

# ***Research on the Sustainable Development Assessment System of Chinese Logistics Enterprises in the Context of Digital Intelligence and Dual Carbon Era***

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**Abstract:** China has entered a "new normal" characterized by high-quality development driven by digital intelligence. The 2024 Government Work Report emphasizes that the logistics industry is gradually forming a new green logistics ecosystem through technological innovation and industrial restructuring, laying the groundwork for a green, low-carbon supply chain. The role of national logistics hubs in urban logistics aggregation and radiation is continuously enhancing. However, logistics enterprises remain at the initial stage of environmentally sustainable development. Therefore, it is essential and practically significant to construct a sustainable development assessment system under the context of digital intelligence and dual carbon goals. This study focuses on the construction of a logistics assessment index system, utilizing the Triple Bottom Line (TBL) principle to conduct a comprehensive analysis of logistics processes from social, economic, and environmental dimensions. It investigates green management strategies for enterprises and proposes actionable suggestions to address issues related to an excessive focus on short-term financial targets and an incomplete performance evaluation index system. This framework aims to adapt to the demands of intelligent and flexible upgrades, thereby promoting the long-term sustainable development of logistics enterprises.

**Keywords:** Green logistics, sustainable logistics, logistics assessment indicators, TBL principle.

## **1. Introduction**

The 2024 Government Work Report explicitly states that the nation is actively promoting the deep integration of the digital economy and the real economy, facilitating the optimization and upgrading of industrial structures, and is committed to promoting green, low-carbon, and circular development to achieve dual carbon goals[1]. These initiatives are expected to profoundly impact China's socio-economic development. However, despite significant attention from the government and regulatory bodies on environmental issues within the logistics industry, challenges persist, such as an excessive focus on short-term financial objectives and incomplete performance evaluation indicators. A mature environmental sustainability assessment and management system has yet to be established, and development in this area remains nascent. For modern logistics managers, the primary contradiction

in achieving environmental sustainability is balancing the additional costs of environmental protection with the growth of economic benefits.

This paper scientifically constructs a sustainable development assessment system for logistics enterprises using the TBL principle. The system aims to help enterprises comprehensively evaluate the environmental, economic, and social impacts of their logistics activities. By conducting an exhaustive evaluation of logistics processes, enterprises can identify bottlenecks and inefficiencies, optimize processes, reduce costs, and enhance efficiency. This framework further assists enterprises in maintaining a competitive advantage and increasing market share in a fiercely competitive market.

## **2. Current Development Status of Chinese Logistics Enterprises and Overview of Assessment Systems**

### **2.1. Development Status of Logistics Enterprises**

Logistics involves the organic integration of basic functions such as transportation, storage, handling, packaging, processing, distribution, and information processing to facilitate the physical flow of goods from the supply source to the receiving destination. As a significant component of logistics, express logistics is increasingly attracting attention to the development of logistics enterprises. In 2023, China's express logistics industry entered the "billion parcels" era, transitioning from "rapid growth" to "high-quality development." [2] Domestic logistics and express delivery companies are progressively transforming into modern logistics enterprises and comprehensive logistics service providers. The strength of Chinese express parcel companies has grown significantly, resulting in an oligopolistic market structure. Major players like China Post and SF Express now rank among the Fortune Global 500, with the top five logistics companies collectively holding over 70% market share.

### **2.2. Constraints of Logistics Enterprises**

#### **2.2.1. Regionalization and Limitation of Data Platform**

From a global point of view, the development of logistics enterprises will gradually tend to oligarchy, resulting in non-interoperability between enterprise data platforms, and platform information integration is insufficient.

1) The United States, China and Japan have the highest concentration of express market: mainly forming 2 (express) +1 (postal) +1 (e-commerce self-built/integrated logistics) pattern; The volume of CR1 is about 30%-40%, and CR3 is about 80%.

