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Mechanism and Path of Digital Transformation in Traditional Manufacturing from an ESG Perspective: A Case Study of DP Holdings

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Abstract

Against the backdrop of the Dual Carbon goals and high-quality development, digital transformation has become a critical pathway for traditional manufacturing enterprises to resolve the conflict between economic and environmental benefits and to achieve green transition. Taking Dongpeng Holdings (DP) as a case study, this paper employs a single-case research method to deeply analyze the internal mechanisms and practical paths through which digital empowerment enhances ESG performance. The findings indicate that DP has achieved significant improvements in environmental, operational, and governance performance through four key mechanisms: data-driven decision- making, process optimization and resource efficiency enhancement, innovation empowerment and value creation, as well as transparency and governance strengthening. Furthermore, the company has constructed a transformation path framework encompassing six dimensions: strategy, data, process, innovation, ecosystem, and culture, thereby realizing the dialectical unity between mechanism elucidation and practical implementation. This study not only reveals the coupling mechanism between digital transformation and ESG performance but also provides theoretical references and practical insights for traditional manufacturing enterprises aiming to advance the digital + green dual transition.

Keywords: Digital transformation, ESG performance, Green transition, Single-case study, Traditional manufacturing.

1. Introduction

With the in-depth advancement of the Dual Carbon goals, social concern for ecological environmental protection is increasing day by day. As the main entities of the market economy, enterprises face an urgent requirement to transform from solely pursuing economic benefits to achieving the coordinated development of economy, society, and environment (Du & Li, 2024) .

The manufacturing industry serves as the pillar of the national economy; however, traditional manufacturing has long relied on an extensive growth model, characterized by prevalent issues such as excessive resource input, high pollution emissions, and low energy utilization efficiency (Zhang & Yang, 2023). According to statistics, the value added of traditional manufacturing accounts for approximately 80% of the total manufacturing industry (Qin et al., 2026); thus, the effectiveness of its green transition is directly related to the realization of China's Dual Carbon goals and the process of high-quality economic development. Nevertheless, for traditional manufacturing enterprises, increased investment in environmental protection often implies rising costs. Amidst fierce market competition, the contradiction between economic benefits and sustainable benefits has become increasingly prominent, even emerging as a critical bottleneck affecting the survival and development of enterprises. To resolve this dilemma, digital transformation has garnered significant attention.

Emerging digital technologies represented by artificial intelligence, big data, and cloud computing are profoundly reshaping the industrial landscape, making digital transformation a vital direction for manufacturing reform. Concurrently, ESG performance has increasingly become a crucial metric for measuring an enterprise's capability for sustainable development. Whether digital transformation can assist traditional manufacturing enterprises in breaking through the high energy consumption and high emission dilemma and achieving enhanced ESG performance has become an urgent practical issue to be addressed.

Although existing literature has verified the positive impact of digital transformation on ESG performance from the perspective of large-sample empirical studies, there remains a lack of in-depth exploration based on micro-level enterprise processes regarding the specific pathways and internal mechanisms through which digital transformation empowers ESG performance. In light of this, this study proposes the following three research questions:

Q1: Through which internal mechanisms does the digital transformation of traditional manufacturing enterprises empower ESG performance?

Q2: Based on an ESG orientation, how should enterprises construct the implementation pathways for digital transformation?

Q3: What references can DP's digital transformation practices provide for enterprises in the same industry?

In response to the aforementioned research questions, this study aims to achieve the following objectives:

(1) To reveal and verify the internal mechanisms by which digital transformation empowers ESG performance. Through an in-depth single-case analysis of Dongpeng, identify and validate the four internal mechanisms (hereinafter referred to as the four mechanisms) through which digital transformation empowers ESG performance.

(2) To attempt to construct an implementation pathway framework for digital transformation based on an ESG orientation. Based on the mechanism analysis, attempt to construct a six-dimensional pathway framework (hereinafter referred to as the six dimensions) encompassing strategic top-level design, data governance foundation, process reengineering and intelligent empowerment, green innovation drive, ecological synergy building, as well as cultural and organizational transformation.

(3) To distill implications. Summarize DP's successful experience to provide practical insights and policy recommendations for the building ceramic industry and other traditional manufacturing enterprises regarding their digital transformation and the enhancement of ESG performance.

This study primarily employs the single-case study method, selecting DP as a single case for in-depth analysis. By systematically collecting secondary textual data such as DP's annual reports, ESG reports, and official website news over the years, this study conducts a profound dissection of the process mechanisms and implementation paths of digital empowerment on ESG performance, providing a reference template for similar enterprises.

