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A Review of the Effects of Carbon Neutrality Policies on Business Development

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ABSTRACT
Human production and daily activities have led to a rising frequency of extreme weather events worldwide, causing widespread ecological and economic damage to both society and nature. Mitigating global temperature rise while ensuring high-quality social development has become a shared challenge for countries and regions across the world in the 21st century. Currently, the mainstream strategy for addressing climate issues is carbon neutrality—achieving net-zero or even negative greenhouse gas emissions by balancing carbon dioxide emissions with equivalent absorption. This has become a central focus of international policy research and discussion. As the primary sources of greenhouse gas emissions, enterprises play a crucial role in policy implementation. Their transformation is essential to providing practical support for sustainable development.

KEYWORDS
Carbon neutrality; Low-carbon transition; High-quality development; Literature review

1 Introduction

The Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC) indicates that the global surface temperature from 2011 to 2020 was 1.09°C higher than that of 1850–1900. In the face of an increasingly severe climate crisis, the development and implementation of carbon neutrality policies have become vital to achieving global sustainable development goals. To mitigate climate change and ensure sustainable development, countries around the world have taken action to fulfill their climate commitments under international agreements such as the Paris Agreement. However, the 2020 Emissions Gap Report shows that the projected global temperature rise this century still far exceeds the Paris Agreement's goal of limiting warming to within 1.5°C. As one of the main sources of anthropogenic greenhouse gas emissions, corporate activities—if aligned with social and environmental responsibilities and responsive to policy initiatives—can inject new momentum into sustainable economic development. At the same time, they can effectively help curb the further worsening of climate issues and promote the coordinated advancement of high-quality development for both society and the environment. This paper first reviews and organizes the existing literature from three perspectives: policy and corporate strategic adjustment, technological innovation and industrial upgrading, and market mechanisms and economic benefits. It then identifies the underlying mechanisms linking carbon neutrality policies with corporate development, summarizes the problems and challenges enterprises face during transformation, and extends the theoretical framework from the perspective of consumer expectations. The paper argues that consumer preferences serve as an invisible driving force behind industrial transformation. Specifically, when policies introduce carbon labels (e.g., indicating the carbon emissions of products) and low-carbon subsidies, consumers tend to actively choose green products. This shift in demand compels enterprises to take one of two approaches: either "beautify" their products (e.g., by using eco-friendly packaging) or "revamp" their technologies (e.g., by developing low-carbon materials). This effectively explains why some enterprises are able to achieve successful transformation through green marketing alone, without relying on advanced technologies. Finally, the inclusion of the BYD Auto case provides strong empirical support for the theoretical analysis.

2 Main text

2.1 Current status of foreign research

2.1.1 Policy and corporate strategic adjustment

Schreyer (2020), using the global integrated assessment model REMIND, conducted a comparative study of carbon neutrality pathways across regions and found that different regions face distinct challenges in achieving net-zero emissions. The study emphasized that sustainable industrial development must be achieved through resource integration and multi-stakeholder collaboration. Williams et al. (2021) applied an innovative modeling approach to empirically analyze the U.S. energy system. Their research demonstrated that, under specific policy frameworks, enterprises in the United States can achieve low-carbon transformation through various strategies such as improving energy efficiency, substituting clean energy sources, and implementing carbon capture technologies. The findings underscore the critical

role of institutional guidance in driving strategic restructuring within enterprises.

2.1.2 Technological innovation and industrial upgrading

Lorenzo et al. (2021) conducted geospatial assessments to quantify the technological potential of biogenic carbon dioxide removal (CDR) in 30 European countries, measured in million tonnes of CO_2 per year, and evaluated the development prospects of bioenergy with carbon capture and storage (BECCS) technologies in Europe. Jahanger (2023) applied the Method of Moments Quantile Regression (MMQR) to analyze greenhouse gas emissions data from the top ten manufacturing countries. The findings indicate that improvements in energy efficiency within manufacturing enterprises can offset the increase in carbon emissions resulting from industrial output. Technological advancements have proven highly effective in promoting energy conservation, reducing emissions, and facilitating product transformation. These results demonstrate that technological innovation and industrial upgrading play a critical role in advancing the goal of carbon neutrality.