2) There are many European countries and the market is more dispersed: the main express delivery companies include local DHL/DPD/GLS and global FedEx (including TNT) /UPS, with a revenue CR5 of about 66% in 2019. Similar to the United States express market, Amazon's self-built logistics share continues to expand.

The development and application of new technologies (such as smart logistics, automation and IOT technologies) by enterprises can improve logistics efficiency and reduce environmental impact, optimize transportation and warehousing management through data analysis, reduce empty driving rates and reduce energy consumption. The initial investment cost of these technologies is high, the data volume is huge, and the R&D feedback cycle is long, although it can bring long-term economic benefits, it is often difficult for an enterprise to bear.

### **2.2.2. The Mutual Restrictive Relationship between the Requirements of the Two-carbon Era and Economic Benefits**

In his 2023 message, UNEP Executive Director Inger Andersen said: “UNEP will work tirelessly to help make this happen – through deploying digital technologies to provide forward looking and relevant science, boosting the implementation of the multilateral environmental agreements that make change possible, and backing Member States to promote climate stability, live in harmony with nature and forge a pollution-free future. "The world pays special attention to environmental issues, and logistics companies continue to improve their response level when complying with environmental regulations. Businesses need to increase investments (such as buying low-emission vehicles, optimizing transportation routes, using renewable packaging materials, etc.), and these initial investments increase operating costs. Although costs increase in the short term, good environmental practices can reduce long-term operating costs (such as reduced fuel consumption, lower fines and environmental remediation costs) and achieve economic benefits. The two are mutually restrictive.

### **2.3. Overview of Logistics Assessment Systems**

Research on logistics industry design and evaluation, both domestically and internationally, has primarily focused on the formulation of financial performance evaluation frameworks and the establishment of performance assessment indicators. Scholars have proposed various evaluation methods and tools from different perspectives. For instance, Liao Yan adopts the Balance Scorecard (BSC) theory combined with the Economic Value Added (EVA) model to select strategic logistics companies for performance assessment[3]. Luo Yanni employs the Analytic Hierarchy Process (AHP) to assign weights to various indicators[4]. Shao Mengjiao and others construct an evaluation system using factor analysis against the backdrop of new productive forces to conduct an empirical analysis of financial performance in logistics enterprises[5]. Similarly, Zhen Haixu uses factor analysis to establish a financial performance evaluation index system, focusing on the data of 44 listed logistics companies in 2021[6]. Sun Yan analyzes the cost efficiency of Shaanxi Province from 2005 to 2022 using the BCC model and super-efficiency DEA model, constructing an evaluation index system for logistics cost efficiency in the province[7]. Sun Junjie emphasizes the financial evaluation and risk analysis of logistics park investment projects[8].

## **3. Sustainable Development Assessment System for Logistics Enterprises**

### **3.1. Theoretical Introduction to the Assessment System**

The Triple Bottom Line (TBL) is a sustainable development framework that encompasses three dimensions: People, Planet, and Profit[9]. This approach promotes sustainable innovations, technologies, and manufacturing practices. To assess the operational outcomes of logistics enterprises using the TBL framework, it is essential to achieve a balanced development across social welfare (People), environmental protection (Planet), and economic profit (Profit). Feng Yahong posits that "enterprises have responsibilities to the broader community, not just their shareholders," and emphasizes the need for companies to utilize a range of measurable performance indicators to assess and demonstrate their sustainability. This approach considers the social, economic, and environmental bottom lines. In light of the advent of the digital intelligence era and the dual-carbon goals, a comprehensive assessment of logistics enterprises can better capture their developmental trends and foster the healthy and sustainable growth of the logistics sector[10]. The essence of TBL theory is to treat sustainable development as the fundamental premise, asserting that project success should not be assessed solely by traditional economic metrics but also by social and environmental

metrics. This aligns perfectly with the developmental direction of logistics enterprises in the contemporary context.