Based on the aforementioned research content, this study attempts to achieve innovations in the following three aspects:

(1) Perspective innovation: Constructing an integrated analytical framework of digitalization and ESG. Breaking through the limitations of previous studies that discussed the economic effects of digitalization and the social value of ESG in isolation, this study takes ESG performance as the core outcome variable of digital transformation. It constructs an integrated analytical framework for the synergistic development of digitalization + greenization, providing a new theoretical perspective for understanding how traditional manufacturing can resolve the contradiction between economic and environmental benefits.

(2) Content innovation: Revealing the process black box of how digital transformation empowers ESG performance. Existing studies mostly stop at the verification of correlations and lack in-depth investigation into the internal transmission paths. This study identifies and validates the four mechanisms, clearly displaying the complete transmission chain from digital input to the improvement of ESG performance, thereby opening the process black box of the transformation's effects.

(3) Path innovation: Distilling an actionable six-dimension transformation action framework. Addressing the deficiency of existing studies in providing practical implementation guidance, this study distills a transformation path framework encompassing six dimensions. This framework embeds ESG concepts into the entire transformation process, offering a clear, replicable, and scalable action guide for enterprises in the same industry.

2. Literature Review

2.1. Research on the Digital Transformation of Traditional Manufacturing

Existing studies generally concur that the digital transformation of traditional manufacturing is not merely a superposition of technologies, but a process of systematic reconstruction in which enterprises utilize digital technologies to overhaul production processes, organizational structures, and business models. Qin et al. (2026) point out that this is essentially a systematic reconstruction of production relations; Wu et al. (2022) further distinguish it as resource integration based on digitization, emphasizing its attributes at the configurational level, while Savastano et al. (2019) add that it is more fundamentally a cultural change. Regarding the motivations and pathways of transformation, scholars have explored them from different perspectives: Zhang and Yang (2023), based on the Theory of Planned Behavior, find that managers' perception of expected benefits and competitive pressure are important internal driving forces promoting transformation; Wu et al. (2022) and Zhu and Li (2025) reveal the path dependency and ecological characteristics of transformation from the perspectives of the three-stage evolution model and the driving effect of leading enterprises, respectively. Furthermore, research has also identified significant gradient differentiation across industries, with small and medium-sized enterprises (SMEs) generally facing the dilemma of being unwilling to transform, afraid to transform, or unable to transform (Qin et al., 2026) . Although existing studies have extensively explored the motivations and stages of digital transformation, most treat it as a process of technological upgrading, rarely considering its social and environmental value attributes within the ESG framework.

2.2. Research on Corporate ESG Performance

ESG, encompassing Environmental (E), Social (S), and Governance (G) dimensions, is an important comprehensive framework for measuring an enterprise's capability for sustainable development. In recent years, the relationship between ESG performance and high-quality enterprise development has received widespread attention in academia. Relevant research mainly unfolds along two threads: the influencing factors of ESG performance and its economic consequences.

Regarding the influencing factors of ESG performance, scholars have explored them from multiple perspectives, including the institutional environment, internal governance, and technological innovation. From the perspective of the institutional environment, government regulatory policies and disclosure requirements from the capital market drive enterprises to improve their level of ESG practices (Wang and Zhang, 2023). Regarding internal governance structure, Cheng and Yu (2025) found that digital transformation enhances corporate ESG performance through three pathways: improving the quality of internal control, increasing analyst attention, and promoting knowledge flow. In terms of technological innovation, Shi et al. (2025) discovered that digital transformation exerts positive effects on all three dimensions—environmental, social, and governance—with technological innovation acting as a key transmission conduit.

In terms of economic consequences, existing studies have confirmed that good ESG performance can bring about various positive effects. Li et al. (2021) found that ESG performance significantly improves corporate

financial performance, with corporate innovation playing a mediating role. Zhang et al. (2025) and Hasemqier et al. (2025) confirmed respectively that ESG performance enhances total factor productivity through green innovation. In international research, Zahroh and Hersugondo (2021), using Indonesian manufacturing as a sample, verified the positive impact of ESG performance on financial performance; Barrymore and Sampson (2021) found that ESG performance has a positive influence on labor productivity, with firm size being a key moderating variable. The aforementioned studies indicate that ESG performance has become a critical factor affecting corporate competitiveness.

