



ESG Practices and Challenges of New Energy Vehicle Enterprises in the Context of Digital Transformation: Taking BYD as an Example

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Abstract. Against the backdrop of the gradual deepening of energy and technological transformation in today's world, the integration of digital transformation and ESG practices in new energy automobile enterprises has become the key to gaining an edge in the industry competition. Taking BYD as the research object, this paper analyzes the practice performance and difficulties and challenges of new energy automobile enterprises by adopting the case study method and literature analysis method. It is found that although it has achieved certain results, it still faces problems such as insufficient adaptation of digital tools to ESG-related indicators, imbalance between technology investment and short-term benefits, and insufficient integration of supply chain and ESG management. In response to the above problems, this paper proposes corresponding initiatives, mainly from the perspective of technology development, process optimization and strategic support to give suggestions and solutions. The conclusions of the study can enrich the theories in related fields and provide practical references for other enterprises in the industry.

Keywords: Digital Transformation, New Energy Vehicles, ESG

1 Introduction

In the context of the global energy structure transformation and the increasing popularity of the concept of sustainable development, the new energy vehicle industry is experiencing unprecedented changes and facing more opportunities and challenges.

On the one hand, driven by both technology and sustainable development, enterprises in the new energy vehicle industry have more efficient, precise and flexible development opportunities. On the other hand, increasingly stringent and comprehensive policy regulation, as well as the urgent demand for sustainable development from consumers and the market, are forcing enterprises to incorporate ESG concepts into their long-term strategic planning. However, a mature integration paradigm has not yet been formed in the industry, and most enterprises still have many deficiencies and challenges in promoting the coordinated development of digital transformation and ESG strategies. Therefore, this paper hopes to focus on the above

two aspects, analyze the common problems existing in today's new energy vehicle enterprises, and put forward corresponding reference suggestions.

At the theoretical level, this study aims to fill the gap in the current research on the synergy between digital transformation and ESG, improve the research framework, and at the same time, explore the internal connection and mechanism between them, so as to provide new perspectives and theoretical support for related academic research through in-depth analysis. The study focuses on BYD, and explores its current situation, problems, experiences and lessons in the synergistic development of the two.

In short, based on the literature, this paper hopes to dig deeper into the case to find out the core problems of NEV enterprises represented by BYD in the process of ESG implementation, as well as the difficulties and obstacles related to digital transformation, and put forward targeted optimization suggestions based on this, so as to provide practical references for the construction of ESG strategies for enterprises in the industry in the context of digital transformation.

2 Theoretical Basis

In recent years, the correlation between digital transformation and enterprise ESG has become a hot research topic in the academic world, and the positive correlation between the two has been verified both theoretically and empirically. The core logic lies in the fact that in the process of digital transformation, the development of digital technology can promote the implementation of enterprise ESG strategy and improve the performance of enterprise ESG by empowering the enterprise green innovation, optimizing the allocation of resources, and reconstructing the enterprise's governance mode.

At the level of correlation between the two, digital technology can empower corporate ESG practices. Empirical research has verified that digitization is one of the core factors affecting ESG performance[1]. The application of digital technologies, such as blockchain and big data, can help enterprises achieve real-time monitoring and accurate tracing of environment-related data, improving the transparency and performance of environmental practices. An empirical study demonstrates that digital transformation of manufacturing enterprises can promote ESG strategy implementation through green technology innovation and green management innovation[2].

At the same time, digital transformation can enhance ESG performance through process optimization, such as improving supply chain resilience and governance structures. Based on the internal and external path model, it has been proposed that digital technology can strengthen internal/external monitoring and knowledge flow while facilitating collaborative innovation[3]. Further research has verified that digital transformation addresses information mismatches and optimizes resource allocation, enabling enterprises to improve efficiency in employee rights protection and supply chain collaboration, thereby enhancing corporate social responsibility performance[4].

However, affected by industry characteristics and the complexity of reality, the positive correlation between the two is not absolute. Research indicates that this relationship is influenced by enterprises' specific technological applications and

strategic implementation differences[5]. For example, a digital strategy implemented with top-level design is more capable of promoting governance improvements than isolated digital technology applications, while technological implementation in enterprises is constrained by supporting mechanisms that may lead to transformation costs exceeding benefits. This conclusion has been further validated through moderating effects models[6].

Focusing on the NEV industry, its technology-intensive and environmentally sensitive nature makes ESG practices subject to multiple internal and external factors. At the external factor level, policy serves as an important driver. The introduction of dual-carbon goals and industry ESG evaluation guidelines has directly motivated many enterprises to establish relevant risk management systems[7]. However, current policy supervision faces issues such as a one-size-fits-all approach, with implementation failing to fully consider industry-specific characteristics, resulting in rising compliance costs for enterprises. Market and stakeholder demands constitute another constraint. A study on BYD demonstrates that shifts in market preferences can drive corporate strategy changes, such as increasing environmental investments in response to rising consumer demand for green mobility[8]. Empirical research confirms that investor concerns and media supervision also push enterprises to optimize governance, though current ESG rating standards lack uniformity[9]. Internally, an enterprise's own ESG strategic positioning and governance structure form the core of practice implementation. Research also highlights that digital transformation strategies can enhance performance by strengthening dynamic capabilities when synergized with ESG objectives, while the absence of corresponding top-level design may lead to technological isolation and hinder development[10]. Although green technology innovation and digital transformation are critical for supporting corporate ESG, enterprises must remain cautious about the high-risk nature of technology investments, which may affect short-term financial performance and create transition challenges.

