Research On the Impact Mechanism of Enterprise Digital Transformation on The Coupled and Coordinated Development of ESG Under Different Types of Enterprises

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Abstract. In the current era where the wave of digitalization is deeply integrated with the concept of sustainable development, the relationship between corporate digital transformation and ESG (Environmental, Social, and Governance) practices has garnered significant attention. This study, based on data from A-share listed companies on the Shanghai and Shenzhen stock exchanges from 2015 to 2022, delves into the impact of corporate digital transformation on the coupling coordination development index of ESG. By employing a two-way fixed effects model for data analysis, the results indicate that the degree of corporate digital transformation significantly enhances the performance of the ESG coupling coordination index. Through heterogeneity analysis of different types of enterprises (state-owned enterprises vs. non-state-owned enterprises), it is found that the impact of digital transformation on the ESG coupling coordination index is more pronounced in non-state-owned enterprises. Finally, based on the above conclusions,this study provides relevant policy recommendations for enterprises to precisely formulate digital transformation strategies to promote the coordinated development of ESG.

Keywords: Digital Transformation, ESG, Coupling Coordination Degree, Enterprise Type.

1. Introduction

ESG, which stands for Environmental, Social, and Governance, is a comprehensive and systematic set of criteria used to evaluate a company's performance in sustainable development and social responsibility. It encompasses a wide range of aspects, including environmental protection practices such as energy conservation, emission reduction, and resource recycling, as well as addressing climate risks; social responsibility initiatives, such as safeguarding employee rights, contributing to communities, and ensuring product quality and safety; and improvements in corporate governance structures,such as board independence, transparency of information disclosure, and risk management mechanisms. As the global concept of sustainable development has evolved from its infancy to vigorous growth, ESG has gradually become a focal point for both investors and enterprises. Governments around the world, in response to global sustainable development goals, have introduced policies and regulations to encourage companies to actively adopt ESG principles. Luo Feifei and others have proposed incorporating ESG performance into the rating systems of relevant entities, which can more accurately assess a company's performance in environmental protection, social responsibility, and corporate governance, thereby providing investors with more precise risk assessments and investment guidance [1].

In the field of academic research, numerous scholars have conducted extensive and in-depth explorations around ESG (Environmental, Social, and Governance). Previous research findings are rich and diverse, covering various aspects such as macro policy environments, industry competition dynamics, and corporate strategic orientations in terms of influencing factors of ESG. For instance, Dai Yunhao and others have shown that stringent environmental regulatory policies can significantly drive companies to improve their environmental dimension of ESG performance [2];

intense industry competition can compel companies to optimize their corporate governance structures to enhance their competitiveness. In studies examining the impact of ESG on corporate financial indicators, Liu Yanli and Sun Xiaoyu empirically analyzed and found a positive correlation

between excellent ESG performance and corporate financial performance. Effective environmental management helps reduce operational costs, while proactive social responsibility practices can enhance corporate brand value, thereby driving financial performance growth [3]. However,Luo Yunxuan and Lu Jingyu, among others, have pointed out that most existing research focuses on the relationship between ESG and external factors, with relatively insufficient attention paid to the coupling and coordination among the internal dimensions of ESG —environmental, social, and governance [4]. Particularly in the current context where the wave of digital transformation is sweeping the globe at an unprecedented pace, corporate digital transformation has become an essential path for achieving long-term sustainable development. Although some studies have begun to explore the impact of corporate digital transformation on ESG development, such as Liu Yiping and others discussing how digital technologies can help companies improve environmental management efficiency and enhance employee communication and collaboration [5], there is still a lack of literature that delves deeply into the mechanisms through which digital transformation affects the coupling and coordination of ESG. For example,how digital transformation promotes synergistic development among the environmental, social, and governance dimensions, enabling resource sharing and complementary advantages,remains underexplored. Additionally, the potential differential impact mechanisms arising from different corporate natures in this process have not been fully investigated.

Under China's socialist market economy system, state-owned enterprises (SOEs) and non-state-owned enterprises (NSOEs) exhibit significant differences in various aspects. Shi Weiting and others have found that SOEs, leveraging their strong capital strength and policy support,often hold advantages in industrial scale, playing a dominant role in key sectors such as energy and transportation.Additionally, SOEs generally have longer listing histories,accumulating extensive market experience [6]. On the other hand, NSOEs,with their flexible market mechanisms and innovative vitality, excel in emerging industries and small-to-medium enterprises,covering a more diversified range of fields.Zhang Xuedong and Chen Ying also suggest that enterprises of different ownership types may follow distinct paths and achieve varying outcomes in the process of digital transformation and the implementation of ESG principles [7].