2.3. Research on the Interactive Relationship between Digital Transformation and ESG Performance

The relationship between digital transformation and ESG performance has been a research hotspot in recent years. Scholars have conducted extensive discussions surrounding the direct impact, mechanisms of action, and contextual conditions between the two. Regarding direct impact, the majority of scholars have confirmed that digital transformation has a significant positive effect on corporate ESG performance. Du and Li (2024) verified this conclusion based on data from listed manufacturing companies, while Shi et al. (2025) further found that digital transformation has a positive influence on all three sub-dimensions: environmental, social, and governance. Tan et al. (2024), from a composite perspective, confirmed that digital transformation simultaneously enhances enterprise total factor productivity and ESG performance, achieving a win-win situation. Song et al. (2025), Cheng and Yu (2025), and Yuan and Zhang (2026) all support this conclusion based on different samples. In international research, Kwilinski et al. (2023), using EU countries as a sample, found that digital transformation possesses the potential to enhance ESG performance and spatial spillover effects; Faizulayev et al. (2026), based on data from Asian manufacturing enterprises, found that ESG variables significantly enhance the explanatory power of the model.

In terms of mechanisms of action, scholars have identified numerous transmission paths. Du and Li (2024) revealed three pathways: enhancing green innovation performance, curbing managerial myopia, and improving resource allocation efficiency. Cheng and Yu (2025), starting from dual internal and external paths, discovered the mediating roles of analyst attention, internal control quality, and internal and external knowledge flow. Based on dynamic capability theory, Yuan and Zhang (2026) found the mediating effects of absorption capability, innovation capability, and adaptive capability. Both Shi et al. (2025) and Kwilinski et al. (2023) verified the conducting role of technological innovation.

Regarding contextual conditions, research has found that the promoting effect of digital transformation on ESG performance is moderated by various factors. Based on heterogeneity tests using the TOE framework, Cheng and Yu (2025) found that the promotion effect is stronger when enterprises possess strong technological capabilities, low customer concentration, and are located in regions with high levels of digital economy development. The study by Faizulayev et al. (2026) further indicated that ESG variables act as an enhancer in the relationship between digital transformation and corporate competitiveness. Kwilinski et al. (2023) revealed the spatial spillover effects of digital transformation on ESG performance from a macro level.

2.4. Research Gaps and Commentary

Based on the comprehensive review of the aforementioned literature, existing research has achieved fruitful results in the fields of digital transformation of traditional manufacturing and ESG performance; however, the following deficiencies still remain:

In terms of research depth, existing studies have verified the positive effect of digital transformation on ESG performance through large-sample empirical analyses and identified multiple pathways such as green innovation performance, dynamic capabilities, and internal control quality. However, these findings primarily address the questions of whether there is an impact and through which variables it is affected, lacking an in-depth dissection of process-oriented questions such as how it affects and why it affects.

In terms of research methodology, existing studies are predominantly dominated by quantitative empirical research, while in-depth case studies are relatively scarce, making it difficult to present the dynamism and complexity of the transformation process. Single-case studies possess unique methodological advantages in revealing complex causal relationships and dynamic evolutionary processes, yet their application in this interdisciplinary field remains limited.

In terms of industry focus, existing studies mostly utilize data from the entire manufacturing sector or across industries, with few conducting in-depth analyses specifically on traditional manufacturing industries such as the building ceramics industry. As a high-energy-consumption and high-emission industry, the building ceramics industry involves high-temperature firing in its production processes, characterized by intensive energy consumption and prominent environmental issues such as dust and waste gas. It faces both environmental pressure and the need for transformation, yet relevant case studies are very limited.

In terms of theoretical integration, although some studies have introduced perspectives such as resource-based theory, dynamic capability theory, and stakeholder theory, research that organically integrates these theories to construct a systematic analytical framework remains limited.

Based on the aforementioned research gaps, this study selects DP as the case object and employs a single-case study method. By integrating Resource-Based View (RBV), dynamic capability theory, stakeholder theory, and business process reengineering theory, this study conducts an in-depth analysis of the micro-mechanisms and practical paths through which digital transformation empowers ESG performance in traditional manufacturing.

2.5. Theoretical Basis and Mechanism Analysis

2.5.1. Analysis of Influence Mechanisms

Based on the integration of the aforementioned theories, this study proposes four core mechanisms through which digital transformation empowers ESG performance:

(1) Data-driven and Intelligent Decision-making Mechanism: Based on the sensing perspective of dynamic capabilities, this mechanism utilizes IoT and energy management platforms to collect energy consumption data in

real-time, shifting the enterprise decision-making model from experience-driven to data-driven. Its process of action manifests as follows: By deploying sensors and smart meters at key energy consumption nodes, the enterprise transforms originally discrete and lagging energy consumption data into a real-time, visible digital stream. Subsequently, the big data analysis platform identifies energy consumption anomalies and areas for emission reduction potential, ultimately providing precise optimization decision-making data for management. This transmission chain enables the enterprise to accurately perceive the operational status of the environmental dimension, effectively reducing information asymmetry and decision-making biases, providing an information foundation for precise control, and thereby significantly improving performance in the E dimension.

