics: Innovative Practices in the Circular Economy Model

Circular economy principles are driving the deep integration of green packaging

technologies and reverse logistics systems. This convergence is increasingly recognized by third-party logistics organizations as a core strategic initiative to reduce ecological pressure and optimize resource allocation. Eco-friendly packaging must implement the "reduce, reuse, recycle" approach, relying on material innovation and systemic transformation to minimize packaging residue emissions. Companies are progressively replacing traditional single-use foam plastics and adhesive tapes with biodegradable starch-based materials, recycled cardboard boxes, and bio-based cushioning. Achieving lightweight and standardized packaging ensures product integrity while significantly reducing raw material consumption and optimizing transport space utilization. This approach decreases transport frequency and minimizes environmental carbon footprints.

Circular packaging requires robust reverse logistics systems. To advance the circular economy, major logistics providers are implementing packaging return incentives. Partners send reusable packaging to designated collection points, where it undergoes centralized cleaning, sterilization, and quality inspection before reentering the market. This creates a closed-loop resource cycle from end-users to logistics hubs and back. Some service providers further incentivize circularity by stipulating in contracts that clients prioritize standardized packaging specifications. Partners consistently returning containers receive free shipping, establishing a sustainable commercial feedback loop. This approach significantly reduces raw material consumption and solid waste generation while aligning business entities and consumers toward shared environmental goals.

The core of building resource-circulating micro-ecosystems lies in seamlessly integrating eco-friendly packaging with reverse logistics systems. This requires radical innovation in logistics network architecture, expanding reverse logistics processing facilities, and employing digital tools for dynamic monitoring and precise management throughout the entire packaging lifecycle. Widespread adoption of circular economy models demonstrates that effective implementation enables enterprises to not only navigate increasingly stringent environmental regulations but also substantially enhance brand reputation and market competitiveness through environmental stewardship. For third-party logistics providers seeking to transition from linear consumption pathways to circular regeneration models—harmonizing economic and ecological benefits—collaborative innovation in green packaging technologies and reverse logistics systems is pivotal.

4. Research Findings and Outlook

Amid intensifying environmental regulation, a comprehensive analysis of the driving forces, practical challenges, and key pathways for sustainable development in the third-party logistics sector yields several core conclusions. Globally stricter environmental policies and growing market preference for sustainable products exert fundamental external pressure on enterprises to adopt eco-friendly operational

models. Internal drivers include companies' inherent need to reduce costs, enhance efficiency, and strengthen competitive advantages, coupled with heightened environmental awareness among management and staff-all essential catalysts for organizational transformation. While the wave of change is unstoppable, the path forward is fraught with challenges. Initial capital investments can be daunting, technical compatibility issues are as complex as precision gear meshing, market drivers lack sufficient momentum to create strong propulsion, and inconsistent carbon emission measurement standards all present urgent, tangible hurdles that must be overcome.

Operationally, analyses indicate that the seamless integration of smart technologies and efficient processes is fundamental to the successful implementation of eco-friendly and energy-saving green logistics models. Furthermore, the deep integration of green packaging and reverse logistics necessitates the implementation of three core principles-"reduction, material substitution, and recycling"-alongside the establishment of recycling incentive mechanisms. These represent key measures for advancing the circular economy and significantly reducing ecological impacts. From a macro perspective, comprehensive implementation of such environmental measures enables third-party logistics enterprises not only to comply with regulatory standards and minimize operational disturbances to ecosystems, but also to significantly enhance their service distinctiveness, public image, and long-term competitive advantage. This ultimately achieves the harmonious coexistence of ecological value and commercial profit.

The ecological evolution of third-party logistics will exhibit several significant future trends. Driven by the global wave of emissions reduction, ecological supply chain management is progressively shifting from a competitive advantage to an essential industry standard. Establishing a unified carbon measurement and ecological evaluation framework spanning multiple sectors and regions will become a core focus for future exploration and application. This initiative aims to eliminate disparities in current environmental performance assessment criteria, laying a scientific foundation for organizations to achieve refined operations. Breakthroughs in green logistics technologies and coordinated infrastructure development must advance in tandem. This holds significant importance for alleviating cost pressures faced by SMEs during transformation and upgrading. To meet increasingly stringent ESG disclosure standards demanded by upstream and downstream stakeholders, a transparent end-to-end carbon footprint management system leveraging cutting-edge technologies like blockchain must be established. In essence, vigorous efforts are required to build a robust eco-logistics collaborative community. This community should lead the development of standardized systems, information platforms, and efficient resource allocation across the entire industrial chain, collectively addressing common industry challenges. The ecological transformation of third-party logistics providers is a dynamic and deepening process reliant on

technological innovation, management advancement, and multi-party collaboration. This highly complex system requires continuous progress to provide robust support for the sustained prosperity of the entire industrial chain.

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