INNOVATIVE BUSINESS MANAGEMENT STRATEGIES FOR ENVIRONMENTAL ENTERPRISES IN THE CONTEXT OF CHINA'S DUAL CARBON GOALS

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Abstract:

With the announcement and implementation of China's dual carbon targets, namely carbon peaking and carbon neutrality, the country is undergoing a critical transformation toward low carbon development. Environmental enterprises, as essential agents of green transition, are facing both unprecedented opportunities and significant challenges. This study investigates the current state of business management in environmental enterprises under the dual carbon policy framework and identifies key limitations in existing practices. It further explores innovative development strategies involving digital transformation, intelligent technologies, data driven decision making, and green supply chain integration. Based on case analysis, the paper proposes a forward-looking management model that aligns with policy trends, technological advancement, and market demands. The findings aim to offer both theoretical insight and practical guidance for promoting high quality and sustainable growth in the environmental sector.

Keywords:

Dual Carbon; Environmental Enterprises; Innovation; Sustainable Development; Management

Introduction

In recent years, climate change has emerged as one of the most pressing global challenges, attracting increasing attention from governments, industries, and the public (Abbass et al., 2022). In response, China has proposed the strategic objectives of carbon peaking and carbon neutrality, collectively referred to as the dual carbon goals (Wang et al., 2021). These goals mark a fundamental shift in the nation's approach to environmental governance and sustainable development (Wei et al., 2022). They aim to promote a comprehensive transformation of the economic structure, energy system, and industrial practices toward a low carbon model (He et al., 2022).

Environmental enterprises play a central role in this transformation. As key actors in pollution control, resource recovery, ecological restoration, and green innovation, these enterprises are vital for implementing national environmental policies and supporting the broader green economy (Jiang et al., 2023). The dual carbon agenda not only provides strong policy incentives and market potential but also imposes higher requirements on enterprise capabilities in technology, management, and adaptation (Xu et al., 2024). However, many environmental enterprises still face significant internal challenges. These include technological innovation lag, rigid and outdated management models, insufficient digital infrastructure, and a shortage of skilled personnel. Moreover, the lack of flexible response mechanisms to policy and market changes further constrains their ability to adapt and grow.

This paper aims to analyze the current landscape of business management within environmental enterprises under the dual carbon framework. It identifies major operational challenges and explores innovation driven strategies to address them. Specifically, it examines the potential of digital tools, intelligent systems, big data, and green supply chain integration in reshaping enterprise operations. The case-based approach was used to propose a policy aligned, market responsive, and technology enabled management model. The study seeks to provide theoretical support and actionable insights to guide environmental enterprises toward high quality and sustainable development in the era of dual carbon goals.

Dual Carbon Policy of China

China's dual carbon policy, which includes the goals of carbon peaking before 2030 and achieving carbon neutrality by 2060, reflects a national commitment to addressing climate change and promoting green transformation (Zhao et al., 2022). The policy emphasizes reducing greenhouse gas emissions, optimizing energy consumption structures, and accelerating the development of low carbon industries (Wen et al., 2024). In response, governments at all levels have introduced a series of regulatory frameworks, financial incentives, and market mechanisms to support low carbon innovation, environmental governance, and clean technology deployment (Li et al., 2023).

This policy framework provides a macro-level direction for national development while also redefining the strategic environment in which environmental enterprises operate (Zhu et al., 2024). It requires enterprises not only to comply with stricter environmental standards but also to proactively contribute to the national decarbonization agenda.

Opportunities For Environmental Enterprises

China's dual carbon policy has created significant opportunities for environmental enterprises. First, the government has introduced a variety of policy incentives, including subsidies, green bonds, tax relief, and preferential credit mechanisms (Shi & Xu, 2023). These measures aim to

reduce the financial burden of green investments and encourage the adoption of clean technologies (Zhang, 2024). Furthermore, the rapid advancement of technology has opened up new possibilities for environmental enterprises to innovate and improve operational efficiency (Obobisa & Ahakwa, 2024). Technologies such as big data, the Internet of Things (IoT), and artificial intelligence (AI) are increasingly being applied to areas such as environmental monitoring, waste management, and resource recycling, enabling enterprises to develop more effective and cost-efficient solutions (Javaid et al., 2022; Wang et al., 2021).

In addition, the growing public awareness of environmental issues and increasing demands for sustainable production processes have created a larger market for environmental services and products (de Guimarães et al., 2018). As both industries and consumers move toward greener practices, there is greater demand for cleaner production technologies, waste treatment solutions, and sustainable supply chain management (Söderholm, 2020). This expanding market provides opportunities for environmental enterprises to increase their market share and enhance their competitive advantage.