(2) Process Optimization and Resource Efficiency Enhancement Mechanism: Combining the Resource-Based View (RBV) with Business Process Reengineering theory, this mechanism embeds digital technology into core links such as procurement, production, and logistics, breaking down information barriers and realizing full-chain data connectivity and process collaboration. Its process of action manifests as follows: Through ERP systems, the enterprise connects originally fragmented order data, inventory data, and production scheduling data, making material allocation more precise and reducing stagnant inventory; MES systems monitor production line energy consumption and yield rates in real-time, automatically adjusting process parameters to reduce energy consumption per unit of product; intelligent logistics systems optimize transportation routes, reducing unnecessary transit losses. The superimposed effect of these multiple processes ultimately achieves refined operations at the manufacturing end and collaborative scheduling at the supply chain end, significantly lowering resource energy consumption and transaction costs per unit of output, while simultaneously making positive contributions to both the E and G dimensions.

(3) Innovation Empowerment and Value Creation Mechanism: Integrating the seizing dimension of dynamic capabilities with stakeholder theory, the empowerment of innovation activities by this mechanism is reflected at three levels: (A) Digital R&D tools accelerate the iteration speed of green technologies, shortening the application cycle from the laboratory to mass production; (B) Data-driven market insights focus innovation more on sustainable development directions, helping enterprises accurately identify customers' low-carbon product needs; (C) The business model extends from product manufacturing to product + service, opening up new value growth points. These triple processes reinforce each other, ultimately helping the enterprise achieve a synergy between economic benefits and environmental benefits, exerting a positive influence on the E and S dimensions.

(4) Transparency and Governance Strengthening Mechanism: According to stakeholder theory, this mechanism realizes the quantifiability, traceability, and verifiability of ESG information through a unified data management platform, strengthening governance from three levels: At the internal level, real-time data monitoring reduces the information asymmetry risk for management, effectively inhibiting myopic behavior; at the external level, transparent data disclosure lowers information costs for stakeholders and enhances the effectiveness of external supervision; at the compliance level, automated data collection and report generation significantly reduce the marginal cost of ESG information disclosure, enabling enterprises to meet increasingly strict disclosure requirements with fewer resource inputs. These three levels work together to ultimately strengthen performance in the G dimension and provide an institutional guarantee for the continuous improvement of the E and S dimensions.

Based on the theoretical analysis of the four major mechanisms above, it can be further found that these mechanisms are not independent of each other but possess a clear progressive logic: The data-driven and intelligent decision-making mechanism is the foundational layer; without precise data sensing, the subsequent process optimization and innovation empowerment lack a basis. The process optimization and resource efficiency enhancement mechanism is the application layer, transforming data insights into actual operational improvements. The innovation empowerment and value creation mechanism is the upgrade layer, opening up new growth spaces on the foundation of the first two layers. The transparency and governance strengthening mechanism is the safeguard layer, providing institutional and governance support for the continuous operation of the preceding three mechanisms. More importantly, the evolutionary logic of these four mechanisms — from foundation-application-upgrade-safeguard—naturally leads to the six key dimensions that enterprises need to systematically lay out in practice: The foundational layer corresponds to the data governance dimension; the application layer corresponds to the process reengineering dimension; the upgrade layer corresponds to the green innovation and ecological synergy dimensions; the safeguard layer corresponds to the strategic top-level design and cultural and organizational transformation dimensions. In other words, a logical consistency is constituted between the four mechanisms at the theoretical level and the six-dimension path at the practical level; the former explains the mechanisms of action, while the latter provides an action framework.

2.6. Research Propositions

Based on the aforementioned theoretical analysis and mechanism discussion, this study focuses not only on the identification and verification of mechanisms but also on the transformational construction from mechanisms to paths—that is, advancing from understanding how transformation occurs to guiding how transformation is implemented. Together, they constitute a dialectical unity of mechanisms explaining principles and paths implementing schemes. Accordingly, the following propositions are proposed:

P1: DP empowers ESG performance through four mechanisms: data-driven and intelligent decision-making, process optimization and resource efficiency enhancement, innovation empowerment and value creation, as well as transparency and governance strengthening.

P2: The practical paths for the digital transformation of traditional manufacturing from an ESG perspective encompass six dimensions.

P3: The mechanisms and paths of digital empowerment on ESG performance constitute a dialectical unity of mechanisms explaining paths and paths practicing mechanisms.