3 Case Description

This paper chooses BYD as the research subject mainly based on the following points. BYD is a key pioneer in China's NEV industry, and its development path fully reflects the transition of China's NEV industry from policy-driven to market-driven growth. And the company's strategic choices and practices have a significant demonstration effect on other enterprises. Also its whole-chain digital transformation is synergistic with its ESG strategy, providing technical support for the implementation of the ESG strategy, and the company's practices offer both successful outcomes and common challenges, providing rich material for studying the relationship between the two.

In terms of digital transformation, BYD has implemented systematic reforms across the entire production, operations, and R&D processes, establishing a unique competitive advantage. In the production phase, the company has actively built smart factories and established smart manufacturing bases across multiple regions in China. By adopting a technical architecture that combines digital twins with industrial internet technology, it has significantly enhanced production efficiency. BYD has also

developed a vehicle-to-everything platform and independently developed the intelligent connectivity system DiLink. This system not only provides users with functions such as intelligent driving and remote control but also analyzes vehicle energy consumption data through big data to deliver personalized low-carbon travel recommendations based on specific circumstances. In the critical area of supply chain management, BYD's digital management platform covers a wide range of suppliers. For example, the company uses blockchain technology to trace raw material origins, focusing on monitoring the extraction and compliance of critical minerals, thereby improving the ESG compliance rates of core suppliers.

BYD's ESG practices are deeply integrated with its digital transformation. In the environmental dimension, initiatives such as carbon-neutral factories have yielded results, and a digital carbon footprint calculation platform covers the entire supply chain. In the social dimension, the company has scaled up digital training programs for employees, with digital technologies enhancing the effectiveness of social responsibility fulfillment. In the governance dimension, digital tools strengthen compliance and transparency, such as the introduction of an electronic voting system to improve board efficiency and decision-making execution rates.

4 Analysis on the Problems

BYD has accumulated profound technical advantages in the field of NEV, providing a solid technical foundation for its digital transformation and ESG strategy implementation. In terms of ESG practices, the company has established a relatively comprehensive system, with clear goals and practical actions. However, due to industry characteristics and the complexity of implementation, there are still numerous problems and dilemmas that require urgent attention. The following sections will delve into these topics in detail.

4.1 Inadequate Adaptation of Digitalization Tools to ESG Indicators

Although BYD has taken numerous measures in digital transformation, its existing digital systems mainly focus on production efficiency and cost control, resulting in insufficient compatibility with ESG indicators. This leads to blind spots in ESG indicator monitoring and assessment, preventing an accurate and comprehensive reflection of corporate performance.

For example, when assessing environmental indicators, the energy consumption monitoring system in smart factories only quantifies direct carbon emissions, with insufficient monitoring of indirect carbon emissions in the upstream and downstream supply chain. This results in reliance on estimates for this portion of data in ESG reports, leading to high error rates and impacting the company's overall carbon reduction assessment, as well as further goal planning and strategic evaluations. Similar issues exist in the social dimension, such as insufficiently accurate monitoring of employee satisfaction metrics, which may be due to the lack of scientific depth in the digital monitoring process, making it difficult to comprehensively assess the fulfillment of corporate responsibilities and the effectiveness of actions. This lack of adaptability stems from the contradiction between the strong dynamism of ESG indicators and the

rigidity of digital tools. That is, ESG rating standards are frequently adjusted both domestically and internationally, while digital systems take a long time to iterate and update, creating a time lag between the two.

4.2 Imbalance Between Technological Investment and Short-term ESG Benefits

Since NEV industry is a technology-intensive industry, mastering advanced technologies and continuous breakthroughs is crucial for enterprises in the industry. Technological research and development has always been BYD's core competitiveness. In 2024, the company's R&D investment reached 54.2 billion yuan, a year-on-year increase of 35%, with a high proportion of investment in ESG-related technologies. However, some R&D investments may not yield immediate results in the short term, making it difficult to quickly improve a company's ESG performance. Additionally, the positive feedback from ESG initiatives often has a lag effect.

For example, the company's R&D investments in cutting-edge intelligent driving technology hold significant strategic importance in the long term, but may not directly improve the company's ESG performance in areas such as carbon emissions reduction or social responsibility fulfillment in the short term. Additionally, according to company announcements, investments in environmental protection technologies may reduce net profit margins, while the reduction in financing costs resulting from improved ESG ratings has a limited impact on revenue. This imbalance stems from both the lag in technology development and the external nature of ESG benefits, making it difficult for companies to directly quantify the returns. This high-investment, slow-return model may arouse some doubts.

