

Research on the Performance Evaluation System of Logistics Enterprises under the Dual-Carbon Background—From the Perspective of Carbon Performance

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Abstract: The "dual-carbon" strategy provides new opportunities for the sustainable and high-quality development of logistics enterprises. This paper starts from the concept of carbon performance, analyzes the necessity of constructing a carbon performance evaluation system for logistics enterprises under the dual-carbon background, and explores specific construction methods. By integrating carbon emission, carbon efficiency, and carbon innovation indicators into the traditional balanced scorecard's four dimensions—financial, customer, internal processes, and learning & growth—this study establishes a carbon performance evaluation system model for logistics enterprises. Furthermore, this paper proposes strategies for optimizing the evaluation system, including formulating carbon emission regulations and standards, building a national carbon trading market, and strengthening guidance and training for enterprise carbon performance management. These efforts aim to facilitate the green transformation of logistics enterprises and contribute to achieving the national dual-carbon goals.

Keywords: Logistics enterprises, Carbon performance, Balanced scorecard

1. Introduction

With the growing severity of global climate change, countries worldwide have proposed carbon reduction targets. China has also adopted the "dual-carbon" strategy as a national policy, imposing higher requirements on economic development models and industrial restructuring. As a high-carbon-emission industry, logistics must undergo a low-carbon transformation. However, traditional logistics enterprise performance evaluation systems primarily focus on maximizing economic benefits, often neglecting environmental and low-carbon factors, making them increasingly inadequate for modern demands. Therefore, under the dual-carbon background, establishing an evaluation system that incorporates low-carbon development indicators and comprehensively reflects the overall performance of logistics enterprises is crucial for promoting the industry's low-carbon transformation and achieving sustainable development.

China's economy continues to grow rapidly, but this development inevitably causes environmental pollution. Additionally, many enterprises, in pursuit of expansion and profit, tend to overlook employee welfare and social development. Whether from the perspective of governments, investors, or creditors, corporate performance evaluation plays a key role in determining a company's standing within its industry and even in society.

This paper integrates carbon performance evaluation into the traditional balanced scorecard framework, incorporating carbon-related metrics into financial, customer, internal process, and learning & growth dimensions. The aim is to establish a comprehensive carbon performance evaluation system that enhances the quality of carbon performance disclosures by logistics enterprises.

2. The structure of the traditional balanced scorecard in logistics enterprises and the absence of carbon performance

2.1. The structure of the traditional balanced scorecard in logistics enterprises

As shown in Table 1, the traditional balanced scorecard consists of four dimensions: financial performance, customer management, internal processes, and learning & growth. Through the balanced scorecard, logistics enterprises can comprehensively assess their operational status, ensuring the balanced development of various indicators to better achieve strategic goals. Moreover, the balanced scorecard helps enterprises translate strategic objectives into specific action plans, monitor execution, and make timely adjustments to strategies and measures.

Table 1: Traditional Balanced Scorecard for Logistics Enterprises

Primary Indicators	Financial Performance	Customer Management	Internal Processes	Learning & Growth
Secondary Indicators	Return on Assets	Customer Satisfaction	Cargo Handling Rate	Training Coverage Rate
	Profit Growth Rate	Customer Loyalty	Vehicle Utilization Rate	Innovation Conversion Rate
	Shareholder Return Rate	On-Time Order Delivery Rate	Warehouse Utilization Rate	Training Input-Output Ratio
	Cash Flow	Market Share	Inbound & Outbound Efficiency	R&D Investment-to-Sales Ratio
	Economic Value Added	New Customer Acquisition Rate	Cargo Damage Rate	Digital Technology Utilization Rate

2.2. The absence of carbon performance in the traditional balanced scorecard for logistics enterprises

The traditional balanced scorecard lacks carbon emission-related indicators, making it ineffective in measuring corporate carbon emissions. As a result, enterprises cannot quantify or manage their carbon footprint. Additionally, the traditional balanced scorecard primarily focuses on internal management efficiency and financial indicators related to operational performance, while neglecting carbon footprint—namely, the total carbon emissions generated during production and operations. This omission poses a significant challenge for logistics enterprises under the dual-carbon policy framework. As China increasingly emphasizes high-quality economic development, the absence of environmental performance evaluations may lead to lower assessments from investors, creditors, and other stakeholders, ultimately hindering a company's future sustainability.

To align with the national dual-carbon policy, modern logistics enterprises must incorporate carbon performance assessment into their balanced scorecard framework. This will drive enterprises toward sustainable development in the future.

3. Carbon performance evaluation system and its necessity

3.1. Carbon performance evaluation system

The carbon performance evaluation system primarily consists of four dimensions: carbon emissions, carbon efficiency, carbon management, and carbon innovation.