3. Case Introduction and Rationale for Selection

3.1. Current Status of Digital Transformation and ESG Practices in Traditional Manufacturing

Traditional manufacturing is the cornerstone of a modern industrial system, with its value added accounting for approximately 80% of the total manufacturing industry (Qin et al., 2026), covering key sectors of the national economy such as steel, petrochemicals, textiles, and building materials. Driven by the dual goals of the Dual Carbon targets and the high-quality development strategy, traditional manufacturing is facing the dual pressure of digital transformation and green low-carbon transition. In terms of the digital transformation process, as of December 2025, the proportion of industrial enterprises above designated size nationwide carrying out digital transformation reached 89.6%, and the penetration rate of digital equipment reached 57.7% (CAICT, 2026). However, the effectiveness of digital transformation varies significantly among different entities. The Report on Digital Innovation in China's Manufacturing Industry (2025) indicates that the digital transformation of manufacturing is transitioning from a scale expansion stage to a quality improvement stage, characterized overall by prominent highlights and structural differentiation. Technology-intensive industries are leading, while resource and process-based industries are lagging relatively behind in their transformation (Xie et al., 2026). Regarding ESG practices, driven by the Dual Carbon goals and green finance policies, ESG information disclosure has become particularly important, yet traditional manufacturing enterprises face significant challenges in their ESG practices, with a lag existing between policy and implementation. Based on this background, this study selects a typical enterprise with industry leadership in both digital transformation and ESG practices for in-depth analysis. This holds significant academic value and practical implications for revealing the internal mechanisms of the integrated development of digitalization + greenization in traditional manufacturing.

3.2. Case Selection and Corporate Profile

This study selects Guangdong Dongpeng Holdings Co., Ltd. (03386.HK) as the single-case sample. According to the industry classification of the China Securities Regulatory Commission, DP belongs to the C30 Non-metallic Mineral Products industry and is a leading enterprise in the building ceramics industry (DP, 2020). As a typical traditional manufacturing enterprise, its production process involves high-temperature firing, and it has long faced environmental pressure of high energy consumption and high emissions, making it an ideal sample for observing the digitalization + greenization dual transformation.

The selection of DP is primarily based on its typicality and representativeness: In terms of ESG practices, the company has been awarded a Wind ESG Rating of 2A, a Huazheng Rating of 3A (DP, 2025a; Liu, 2025), recognized by the Ministry of Ecology and Environment of the People's Republic of China as a 2025 ESG Potential Enterprise (DP, 2025b, July 9), and included in S&P Global's Sustainability Yearbook (DP, 2026a, February 26), reflecting an industry-leading governance level (G1). In terms of digital transformation, as one of the first batch of demonstration enterprises for Made in China 2025, DP has deeply applied APS, MES, and big data management systems to achieve intelligent production across the entire chain. This study mainly relies on secondary materials such as the DP 2025 ESG Report (DP, 2025c) for coding analysis.

4. Mechanism Analysis and Practice Path

4.1. Mechanism Analysis of DP's Digital Transformation Empowering ESG Performance

The analytical framework in Chapter 2 indicates that digital transformation empowers corporate ESG performance through four mechanisms: data-driven and intelligent decision-making, process optimization and resource efficiency enhancement, innovation empowerment and value creation, as well as transparency and governance strengthening. Using DP's specific practices as evidence, this chapter verifies the operational logic of the aforementioned mechanisms at the enterprise level one by one. During the analysis process, this study systematically extracted and integrated key data from DP's ESG report based on the coding logic shown in Table 1, providing detailed empirical support for the verification of the mechanisms.

Table 1. Extraction and Coding of Key Content from the 2025 DP ESG Report.

Dimension/Path		Code	Key Content Extraction
E	Environmental Performance	E1~E4	Performance data such as reduction in carbon emission intensity, certification as a national-level green factory, and application of dry granulation technology.
S	Social Value	S1~S4	Innovation indicators including R&D investment ratio, number of valid patents, innovation platform construction, and industry standard formulation.
G	Corporate Governance	G1	Establishment of a three-level governance structure consisting of the Board-ESG Management Team-Executive Team.
ST	Strategic Top-level Design	ST1~ST2	Strategic content such as corporate development vision, strategic positioning, and employee cultural identity.
DG	Data Governance Foundation	DG1~DG2	Digital infrastructure including data middle platforms and the application of the QMS quality management system.
PT	Process Reengineering Empowerment	PT1~PT2	Process optimization practices such as intelligent production, AI visual inspection, and supplier collaborative operations.
EC	Ecological Synergy Building	EC1~EC3	Ecological construction initiatives including green supply chain management, SRM platform operations, and 5A-level certification.
IC	Cultural and Organizational Transformation	IC1	Soft change measures such as the cultivation of employee digital capabilities and cultural sustainability construction.