2.1.3 Market mechanisms and economic benefits

Becker (2020), using a French Cognac brandy producer as a case study, combined empirical analysis, energy consumption estimation, and economic benefit evaluation to assess the feasibility of implementing carbon neutrality strategies in energy-intensive small and medium-sized enterprises. The study found that, compared to traditional production models, low-carbon transformation not only significantly improves long-term economic returns but also aligns with modern consumer preferences for environmentally friendly products, thereby enhancing brand competitiveness.

Murshed (2022), employing macroeconomic modeling techniques, systematically investigated the key drivers of low-carbon economic growth. The study showed that optimizing carbon productivity (economic output per unit of carbon emissions) is a fundamental factor in promoting sustainable low-carbon development. It was recommended that policymakers foster technological innovation and adjust industrial structures to reduce reliance on high-carbon growth pathways.

2.2 Current status of domestic research

2.2.1 Policies and corporate strategic adjustments

Zhao Xin and his research team (2022) employed visual analysis methods to summarize carbon neutrality management measures across 26 global regions. Based on China's specific context, a phased emission reduction roadmap was developed, along with targeted implementation strategies. Wei Yiming et al. (2022) applied bibliometric methods to systematically examine the theoretical fr amework and implementation mechanisms of China's carbon neutrality pathway from the perspective of industrial transformation. Their study highlighted that achieving the "dual carbon" goals requires coordinated efforts across regions, sectors, and diverse stakeholders. Lin Chen and collaborators (2022) innovatively integrated LiDAR technology with the LMDI decomposition method to map the spatial distribution of carbon emissions and interpret the outcomes of the COP26 conference. A comprehensive review was conducted on the institutional arrangements adopted by the international community to promote net-zero emissions, and strategic planning recommendations were provided to support corporate low-carbon transformation.

2.2.2 Technological innovation and industrial upgrading

Zou Caineng (2021) conducted an integrated data analysis to forecast ten disruptive technological innovations likely to drive industrial transformation under the carbon neutrality agenda. Zhang Xiliang (2022), using tools such as the C-GEM (China – Global Energy Model), focused on how carbon neutrality policies can stimulate corporate technological innovation and facilitate industrial transformation and upgrading. He emphasized that energy-intensive enterprises should continuously optimize their energy structures, promote innovations in low-carbon, zero-carbon, and negative-carbon technologies, enhance energy efficiency, and advance high-quality economic development. The study underscored the vital role of technological innovation in achieving carbon neutrality goals.

2.2.3 Market mechanism and economic efficiency

Zhou Kaile (2019) systematically reviewed domestic and international research in the field of carbon trading, focusing on the key issues and developmental bottlenecks encountered in the practical implementation of China ' s carbon finance market. Using a literature review approach, the study provided an in-depth analysis of the current market operation

characteristics and the institutional barriers it faces.

Wang Yao (2021) conducted an empirical study from the perspective of policy economics to examine the relationship between carbon pricing mechanisms and corporate performance. The study found that the carbon emissions trading system not only significantly promoted the low-carbon transition of enterprises but also reshaped their cost-benefit structures through market-based adjustments. Based on these findings, the author recommended strengthening the regulatory framework for carbon emissions trading, optimizing market operation mechanisms to enhance corporate competitiveness, and advancing innovation in the green finance system.

Compared with international research, domestic studies tend to place excessive emphasis on policy description and macro-level pathway design, while lacking empirical investigations into micro-level corporate behavior. In particular, they lag behind international standards in areas such as techno-economic assessment and the modeling of market incentive mechanisms. Future research should incorporate methods such as geospatial analysis and enterprise panel data modeling to better verify the causal links between policy implementation and corporate response.