### 3.2. Assessment Indicators for the Sustainable Development System

Currently, people are in an era characterized by rapid advancements in the Internet of Things (IoT). The assessment of the supply chain system is guided by three critical indicators: economic, environmental, and social dimensions. These dimensions are further broken down into ten primary indicators. Specifically, the economic dimension comprises 14 secondary indicators, the environmental dimension includes 10 secondary indicators, and the social dimension consists of 5 secondary indicators. Logistics enterprises may determine the weight and quantification methods for these assessment indicators based on their specific circumstances and the relative importance of each indicator. Weight allocation should accurately reflect the significance of each dimension, with common methods for determining weights including expert scoring and entropy weight methods. Quantification methods, such as standardization of indicators and weighted summation, aim to convert all indicators into comparable numerical values.

Table 1: Assessment Indicators for Sustainable Logistics Development System\*.

<b>Dimension</b>	<b>Primary Indicator</b>	<b>Secondary Indicators</b>
<b>Economic Dimension</b>	Operational Efficiency	Cycle Time, Inventory Turnover Rate, Packaging Utilization Rate, Load Utilization Rate, Transportation Route Optimization Level
	Cost Control	Energy Consumption Cost, Labor Cost, Transportation Cost
	Digital Intelligence Level	Information System Integration Level, Automation Level, Artificial Intelligence Application Level
	Service Quality	Delivery Timeliness, Damage Rate, Customer Satisfaction
<b>Environmental Dimension</b>	Resource Utilization Efficiency	Packaging Material Utilization Rate, Energy Utilization Efficiency, Storage pallet material and wear resistance
	Pollution Emission Control	Greenhouse Gas Emissions, Waste Discharge, Noise Pollution
	Green Transportation Assessment	Low Carbon Vehicle Utilization Rate, Energy Optimization Level of Transportation Routes
	Environmental Management System	Environmental Management Certification, Employee Environmental Training
<b>Social Dimension</b>	Employee Development	Employee Training, Occupational Health, Wage and Benefit Security
	Public Participation	Public Communication Channels, Volunteer-Service Activities

This assessment system emphasizes the quantification of qualitative indicators, such as service quality, public participation, and the cultivation of an environmental protection culture. To enhance the objectivity of the evaluation, specific quantifiable criteria can be established, such as the duration of employee participation in environmental activities and the number of training hours. Additionally, a new indicator for the environmental management system has been introduced, particularly the ISO 14001 Environmental Management System certification, which can verify whether the packaging materials, operational pallets, waybills, and post-use disposal of products used by logistics enterprises comply with environmental protection standards and regulations.

### **3.3. Characteristics Analysis of the Sustainable Development Assessment System**

Compared to traditional assessment systems, this indicator framework, which focuses on digital intelligence and the dual-carbon era, possesses the following characteristics:

#### **3.3.1. Greater Emphasis on Digital Intelligence Level**

The assessment of enterprises includes indicators such as the integration level of information systems across supply chain segments, automation level, and application degree of artificial intelligence, reflecting the extent of digital transformation. Moreover, advanced technologies such as big data, IoT, AI, and digital twins can be utilized to achieve precise evaluation and dynamic monitoring of sustainable logistics performance, enhancing the scientific nature and timeliness of assessments.

#### **3.3.2. A Stronger Focus on Sustainable Development**

Sustainable development aligns closely with the ESG (Environmental, Social, and Governance) framework. Traditional evaluation systems often focus solely on specific segments of transportation or distribution. In contrast, this system encompasses the entire lifecycle of products—from transportation, warehousing, and distribution to loading and unloading, packaging, distribution processing, and recycling. It encourages enterprises to adopt energy-saving and environmentally friendly logistics equipment and techniques, aiming to maximize resource recycling and enhance the reuse of logistics waste. It is conducive to the long-term sustainable development of logistics enterprises and promotes a green and low-carbon life cycle.