4.1.1. Environmental Dimension: Data-Driven and Intelligent Decision-making

The core of this mechanism lies in achieving real-time collection and intelligent analysis of production data through IoT devices and industrial internet platforms, providing an information foundation for precise control in the environmental dimension and realizing a paradigm shift from experience-driven to data-driven decision-making. DP deployed sensors and smart meters at key energy consumption nodes, transforming originally discrete and lagging energy consumption data into real-time, visible digital streams. Through the big data analysis platform, energy consumption anomalies and areas for emission reduction potential were accurately identified. This process enabled DP to achieve a fundamental transformation from passive emission reduction to active carbon control, where data insights became the direct basis for formulating environmental optimization strategies. In 2025, the carbon emission intensity per unit of ceramic tiles produced by DP decreased by 2.49% year-on-year, and the carbon emission intensity per unit of sanitary ceramics decreased by 5.33% (E1). This emission reduction result is significantly better than the industry average (approximately 7.06 kg CO_2eq./m^2) (CBC & SWA, 2024, March 15), effectively validating the empowerment effect of digital transformation in the Environmental (E) dimension and providing a feasible path for breaking the high energy consumption, high emission development dilemma of traditional manufacturing.

4.1.2. Operational Dimension: Process Optimization and Resource Efficiency Enhancement

The core of this mechanism lies in embedding digital technologies into core links such as procurement, production, and logistics to break down information barriers, realizing full-chain data connectivity and collaborative scheduling, thereby enhancing resource utilization efficiency. At the manufacturing end, taking Industry 4.0 as a reference standard, DP comprehensively introduced advanced production management systems to achieve full-cycle consistency in quality management. At the supply chain end, DP built a localized supply system and a one-stop digital procurement management platform, realizing a full-chain localized layout from raw material acquisition to finished product supply. Through full-chain optimization, all three of DP's major production bases were recognized as national-level Green Factories, and DP was the first in the industry to pass the Ministry of Industry and Information Technology's Green Supply Chain Management Enterprise certification, achieving a win-win for both operational efficiency and environmental performance (E2 & E3).

4.1.3. Value Dimension: Innovation Empowerment and Value Creation

The core of this mechanism lies in opening up green value creation space through a digital R&D paradigm and business model innovation, achieving a synergy between economic benefits and environmental benefits. On the R&D front, DP established 37 innovation platforms (S3), accumulating a total of 2,548 patents and holding 1,322 valid patents of various types. In 2025, the R&D investment ratio reached 3.58% (S1 & S2 & S4). Regarding green products, DP took the lead in applying advanced processes such as dry granulation, significantly reducing production energy consumption and emissions (E4). In terms of business model innovation, with the core philosophy of making sustainability a measurable competitiveness, DP organically combined green product innovation with business model transformation. In terms of value creation, green innovation achievements have been successfully applied in multiple zero-carbon building projects, opening up new growth spaces for the enterprise and effectively enhancing performance in the Social (S) dimension.

4.1.4. Governance Dimension: Transparency and Governance Strengthening

The core of this mechanism lies in realizing the quantifiability, traceability, and verifiability of information through the standardized collection and visual presentation of ESG data, strengthening governance performance at three levels: internal governance, external supervision, and compliance management. At the internal governance level, DP constructed a three-level governance architecture comprising the Board-ESG Management Team-Executive Team, improving cross-departmental information collaboration and decision-making response efficiency (G1). At the external supervision level, relying on solid ESG data management and high-quality information disclosure, DP gained widespread recognition from the capital market and rating agencies. At the compliance management level, all eight of DP's production bases passed the ISO 50001 energy management system certification (DP, 2025c), and the company strictly manages and disposes of hazardous waste in compliance, with emission indicators stricter than national standards. These governance achievements strongly support the strengthening of the Governance (G) dimension and provide an institutional guarantee for the continuous improvement of the Environmental (E) and Social (S) dimensions.

4.2. Practice Path: ESG-oriented Digital Transformation Framework

The previous mechanism analysis revealed how digital transformation works, and this chapter further explores how enterprises implement it. Based on DP's transformation practices, this study distills a transformation path framework encompassing six dimensions, providing an actionable guide for reference by enterprises in the same industry. The construction of this framework is based on the coding system in Table 1, ensuring the empirical basis of the path distillation through the coding analysis of key practical materials in each dimension.