Challenges For Environmental Enterprises

However, despite these opportunities, environmental enterprises also face a range of challenges under the dual carbon framework. Technologically, many enterprises still lag in adopting advanced technologies, such as digitalization and automation, which limits their ability to innovate and stay competitive (Wang et al., 2022). Without significant investment in research and development, these enterprises struggle to meet the growing demands for energy efficiency and sustainable solutions. Moreover, many environmental enterprises continue to rely on outdated management practices that are less responsive to market changes, regulatory requirements, or technological advancements. This traditional approach hampers their capacity to adapt to the dynamic demands of the green economy.

The environmental sector is also experiencing heightened market competition. As the industry grows, an increasing number of new entrants are competing for market share, putting pressure on existing enterprises to differentiate themselves through technological, managerial, or service innovations (Qi & Han, 2023). In this highly competitive environment, those unable to innovate or scale up operations efficiently risk falling behind.

In addition to these internal challenges, external factors such as fluctuating raw material prices, evolving regulatory frameworks, and geopolitical risks pose significant risks to the stability and long-term viability of environmental enterprises (Wang et al., 2024). The dual carbon transition is a complex and long-term process, and enterprises must develop flexible, forward-looking strategies to navigate this uncertainty while remaining committed to their environmental and business objectives.

Current State In The Business Management

Despite the favorable policy environment created by the dual carbon strategy, many environmental enterprises remain constrained by outdated business management practices. A significant number of these enterprises still operate under traditional management models that emphasize stability over innovation, focusing primarily on securing government contracts and executing fixed, long-cycle projects. Such approaches, while historically effective, are increasingly misaligned with the dynamic and rapidly evolving demands of the green economy (Zhang & Xu, 2019). The result is a general lack of organizational agility, with slow decision-

making processes and limited responsiveness to policy changes, market fluctuations, and technological advancements.

Operational inefficiencies are further exacerbated by limited adoption of digital tools and intelligent management systems. Many enterprises continue to rely on manual processes and fragmented data systems, hindering their ability to collect, analyze, and act upon environmental and operational data in real time (Creech et al., 2014). This technological lag significantly reduces their capacity for precise environmental monitoring, performance optimization, and risk prediction. Moreover, without integrated platforms, enterprises struggle to achieve coordination across departments and supply chain partners, resulting in duplicated efforts, increased costs, and missed opportunities for value creation (Herrero & Jimenez, 2019).

Another major constraint is the insufficient investment in research and development, which limits innovation in both products and services. Many environmental enterprises lack the in-house expertise or capital required to develop proprietary technologies or to customize solutions based on complex, site-specific environmental problems (Nderi et al., 2025). As a result, they tend to rely on standard, low margin services that offer limited differentiation in an increasingly competitive market.

Talent shortages represent an additional structural challenge. Environmental enterprises require professionals with interdisciplinary knowledge spanning environmental science, engineering, information technology, and strategic management, but the availability of such talent is often inadequate (Lozano et al., 2024). This gap makes it difficult for firms to implement complex, innovation-driven projects or to effectively navigate digital transformation initiatives.

Compliance and risk management also remain areas of concern. Environmental regulations in China are undergoing continuous refinement, with increasingly strict standards and enforcement mechanisms. Enterprises that fail to keep pace with these developments risk legal penalties, operational disruptions, and reputational damage. Many enterprises also lack robust internal systems for environmental risk assessment and crisis response, further exposing them to potential liabilities (Boyer et al., 2008).

Case Analysis
Under the dual carbon policy framework, a number of leading environmental enterprises in China have undertaken innovative transformations to align with national decarbonization goals while improving operational efficiency and market competitiveness. These transformations cover core technology development, equipment upgrades, digital integration, and business model innovation, offering valuable reference points for the broader industry. This paper selects five representative companies based on criteria including industry influence, diversity in environmental sub-sectors (e.g., solid waste, hazardous waste, digital governance), and the extent of their low-carbon innovations. These cases provide a cross-sectional view of the main strategies adopted by environmental enterprises in response to dual carbon objectives.

One representative example is China National Building Materials Group, which has implemented smart equipment and intelligent process control systems across its cement production lines. Through real-time data analytics and automated system adjustments, the company has achieved dual reductions in energy consumption and carbon emissions—two critical metrics in the high-emission cement sector. This case underscores how equipment

digitization and industrial automation can simultaneously enhance environmental and economic performance (Chen et al., 2022).

In the field of hazardous waste treatment, Nanjing Jiangyu Environmental Protection Co., Ltd. has focused on resource recovery innovation. By developing and applying advanced solvent purification technologies, the company successfully converts waste organic solvents into high-purity electronic-grade materials. This closed-loop system supports both pollution control and resource recycling, exemplifying how circular economy principles can be integrated into hazardous waste management (Zhang et al., 2022).

Technological innovation in solid waste treatment is also accelerating. Several firms have adopted pyrolysis and gasification technologies for complex municipal and industrial waste streams. These thermochemical processes reduce landfill dependency while enabling energy recovery in the form of syngas and biochar (Dong et al., 2018). In parallel, the exploration of biomass-to-hydrogen technology is opening new pathways for renewable energy generation and carbon reduction in decentralized waste-to-energy systems.