#### **3.3.3. Increased Attention to Risk Management**

Regarding long-standing natural risks, such as greenhouse gas emissions data and related indicators, it is essential to assess businesses' capabilities in recognizing, evaluating, and addressing climate change, with a particular focus on both physical and transitional risks. Human operational risks such as loss of goods, traffic accidents, and equipment damage can significantly impact the normal operations of logistics enterprises. To mitigate operational risks, logistics companies should establish robust operational procedures and safety management systems, as well as enhance employee training. In the event of emergencies or crises, companies need to implement measures that emphasize humanistic care. Furthermore, establishing efficient and smooth communication channels is crucial to ensure that organizations can swiftly and effectively convey information to the public, guiding them to take appropriate actions and thereby reducing the negative impact of crises.

## 4. Strategies and Recommendations for Advancing the Sustainable Development Assessment System in Logistics Enterprises

### 4.1. Continuously Integrating Big Data Technologies with Sustainable Logistics

Logistics companies should clearly define the objectives and scope of their assessments. In constructing the data ecosystem, it is crucial to establish a unified recognition and understanding of data to break down data silos and enhance data standardization. This ecosystem encompasses multiple dimensions, including personnel, functions, processes, and technologies. Through the integration of big data, an organic combination of elements can be achieved. To ensure the smooth flow and effective application of data, particular attention must be paid to the management and collaboration of supply chain big data, ensuring process traceability and forming a logical closed loop of data processes. For instance, SF Express has leveraged big data technologies to create a data platform recognized as a beacon in the logistics industry, emphasizing advanced computing and analysis techniques. SF Express excels in core algorithmic technologies such as natural language processing, logistics route planning, and intelligent recommendation engines [11].

### 4.2. Cultivating Comprehensive Talent

The logistics industry is continuously evolving, with new technologies and management concepts emerging. Companies need to place greater emphasis on cultivating employees' digital skills and data analysis capabilities. This transformation involves not only skill enhancement but also a fundamental shift in employees' mindsets and working methods. For example, SF Express's "Job-Fit Matching" industry class serves as a model for preemptive talent development. Through the "SF Class," the company collaborates with educational institutions to advance industry-academia partnerships, allowing students to expand their knowledge, gain practical training, and access better employment opportunities, thereby achieving the dual goals of school-enterprise cooperation and high-quality talent cultivation. Finnish explores existing highly effective university–industry collaboration (UIC) models and seeks explanations for their success by examining the literature from the point of view of establishing successful relationships, with a focus on critical drivers for success. [12].

Currently, talent development in Chinese enterprises is predominantly concentrated in vocational and technical education at the associate degree level. Relevant university programs can implement case-based learning and project practice, enabling students to deepen their understanding and application of the logistics assessment indicator system through real-world problem-solving. For existing logistics professionals, opportunities for educational advancement and periodic vocational training should be provided to update knowledge and skills, particularly regarding new assessment indicators, data analysis tools, and the application of information technology[13].

## 5. Conclusion

China's economy has transitioned from a phase of rapid growth to one of high-quality development. In this developmental trajectory, enterprises are continuously seeking to enhance service levels and improve customer satisfaction. By applying intelligent technologies and the control of carbon emissions, companies can choose a sustainable development assessment system that evaluates various indicators, providing a more comprehensive measure of their capabilities and formulating development strategies. This approach not only enhances brand value and market competitiveness but also offers a superior customer experience, creating a virtuous cycle that further drives enterprise upgrades and development.

In this paper, the consideration of the importance and weighting of the assessment system is not sufficiently comprehensive, and the methods employed are relatively singular. Future research should

address these aspects more thoroughly. However, it is noteworthy that the sustainable development assessment system for logistics enterprises is a dynamic process that requires regular updates and adjustments. As the field progresses into the era of digital intelligence and carbon neutrality, new indicators and assessment methods are expected to continuously emerge. Therefore, enterprises must maintain keen market insights and innovative capabilities to continually refine and optimize their assessment systems.

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