4.2.1. Strategic Top-level Design

Digital transformation is by no means a fragmented technology deployment, but an engineering project that requires systematic top-level planning from a strategic height. DP conducted a systematic layout at the strategic level: (1) Clarification of strategic positioning. Upholding the vision of Centennial Enterprise, Global Dongpeng, DP takes Innovation-driven, Lean Operations, Digital Empowerment, Green Development as the four major transformation and upgrading paths, firmly advancing the Digital Drive, Intelligent Manufacturing Future strategy (ST1). In terms of green and low carbon, with Low-carbon Dongpeng, Pioneer in Green Building as the overall positioning, low-carbon development has been incorporated into the company's highest strategy. (2) Systematization of strategic goals. Digital transformation focuses on the three major goals of experience

improvement, efficiency improvement, and model innovation, forming a progressive logic from improving customer experience to enhancing operational efficiency and then to innovating business models. At the same time, ESG concepts are embedded into the strategic goal system. (3) Organization of strategy implementation. DP constructed a three-level governance architecture of Board-ESG Management Team-Executive Team to ensure the effective transmission of ESG strategy from top-level decision-making to grassroots execution (G1).

4.2.2. Data Governance Foundation

DP consolidated the foundation of transformation by establishing a systematic data governance system: (1) Building a unified data middle platform. Through data science governance, data transmission across entire business segments such as R&D, production, supply chain, and marketing was connected, breaking down information silos (DG1). (2) Deploying a full-process data collection system. A data collection and energy management center was deployed at the production end to achieve real-time collection and full-process traceability of production data. (3) Achieving deep integration between systems. The application of the QMS quality management system was deepened to realize real-time feedback of process quality data, integrating scattered resources into unified data assets (DG2).

4.2.3. Process Reengineering and Intelligent Empowerment

Taking Industry 4.0 as a reference standard, DP systematically and digitally reconstructed core business processes: In terms of production processes, by building a full-chain digital production system, lean control from raw materials to finished products was achieved (PT1); In terms of quality control, a thinking factory was created, promoting data to replace experience in leading production; In terms of supply chain processes, a localized supply system and a digital procurement platform were created to optimize resource allocation. At the same time, industrial internet and 5G technologies were introduced to fully build smart manufacturing factories that meet international Level 4 standards (PT2).

4.2.4. Green Innovation Driven

Green innovation is a key bridge connecting digital transformation and ESG environmental dimension performance. DP adopted the following innovation measures: In terms of R&D innovation, DP built a strong technology innovation system, equipped with a large number of innovation platforms and engineering technology research centers, with R&D investment increasing year by year; In terms of green products, DP took the lead in applying advanced processes such as dry granulation and low-temperature fast firing, significantly reducing production energy consumption and emissions (E4), actively implementing the 3R concept of the full product life cycle, and converting waste into high value-added products; In terms of business model innovation, DP organically combined green product innovation with business model transformation, and green innovation achievements have been successfully applied in multiple zero-carbon building projects, achieving a dual improvement in economic and environmental benefits.

4.2.5. Ecological Synergy Building

An enterprise's ESG performance depends not only on its own operations but is also profoundly influenced by the upstream and downstream supply chain. As a chain master enterprise, DP actively built an industrial ecosystem: In terms of standard co-construction, as a drafting unit of national standards, DP was among the first to pass the new national standard 5A certification (EC2), leading the high-quality development of the industry with high standards; In terms of supply chain empowerment, the SRM supplier collaboration system was launched to help upstream and downstream SMEs reduce management thresholds (EC1); In terms of green collaboration advancement, the two provisions and one co-construction model was proposed, clarifying the green threshold for procurement and opening resources to the supply chain to convey the concept of sustainable development (EC3).

4.2.6. Cultural and Organizational Transformation

The core challenge of digital transformation is often not technology, but human concepts and organizational inertia. DP promoted changes from the soft level: In terms of cultural reshaping, DP constructed a culture-led quality management model, where corporate culture penetrated every link of production activities, providing an important foundation for corporate governance; In terms of organizational change, DP started organizational vitality through the Amoeba mechanism, built a scientific governance architecture, and achieved cross-departmental information collaboration and decision-making response efficiency improvement; In terms of talent and capability building, DP focused on cultivating employees' digital capabilities, incorporated AI application into performance appraisal, making digital concepts penetrate into employees' thinking and actions (IC1). At the same time, the company attaches great importance to employee growth and care. Through benchmarking publicity activities such as annual awards and Culture Star selections, advanced models practicing sustainable development concepts are established; By means of roundtable tea parties between senior management and employees during anniversaries, employees' voices are listened to, empowering employees and the enterprise to grow together, and strengthening employees' sense of identity and mission with the vision of Centennial Enterprise, Global Dongpeng, laying a solid foundation for digital transformation (ST2).