2.3 Case study—the example of BYD auto

2.3.1 Corporate development history

BYD Company Limited was established in February 1995 and is headquartered in Shenzhen, Guangdong Province. Initially a manufacturer of rechargeable batteries, the company entered the automotive industry in 2003 through the acquisition of Xi'an Qinchuan Automobile Co., Ltd. It was listed on the Hong Kong Stock Exchange (01211.HK) in 2002 and on the Shenzhen Stock Exchange (002594.SZ) in 2011.In 2024, BYD's sales of new energy vehicles exceeded 4.27 million units, securing its position as the global leader in new energy vehicle sales for the second consecutive year. Its ranking on the Fortune Global 500 climbed to 143rd, solidifying its status as a leading enterprise in the global new energy vehicle industry.

2.3.2 Measures and achievements

BYD has actively aligned itself with the carbon neutrality strategy, focusing on transforming the energy structure by replacing traditional energy sources with clean energy alternatives. It has also established a comprehensive end-to-end battery recycling system and significantly increased investment in the research and development of new energy vehicle technologies, with particular emphasis on the independent development and manufacturing of core components. In the field of intelligent technology, the company has further enhanced its resource allocation for the development of intelligent driving systems. Through systematic optimization of its product portfolio and the restructuring of the industrial value chain, BYD has successfully built a high-end brand matrix, driving both sustainable corporate growth and industrial upgrading.

BYD Company Limited December 2024 Production and Sales Report

The Company and all members of its Board of Directors warrant that the information disclosed is truthful, accurate, and complete, with no false records, misleading statements, or material omissions. The production and sales report data for BYD Company Limited ('the Company') for December 2024 is as follows:

Unit: Vehicles

	Production					Sales				
Category	Current Month	Same Period Last Year	Current Year Accumulated	Last Year Accumulated	Accumulated YoY	Current Month	Same Period Last Year	Current Year Accumulated	Last Year Accumulated	Accumulated YoY
New Energy Vehicles	466,441	308,972	4,304,073	3,045,231	41.34%	514,809	341,043	4,272,145	3,024,417	41.26%
Passenger Vehicles	460,719	308,107	4,281,084	3,033,662	41.12%	509,440	340,178	4,250,370	3,012,906	41.07%
Pure Electric	189,759	176,373	1,777,965	1,589,571	11.85%	207,734	190,754	1,764,992	1,574,822	12.08%
Plug-in Hybrid	270,960	131,734	2,503,119	1,444,091	73.34%	301,706	149,424	2,485,378	1,438,084	72.83%
Commercial Vehicles	5,722	865	22,989	11,569	98.71%	5,369	865	21,775	1,511	89.17%
Buses	1,375	805	5,580	4,705	18.60%	1,375	805	5,580	4,705	18.60%
Others	4,347	60	17,409	6,864	153.63%	3,994	60	16,195	6,806	137.95%
Total	466,441	308,972	4,304,073	3,045,231	41.34%	514,809	341,043	4,272,145	3,024,417	41.26%

Figure 1

(https://view. inews. qq. com/k/20250123A06BAV00? web_channel=wap&openApp=false&openid=o04IBAIrWF92mDCU27kQoWPQ9uWs&key=&version=1800382e&devicetype=iOS16.4.1&wuid=oDdoCt-5Io3WuFOd97L-gMGkeQWU)

In 2024, BYD's total production of new energy vehicles reached 4.3 million units, marking a 41.34% increase compared to 2023; total sales amounted to 4.27 million units, reflecting a year-on-year growth of 41.26%.According to the report by the China Association of Automobile Manufacturers, BYD exported 433,000 vehicles in 2024, marking a 71.8% increase

compared to 2023.