4.3 Insufficient Integration of Supply Chain Digitization and ESG Management

Although BYD has built a supply chain digital platform and achieved certain progress, there is still insufficient integration with ESG standards. Data silos exist across various links in the supply chain, leading to coordination challenges. This means that suppliers and logistics providers cannot effectively and fully share information and data, making it difficult for the company to assess and manage the ESG performance of the supply chain as a whole.

For example, due to technical and financial constraints, the company cannot accurately monitor suppliers' environmental compliance metrics in real time, making it difficult to promptly identify non-compliance issues during the production process. Additionally, different suppliers adopt inconsistent ESG standards, making it challenging for the platform to uniformly organize and convert data, which brings great obstacles to collaborative management.

5 Discussion

In response to the above problems, this paper aims to combine theoretical research with industry practice to discuss corresponding solutions and propose more specific and practical solutions.

5.1 Inadequate Adaptation of Digitalization Tools to ESG Indicators

To address the issue of inadequate compatibility, companies can develop modular tools to achieve an organic integration of qualitative research and quantitative analysis. Specifically, organize a professional team to develop modular tools for monitoring and evaluating ESG indicators, and on the basis of retaining the basic functions of the original core system for data storage and analysis, develop corresponding plug-ins to address the dynamics of ESG, so as to shorten the iterative updating cycle.

Furthermore, the theory of dynamic adaptation can be applied to solve the problem. Collaborate with external institutions, such as co-building an indicator database, to establish a dynamic update mechanism that aligns indicators with tools. Regularly sort out the key contents of concern of global and domestic mainstream ESG standards, promptly update the monitoring dimensions of digital tools, and periodically optimize module tools to better adapt to the dynamic nature of ESG and market demands, thereby filling in the assessment blind spots.

5.2 Imbalance Between Technological Investment and Short-term ESG Benefits

Companies should implement technological innovations in phases. Before investing in R&D, they should conduct thorough feasibility studies and establish a tiered assessment model for the ESG benefits of technological investments. Projects should be classified into short-term, medium-term, and long-term categories, with separate investment plans and benefit assessment cycles established for each.

Also, companies should develop a phased plan to balance different types of inputs according to its financial situation and long-term or short-term development strategy. On one hand, it should enhance the confidence of the company through short-term projects that can improve the benefits and show the results to the stakeholders. On the other hand, long-term strategic projects should be emphasized to guarantee the company's sustainable development and core competitiveness. More importantly, companies should improve the technology tracking and evaluation mechanism to assess the implementation progress and ESG benefit outcomes of technology projects, and adjust strategies in a timely manner, to ensure that investments can lead to improved benefits.

5.3 Insufficient Integration of Supply Chain Digitization and ESG Management

If funds and technologies permit, the company can build a digital twin system based on its existing supply chain digital platform, collect data from all links of the supply chain in real time through the Internet of Things, big data, etc., breaking down data silos and achieving more comprehensive data sharing.

Considering that small and medium-sized suppliers may have relatively weak digital foundations, the company may provide them with lightweight digital tools that ensure basic data collection functions while lowering the threshold for accessing the integration platform.

Additionally, a data platform combining centralized and decentralized components can be established. The comprehensive platform would be responsible for unifying

standards and facilitating cross-regional and cross-departmental collaboration, while regional platforms would connect with local suppliers and provide customized data services.

6 Conclusion

Taking BYD as a case study, this study provides an in-depth analysis of the practices and challenges faced by NEV enterprises in the process of digital transformation and ESG integration. The research results show that BYD has built a relatively comprehensive ESG system, which covers multiple levels such as Technology, Process and Strategy. It is supported by digital tools, facilitated by digital supply chain management, and incorporates ESG concepts into the company's core strategy, forming a top-down promotion mechanism that has achieved remarkable results. However, the effectiveness of this mechanism is constrained by a number of factors, including the lack of adaptability of digital tools, difficulties in supply chain collaboration, imbalance between inputs and short-term outputs. These problems reflect the common contradictions faced by many NEV enterprises in the process of digital transformation and ESG integration.

The research results in this paper can provide a practical path for other enterprises in the new energy vehicle industry, holding theoretical value and practical guidance significance, and contributing to the industry's healthy development in this integration process.

However, this study employs a single-case analysis method, focusing solely on BYD. Although BYD possesses a certain degree of representativeness within the industry, the research findings are unable to fully encompass the actual circumstances of all enterprises and adequately consider the differences between enterprises of varying scales and types. Future research could select multiple companies of different sizes and operating in different niche markets for comparative analysis to expand the scope of the study and enhance its practicality. Additionally, quantitative analysis methods could be introduced, using data to construct an indicator system and quantitatively measure the efficiency of integrating digitalization with ESG, so as to further enhance the scientific rigor and universality of the research.

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