Table 2: Carbon Performance Evaluation System

Key Performance Indicators	Description	Evaluation Methods
Carbon Emissions	Enterprise carbon emissions	Total carbon emissions, factory carbon emissions
Carbon Efficiency	Relationship between activity output and carbon emissions	Unit cargo transportation efficiency
Carbon Innovation	Innovative emission reduction solutions	Innovation scheme design

The carbon emissions of logistics enterprises mainly refer to the greenhouse gas emissions, such as carbon dioxide (CO₂), generated during business activities such as transportation and warehousing. These emissions primarily come from transportation activities, warehousing operations, and auxiliary processes. Carbon efficiency refers to the relationship between carbon emissions and the services or products provided by the enterprise in logistics operations. It is usually measured as the ratio of carbon emissions to transportation mileage, cargo volume, or other operational indicators. Carbon innovation refers to the adoption of innovative measures and methods in carbon management and emission reduction to lower carbon emissions, improve carbon efficiency, and promote sustainable development.

3.2. The necessity of carbon performance evaluation for logistics enterprises

Under the dual-carbon national strategy, enterprises must enhance their core competitiveness to gain excess returns in market competition. Conducting carbon performance evaluations helps logistics enterprises strengthen their competitive advantages in the following ways:

(1) Enhancing Innovation Capabilities

Focusing on carbon emissions encourages enterprises to explore new business models and solutions. To address carbon emission challenges, companies need continuous innovation. This innovation-driven approach fosters an internal culture of creativity, shifting away from high-investment, low-efficiency, and extensive operational models. By improving resource and capital utilization, enterprises can achieve a balance between economic growth and environmental sustainability[1].

(2) Improving Financing Capabilities

Proactively disclosing carbon performance data can lower financing costs. Companies with strong carbon performance tend to have lower risks, making investors more willing to provide low-cost financing. This reduces the company's financing expenses, thereby improving profitability and overall competitiveness. Additionally, outstanding carbon performance can help companies access diversified financing channels, including green bonds, thereby expanding financing options and reducing financial risks[2].

4. Construction of the carbon performance evaluation system for logistics enterprises under the dual-carbon background

4.1. Principles of constructing the carbon performance evaluation system for logistics enterprises

4.1.1. Principle of strategic alignment

The principle of strategic alignment emphasizes that all corporate activities and objectives must be consistent with the overall strategy to maximize efficiency[3]. Therefore, a company's performance evaluation system must align with its strategic goals to be effective. Traditional logistics enterprise strategies typically include cost leadership, differentiation, customer orientation, and green logistics strategies. However, under the national dual-carbon policy, enterprises must place greater emphasis on green and low-carbon dimensions. Consequently, incorporating carbon performance into corporate performance evaluation is necessary to maintain consistency between performance assessments and overall corporate strategy.

4.1.2. Principle of system integration

The principle of system integration refers to the coordination and integration of various subsystems to ensure the efficient operation of the entire system and the achievement of predefined objectives[4]. This principle emphasizes holistic, coordinated, and consistent approaches. The traditional performance evaluation system lacks sufficient attention to carbon performance. Under the dual-carbon background, the traditional balanced scorecard fails to achieve coordination and consistency, making it difficult to integrate carbon performance with business performance for comprehensive assessment and evaluation[5]. Thus, it is necessary to incorporate carbon performance indicators and strategies into each dimension of the balanced scorecard.

4.1.3. Principle of data-driven decision-making

This principle underscores the need for scientific and reasonable carbon performance indicators that accurately reflect an enterprise's carbon management capabilities while ensuring ease of data collection and measurement. When integrating carbon performance into the balanced scorecard of logistics enterprises, the data-driven principle plays a crucial role. By leveraging accurate data analysis and monitoring, companies can not only achieve carbon reduction targets but also enhance overall operational performance[6].

4.2. Matching carbon performance with balanced scorecard dimensions

4.2.1. Matching financial performance with carbon performance

The financial dimension in the balanced scorecard represents a company's financial health and performance, typically evaluated through revenue growth and profitability. Integrating carbon performance with financial performance enables investors to gain a more intuitive understanding of the financial impact of carbon-related activities. By incorporating carbon reduction costs and carbon credit revenue, investors can assess both the costs and benefits of carbon reduction efforts. Additionally, indicators such as the return on investment (ROI) of carbon reduction initiatives and low-carbon R&D expenditure ratio provide insights into financial performance in carbon efficiency and carbon innovation, helping investors understand a company's low-carbon development trajectory[7].