In light of this, this study aims to fill the aforementioned gaps by introducing the ESG Coupling Coordination Development Index to accurately measure the internal development dynamics of ESG. It then analyzes the impact of the degree of corporate digital transformation on the ESG coupling coordination degree and do mechanism analyses under different corporate ownership types. This research not only significantly enriches the body of knowledge in the fields of ESG and corporate digital transformation but also provides new perspectives and methodologies for subsequent related studies. Furthermore,it offers practical theoretical foundations and actionable guidance for enterprises to formulate digital transformation strategies tailored to their ownership types, thereby promoting the coordinated development of ESG.

2. Research Hypotheses and Methodology

2.1. Research Hypotheses

Corporate digital transformation refers to the process by which enterprises introduce and apply digital technologies to deeply integrate with production factors such as physical capital and human capital, thereby forming new combinations of production factors. This is of significant importance for enhancing corporate competitiveness and innovation capabilities [8, 9]. Corporate digital transformation plays a notable role in improving ESG performance [10]. Environmental Dimension: Through digital transformation,enterprises can utilize intelligent energy management systems, deploy IoT-based sensors to collect energy data, and analyze this data to identify areas of energy waste. Social Dimension: Digital transformation provides employees with flexible working models, leveraging collaborative office software and other tools to break geographical barriers [11]. Governance Dimension:Digital transformation facilitates smoother internal data flow, enabling

management to access comprehensive real-time data through data visualization platforms. By employing big data risk assessment models in investment decisions, decision-making becomes more transparent and scientific. Additionally, digital compliance management systems allow enterprises to track regulatory changes in real time, automatically update internal compliance requirements, and monitor employee operations [12]. Thus, corporate digital transformation holds significant importance for the development of ESG.

Compared to traditional ESG evaluations, the ESG coupling coordination degree offers several notable advantages. Traditional ESG evaluations often treat environmental, social, and governance dimensions in isolation, overlooking their intrinsic interconnections, which makes it difficult to comprehensively assess a company's sustainable development capabilities. In contrast, the ESG coupling coordination degree views the enterprise as an organic whole, emphasizing the complex interactions and feedback mechanisms among the dimensions,thereby more accurately reflecting the overall condition of the enterprise [13].Traditional ESG evaluations primarily rely on past and present performance, limiting their ability to predict future trends and risks. The ESG coupling coordination degree, however, dynamically tracks corporate development changes, providing early warnings of potential issues and offering forward-looking information for decision-making.In terms of evaluation results, traditional ESG evaluations often use simple scoring methods, which can lead to biases. The coupling coordination degree employs complex models to consider nonlinear relationships among dimensions, resulting in more precise evaluation outcomes. Furthermore, the ESG coupling coordination degree effectively guides enterprises to pursue holistic sustainable development, avoiding short-sighted behaviors. It also flexibly adapts to changing market environments and incorporates emerging ESG factors,comprehensively supporting enterprises in navigating complex environments [14]. Therefore, this study innovatively introduces the ESG coupling coordination degree to replace traditional ESG ratings.

H1: Corporate digital transformation significantly promotes the improvement of the ESG coupling coordination degree.

Conducting a heterogeneity analysis of the impact of corporate digital transformation on ESG coupling coordination development in state-owned enterprises (SOEs) and non-state-owned enterprises (NSOEs) holds significant importance in multiple aspects. From a policy-making perspective, SOEs play a crucial role in implementing national strategies and leading industry development. Through such analysis, the government can better understand the effectiveness and shortcomings of SOEs' digital transformation in promoting ESG coupling coordination, providing a basis for formulating more targeted policies. For instance, increasing technical support for SOEs' digital transformation and incentivizing their coordinated development in environmental, social, and governance aspects. For NSOEs, policymakers can introduce encouraging measures to guide them in leveraging digital means to enhance ESG coupling coordination and optimize the business environment.