2.3.3 Challenges faced

Trade barriers have forced BYD to revise its export strategies, leading to heightened compliance pressures. The high cost of localized production makes cost-sharing difficult. Rapid technological advancements require significant capital investment to maintain a competitive edge. Traditional automotive giants are accelerating their green transitions, further eroding BYD's competitiveness. The company's dependence on key raw materials from South America and Africa exposes it to geopolitical risks, which could drive up production costs and squeeze profit margins.

2.3.4 Conclusion

Amid the global shift toward low-carbon development, BYD's transition to clean energy supports Jahanger's (2023) conclusion on the role of technology in offsetting carbon emissions. A multidimensional strategic transformation has been implemented, resulting in notable gains in production efficiency through clean energy adoption, manufacturing process innovation, and supply chain optimization. BYD positions product upgrades and environmental performance as core competitive advantages, aligning closely with shifting market demands. Continued increases in R&D investment have led to technological breakthroughs that not only enhance product differentiation but also contribute to sustained market share growth. The application of green financial instruments and refined operational management has steadily improved the company's profitability.

However, the exposure of supply chain risks highlights the issue of "low-carbon path dependence" identified by Murshed (2022). Ongoing challenges such as volatility in the international trade environment, limited supply chain resilience, and the difficulty of balancing operational efficiency with emission reduction targets continue to hinder development. BYD's experience illustrates that companies undergoing low-carbon transformation must establish integrated mechanisms that align technological innovation, value chain restructuring, and financial stability. It is crucial to balance innovation inputs with output efficiency, enhance international supply chain coordination, proactively address trade protectionism, and ultimately achieve a synergy between economic performance and environmental sustainability.

3 Literature review

The impact mechanism of the carbon neutrality strategy on enterprise transformation has become a prominent topic in academic research, characterized by its interdisciplinary nature.

International studies focus on the synergistic interplay among policy, technology, and market forces, highlighting how corporate strategies adapt under institutional constraints. These studies show that carbon policies reshape the corporate decision-making environment through emission standards and incentive mechanisms, with regional cooperation and the selection of technological pathways emerging as critical issues. Research on technological innovation indicates that the integration of clean energy and carbon management technologies not only optimizes resource allocation but also drives the restructuring of value chains. At the market level, attention is given to how carbon pricing signals guide resource allocation and help balance economic and ecological benefits.

Domestic research emphasizes the localization of policies and multi-level governance, analyzing the alignment between institutional flexibility and industrial transformation through gradual transition models. Techno-economic studies underscore the synergistic effects of energy structure adjustments and negative carbon technologies, while research on market mechanisms focuses on the price discovery function of carbon financial instruments and their impact on corporate capital structures.

Current research presents four main limitations: insufficient exploration of transformation pathways for small and medium-sized enterprises; the use of static analytical methods that fail to capture the costs of dynamic adjustments; inadequate investigation into the coordination mechanisms between policy and market; and a lack of cross-national comparative studies. Future research should focus on developing dynamic analytical models, enhancing the assessment of transformation costs, and examining risk transmission mechanisms to improve the theoretical framework.

4 Conclusion and policy recommendations

Carbon neutrality policies can enhance enterprise productivity, thereby facilitating corporate transformation, industrial upgrading, and improved economic performance. Consumer preferences act as an implicit driving force behind enterprise transformation and upgrading.

In the case study, BYD achieved a significant increase in productivity through energy transition, technological

innovation, and integration of the industrial chain.Green products are being developed in response to consumer demand. Innovation efforts are being intensified to build competitive advantages and enhance market position. Green financing is being utilized to optimize the interest rate structure. However, tightened international policies and limited supply chain resilience continue to hinder development.

In summary, under carbon neutrality regulations, enterprises must strengthen carbon footprint management and establish a dynamic balance among technological upgrades, value chain restructuring, and cost control. At the same time, it is essential to focus on the development of demand-driven, non-technological green pathways in order to consolidate a competitive edge in the global new energy sector.

About the Author

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