In summary, DP's digital transformation practice has constructed a systematic path from strategy to execution, from technology to culture, and from the enterprise itself to the industrial ecosystem. The six dimensions support each other: strategy and data establish the direction and foundation, process and innovation focus on efficiency and value, and ecology and culture expand boundaries and consolidate guarantees. This framework embeds ESG concepts into the entire transformation process, providing a replicable action guide for traditional manufacturing.

Building upon the verification of these mechanisms and paths, the following chapter explores the theoretical implications and practical insights derived from DP's experience.

5. Discussion

By analyzing the case of DP, this research elucidates the systemic nature of digital transformation in driving ESG performance within traditional manufacturing. Rather than a mere technical overlay, the transformation manifests as an empowerment process anchored in four core mechanisms: data-driven intelligent decision-making, process optimization for resource efficiency, innovation-enabled value creation, and transparency-enhanced governance strengthening. These mechanisms do not operate in isolation; rather, they interconnect to form a cohesive six-dimensional practical pathway. The analysis indicates that DP has successfully integrated ESG principles into its corporate strategy, evidenced by high levels of digitalization and sustainability performance. This suggests that for traditional manufacturers, digital transformation is viewed not merely as a cost center but as a viable strategy to reconcile the traditional conflict between economic growth and environmental stewardship.

The case analysis further highlighted a strong positive correlation between digital initiatives and ESG outcomes. Specifically, the four identified mechanisms map directly onto the six dimensions of the practical path. For instance, the data-driven mechanism provides the necessary inputs for the data governance dimension, while the process optimization mechanism underpins the process reengineering dimension. This alignment confirms that variables within the transformation model are tightly coupled, validating the proposed relationship between theoretical mechanisms and practical execution.

In dissecting the relationship model, it becomes clear that digital transformation does not automatically yield ESG benefits; it requires the mediation of specific internal capabilities. This aligns with the Resource-Based View (RBV) and dynamic capability theory, which posit that firms must develop distinct capacities to leverage digital tools effectively. The mechanisms identified answer the theoretical why—explaining the causality—while the paths address the operational how. Thus, the study bridges the gap between abstract theory and concrete action, showing that data governance is the practical manifestation of data-driven logic, and green innovation is the tangible output of the innovation empowerment mechanism.

This work contributes to the literature in three primary ways. It breaks the silos of previous research by integrating digitalization and ESG into a unified framework, blending RBV with stakeholder theory. Furthermore, by unlocking the process black box, the study moves beyond confirming correlations to explain specific transmission chains—showing how digital inputs convert into ESG outputs. Finally, the concept of a dialectical unity between mechanisms and paths is introduced, suggesting that theory and practice mutually reinforce corporate transformation.

Drawing from DP's experience, this study offers actionable insights for peers in traditional manufacturing. Strategically, firms must align digital and green goals at the top level, treating ESG as a core component of strategy rather than a compliance burden. Operationally, the foundation lies in dismantling data silos to build a unified data governance platform. On the production floor, the thinking factory model demonstrates that process reengineering—using tools like AI visual inspection—can simultaneously boost efficiency and environmental performance. Beyond the factory gates, leading enterprises should act as chain masters, utilizing ecological thinking to drive green standards across the supply chain. Furthermore, cultural transformation is paramount; digital and ESG values must be embedded into employee performance metrics and organizational habits.

Policy-wise, the government should enhance collaborative guidance by merging digitalization and ESG policies into a unified framework, setting clear indicators for synergistic development. Targeted support is crucial for SMEs facing resource constraints, potentially through dedicated transformation funds. The benchmarking role of industry leaders like Dongpeng can be leveraged to disseminate best practices throughout the sector.

Nevertheless, this study acknowledges certain limitations. The reliance on a single case, while offering depth, limits the generalizability of the findings across different contexts. Future inquiries could employ multi-case comparisons or quantitative methods to test the framework's broader applicability. Additionally, the dependence on secondary public data may have missed nuanced internal insights; direct field interviews could enrich future empirical evidence. Finally, given the specific characteristics of the ceramics industry, extending this research to other high-impact sectors like steel or textiles could reveal industry-specific adaptation mechanisms.

6. Conclusion

Digital transformation represents a viable and necessary trajectory for traditional manufacturers aiming to enhance ESG performance.

The effectiveness of this transition is contingent upon a structured logic progressing from foundational data sensing to systemic governance safeguards. By embedding ESG values into the entire transformation lifecycle—ranging from strategic design to cultural integration—enterprises can achieve a harmonious balance between operational efficiency and social responsibility. This study contributes a replicable digitalization + greenization framework, providing a roadmap for enterprises to navigate the complexities of modern sustainable development.

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