At the corporate strategy level, SOEs, with their abundant resources and large scale, exhibit different digital transformation paths and impacts on ESG coupling coordination compared to NSOEs. By analyzing the role of digital transformation in ESG coupling coordination, SOEs can better fulfill their social responsibilities and enhance the value preservation and appreciation of state-owned assets [15]. For NSOEs, such analysis helps them identify their positioning in digital transformation and ESG coupling coordination development, enabling them to formulate differentiated strategies and highlight sustainable development advantages in market competition. From an investment perspective, investors are concerned about the sustainable development potential of enterprises. Heterogeneity analysis can help investors understand the varying impacts of digital transformation on ESG coupling coordination across different ownership types, assess investment risks and returns, optimize investment portfolios, and guide capital flows toward enterprises that excel in leveraging digital transformation to promote ESG coupling coordination. This contributes to the rational allocation of resources in the capital market [16]. On the other hand, this analysis aids in a deeper

understanding of heterogeneity, providing a basis for different enterprises to formulate strategies and for policymakers to design policies. In summary, this study proposes the following hypothesis:

H2:The impact mechanism of digital transformation on ESG coupling coordination may vary under different corporate ownership types.

2.2. Methodology

2.1.1 Variable Selection

The dependent variable focuses on corporate ESG performance.This study utilizes the Hua Zheng ESG Rating as the primary data source.This rating system comprehensively evaluates corporate sustainable development practices across three dimensions: Environment (E), Social (S), and Governance (G), and is widely recognized for its authority and industry acceptance.Based on this, the coupling coordination degree calculation model is employed. This model comprehensively considers the interrelationships and synergistic effects among the ESG dimensions, using complex mathematical operations to accurately derive the ESG Coupling Coordination Degree (ESG-CCD). This quantitative indicator provides a more comprehensive and in-depth reflection of the overall level and internal coordination of corporate ESG performance. Compared to single-dimensional evaluations, it offers a more integrated and accurate measure for the dependent variable in this study (Fan Dongjun et al., 2024) [17]. The primary explanatory variable is the degree of corporate digital transformation. Drawing on the advanced research methodology proposed by Zhen Hongxian (2023) in Economic Research, this study focuses on a total of 139 digital-related keywords across core categories such as technology classification, organizational empowerment, and digital application(ZhenHongxian et al., 2023) [18]. Specifically:Technology Classification Includes terms related to cutting-edge technologies such as big data, artificial intelligence, and cloud computing; Organizational Empowerment Encompasses vocabulary related to organizational changes in management structures and talent development to support digital transformation. Digital Application: Focuses on terms related to the use of digital tools in practical business scenarios such as production, marketing, and customer service. Using text mining techniques, the frequency of these keywords is analyzed in a large corpus of corporate documents,including annual reports, announcements, and official press releases. A higher keyword frequency indicates more frequent and in-depth digital practices in the corresponding areas. This approach constructs a comprehensive quantitative indicator to measure the degree of corporate digital transformation (denoted as Digital), providing robust support for exploring its relationship with corporate ESG performance.

In the selection of control variables, this study draws extensively on previous academic literature and relies on the professional and authoritative CSMAR database for data collection.The following control variables are selected:Firm Size (size): Measured by the natural logarithm of total assets. Larger firms may have unique advantages in resource acquisition and strategic planning, which could influence their ESG practices and digital transformation processes; Leverage Ratio (lev): Reflects the level of debt and solvency of a firm, significantly impacting its financial stability and the formulation of sustainable development strategies; Profitability (roa): Measured by return on assets (ROA), indicating the ability of a firm to generate profits using its total assets.Firms with higher profitability often have greater flexibility in allocating resources to ESG initiatives and digital transformation; Shareholding Ratio of the Largest Shareholder (top1): Concerns the equity structure and decision-making power distribution within a firm, which may influence the formulation and implementation of strategic directions, including ESG and digital transformation strategies. To ensure comparability and eliminate scale differences, the variables are normalized. This normalization facilitates the interpretation and comparison of coefficients in regression analysis, systematically and effectively controlling for other potential confounding factors. This approach ensures the scientific rigor,accuracy,and reliability of the research findings, laying a solid foundation for clearly revealing the intrinsic relationship between the explanatory and dependent variables.