4.2.2. Matching customer management with carbon performance

Effective customer management significantly enhances corporate competitiveness, customer satisfaction, and operational efficiency. Under the dual-carbon policy, customers are increasingly concerned about a company's carbon performance. Integrating carbon performance into customer management improves decision-making, brand reputation, and risk management, fostering long-term growth in a highly competitive market. To address customer concerns about carbon emissions, this study introduces the carbon emission transparency index. Additionally, indicators such as per-customer carbon footprint and green delivery selection rate provide logistics managers with actionable insights.

4.2.3. Matching internal processes with carbon performance

Optimizing internal processes enhances operational efficiency, reduces unnecessary steps and bottlenecks, and improves resource utilization, ultimately lowering operational costs. By integrating internal process performance with carbon performance, companies can significantly improve energy efficiency and resource utilization. Optimizing logistics processes to reduce unnecessary energy consumption and material waste helps minimize the carbon footprint. This not only lowers operational expenses but also supports national carbon peak targets. To achieve this, this study incorporates key indicators such as total carbon emissions from transportation operations, empty load rate, warehouse utilization rate, and route optimization into the performance evaluation framework.

4.2.4. Matching learning & growth with carbon performance

The learning & growth dimension evaluates a company's efforts in employee development, knowledge management, organizational learning, and corporate culture. The goal is to foster continuous learning and growth, thereby enhancing corporate competitiveness and adaptability. Integrating carbon performance into the learning & growth dimension enables companies to train employees on environmental awareness and sustainability practices. The selected evaluation indicators include employee participation in corporate carbon emission monitoring, employee environmental awareness training coverage, and the number of carbon reduction technological innovations.

Table 3: Performance Evaluation System for Logistics Enterprises from a Carbon Performance Perspective

Primary Indicators	Secondary Indicators		
	Carbon Emission Indicators	Carbon Efficiency Indicators	Carbon Innovation Indicators
Financial Performance	Carbon Reduction Cost / Carbon Emission Cost / Carbon Credit Revenue	Carbon Reduction ROI	Low-Carbon Technology R&D Expenditure Ratio
Customer Management	Carbon Emission Transparency / Customer Perception and Evaluation of Corporate Carbon Reduction Projects	Per-Customer Carbon Footprint / Customer Green Delivery Selection Rate	Implementation of Low-Carbon Service Promotion
Internal Processes	Total Carbon Emissions from Transportation Operations	Energy Utilization Rate / Warehouse Utilization Rate	Optimization of Cargo Packaging

Table 3: (continued).

Learning & Growth	Employee Participation in Corporate Carbon Emission Monitoring	Employee Environmental Awareness Training Coverage	Number of Carbon Reduction Technological Innovations
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5. Strategies and recommendations for promoting the carbon performance evaluation system of logistics enterprises under the dual-carbon background

5.1. Establishing carbon emission regulations and standards

Under the dual-carbon policy framework, promoting the construction of a carbon performance evaluation system for logistics enterprises requires comprehensive and systematic governmental measures in policy guidance and regulatory development. First, the government should formulate and implement mandatory carbon emission regulations, setting clear emission limits and reduction targets. Logistics enterprises must meet these standards within a specified timeframe. Additionally, a mandatory carbon emission reporting system should be established to ensure that enterprises regularly submit and publicly disclose carbon emission data. Second, a standardized carbon emission accounting system should be developed, adopting frameworks such as ISO 14064 or equivalent national standards. This would ensure the comparability and reliability of corporate carbon emission data. Furthermore, a certification system should be introduced to facilitate the regular auditing and verification of enterprise carbon emissions.

5.2. Establishing a carbon market mechanism

The establishment of a carbon market mechanism is a crucial step in promoting carbon performance evaluation in logistics enterprises. To achieve this, the government and relevant institutions must take action in multiple areas. First, a nationwide carbon emission trading market should be established to provide enterprises with a platform for carbon quota trading. By leveraging market-based mechanisms, businesses would be incentivized to reduce emissions voluntarily in pursuit of economic benefits. To ensure the effective operation of the carbon trading market, the government must establish clear trading rules and regulatory frameworks to maintain fairness, transparency, and efficiency in market operations. Additionally, the government should strengthen corporate guidance and training to help enterprises understand and navigate the carbon market mechanism. By enhancing companies' capabilities and motivation to participate in carbon trading, these measures can accelerate the green transformation of the logistics industry and support the achievement of national dual-carbon goals.

6. Conclusion

This study analyzes the necessity of constructing a carbon performance evaluation system for logistics enterprises under the dual-carbon strategy. By integrating carbon performance metrics into the four dimensions of the balanced scorecard, this paper proposes matching solutions and optimization measures to enhance the accuracy of carbon performance evaluation for logistics enterprises. However, further policy development and regulatory measures are needed to drive the long-term advancement of carbon performance evaluation in the logistics sector.

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