Digital transformation is another key driver of efficiency and innovation. Welle Environmental Group Co., Ltd, a comprehensive environmental services provider, has deployed a full life cycle digital management system across its operations. This platform integrates production control, logistics, environmental monitoring, and asset management, enabling precise operational adjustments and predictive maintenance (Sternad et al., 2023). In a single facility, this transition led to an annual efficiency gain of over three million RMB, demonstrating the tangible economic benefits of digital innovation.

At the municipal governance level, platforms such as Shanghai's "One Net Unified Management" system illustrate how digital technologies can also empower regulatory authorities. By integrating environmental data from multiple sources, including enterprise monitoring systems, public complaints, and on-site inspections, the platform enables real-time monitoring, early warning, and targeted enforcement (Zhao & Cheng, 2024). This model reduces regulatory costs while enhancing transparency and compliance in the environmental sector.

Innovative Development Pathways For Business Management

To adapt to the evolving requirements of China's dual carbon strategy and to maintain competitiveness in a rapidly transforming green economy, environmental enterprises must fundamentally reconfigure their business management models. The successful cases discussed above suggest that innovation in management should be multi-dimensional, integrating technological, organizational, and digital strategies in a coordinated manner (Wang et al., 2021). This section outlines several key pathways for achieving such innovation.

Technology-driven transformation is essential for improving both environmental performance and economic viability (Wu et al., 2023). Enterprises should prioritize the development and deployment of core low-carbon technologies, particularly in areas such as pollutant treatment, resource recovery, and energy efficiency. For example, companies like China National Building Materials have achieved dual reductions in emissions and energy consumption through the integration of intelligent process control systems. Similarly, the adoption of advanced thermal conversion technologies, such as pyrolysis and gasification in solid waste treatment, not only reduces final waste output but also recovers valuable energy products.

These technological advancements must be supported by management systems that can effectively evaluate, finance, and scale such innovations across multiple sites or operations.

Digital empowerment plays a critical role in transitioning from extensive, reactive operations to precise, data-driven management. As illustrated by the Welle Environmental Group Co., Ltd's full life cycle digital platform and Shanghai's city level integrated monitoring system, digital technologies enhance real-time visibility and decision-making. Enterprises should invest in building digital infrastructures that unify environmental monitoring, equipment diagnostics, supply chain coordination, and regulatory compliance tracking. The integration of the Internet of Thing, big data, and artificial intelligence can significantly improve operational efficiency, reduce response time, and enhance regulatory transparency. Moreover, digital systems enable predictive analytics, which is crucial for proactive risk management and resource optimization (Mustafa, 2024).

Green supply chain management is becoming a cornerstone of sustainable business operations. Environmental enterprises must go beyond internal optimization and extend low-carbon principles throughout their value chains (Xin, 2024). This includes establishing green procurement standards, collaborating with suppliers and customers on emission reduction goals, and implementing life cycle assessment tools. Enterprises such as Nanjing Jiangyu Environmental Protection have demonstrated that closed-loop models based on waste valorization can generate both environmental and economic value, showcasing a viable path toward circular economy integration.

Organizational restructuring and talent development are necessary to support innovation-led strategies. The shift toward interdisciplinary, technology-driven operations requires flatter organizational structures that facilitate cross-functional collaboration and agile decision-making. Moreover, environmental enterprises must actively cultivate a workforce equipped with expertise in environmental science, digital technology, and systems thinking (Sharma & Kohli, 2023). Investment in talent development, internal innovation teams, and partnerships with research institutions can enhance the organization's capacity to absorb and apply new knowledge effectively.

Adaptive governance and risk management must be embedded into strategic planning. As regulatory standards evolve and market conditions fluctuate, environmental enterprises must build internal mechanisms that allow for flexible, responsive management. This includes establishing early warning systems for policy shifts, creating scenario-based planning models, and fostering a culture of continuous improvement (Wang et al., 2022b). Such capabilities will not only ensure compliance but also position enterprises to take advantage of emerging policy incentives and market opportunities.

Conclusion

Under the comprehensive advancement of the dual carbon goals, environmental enterprises are presented with unprecedented opportunities as well as higher demands. To achieve green, low-carbon, and high-quality sustainable development, these enterprises must break free from traditional management models and leverage technological innovation and digital transformation to build a forward-looking and adaptive management system. In the future, with the deepening of policies and the maturation of relevant technologies, environmental enterprises will play an increasingly crucial role in driving green transformation both in China and globally. To this end, the innovative development of environmental enterprise management

must be holistic and future-oriented. By integrating technological innovation, digital transformation, green supply chain strategies, organizational agility, and adaptive governance, enterprises can better align with national dual carbon goals while realizing sustainable and high-quality growth.

Acknowledgements

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