2.2.2 Model Construction

To measure the coupling coordination degree of corporate ESG, the mathematical principles of the coupling coordination degree model are applied as follows. The first step is data normalization:

$$x_{i,j} = \frac{x_{i,j} - min(x_{k,j})}{max(x_{k,j}) - min(x_{k,j})} \quad i=1,\ldots,n; \quad j=3,\ldots,m \tag{1}$$

Next,the correlation coefficient and dispersion coefficient are calculated using the following formulas:

$$r_{j,k} = \frac{\sum(x_{i,j} - \overline{x_j})(x_{i,k} - \overline{x_k})}{\sqrt{\sum(x_{i,j} - \overline{x_j})^2 \sum(x_{i,k} - \overline{x_k})^2}} \quad j, k=1,\ldots,m \tag{2}$$

$$cv_j = \frac{\sqrt{\frac{1}{n-1}\sum(x_{i,j} - \overline{x_j})^2}}{\overline{x_j}} \quad j=1,\ldots,m \tag{3}$$

Then,the average correlation coefficient and final weights are calculated using the following formulas:

$$c_j = \frac{1}{m}\sum|r_{j,k}| \quad j=1,\ldots,m \tag{4}$$

$$\omega_j = \frac{cv_j \times c_j}{\sum c_k} \quad j=1,\ldots,m \tag{5}$$

Finally, the coupling coordination degree is calculated as follows:

$$C_i = \frac{\sqrt[3]{u_{1i}u_{2i}u_{3i}}}{\frac{u_{1i}+u_{2i}+u_{3i}}{3}} \quad i=1\ldots, n \tag{6}$$

$$T_i = a \cdot u_{1i} + b \cdot u_{2i} + c \cdot u_{3i} \quad i=1,\ldots, \tag{7}$$

$$D_i = \sqrt{C_i \cdot T_i} \quad i=1,\ldots,n \tag{8}$$

Next, this study constructs a two-way fixed effects model to explore the impact of digital transformation on ESG coupling coordination. The specific formula is as follows:

$$ESG - CCD_{it} = a_1 Digital_{it} + a_2 Size_{it} + a_3 Lev_{it} + a_4 roa_{it} + a_5 top1_{it} + \mu_i + \sigma_t + \delta_{it} \tag{9}$$

where i represents the individual firm (cross-sectional unit), t represents the time index (time period), μ denotes the individual fixed effects, σdenotes the time fixed effects, δ represents the unobservable random error term.

3. Emprical analysis

3.1. Data Sources and Preprocessing

This study focuses on A-share listed companies in the Shanghai and Shenzhen stock exchanges from 2015 to 2022, aiming to deeply explore the intrinsic relationship between corporate digital transformation and ESG performance. During the data collection phase, we extensively gathered various types of data:Hua Zheng ESG Rating Data: Used to measure the dependent variable, corporate ESG performance, Corporate Text Data Used to calculate the frequency of keywords related to the main explanatory variable, the degree of corporate digital transformation, Control Variables Data: Sourced from the professional and authoritative CSMAR database.In the sample processing stage, we adhered to a rigorous approach and carefully screened the original sample: (1)Excluding samples with missing data were removed to ensure data completeness and usability, avoiding potential bias in the research results due to the absence of key data; (2)Excluding ST (Special Treatment) and PT (Particular Transfer) companies, which typically face financial difficulties or other abnormal conditions, were excluded to prevent interference with the research results and ensure the

generalizability of the conclusions. (3)Excluding companies that issue both A-shares and B-shares were excluded to reduce complexity arising from different market rules and investor structures, ensuring a more homogeneous research sample. After applying these rigorous screening criteria, a final dataset of 800 firm-year observations was obtained, providing a solid data foundation for subsequent empirical analysis. The descriptive statistical analysis results after data preprocessing are shown in Table 1 below:

Table 1 The Descriptive Statistical Analysis Results

Variable	Obs	Mean	Std. Dev.	Min	Max
ESG-CCD	800	0.6894	0.1648	0	0.9857
Digital	800	1.5910	1.3398	0	5.2626
size	800	0.4667	0.2002	0	1
lev	800	0.4808	0.2293	0	1
roa	800	0.6507	0.0994	0	1
top1	800	0.3780	0.2264	0	1

From the above statistical analysis results, the mean value of the ESG coupling coordination indexranges between 0 and 0.985, reflecting certain differences in ESG practices among the sample firms and indicating that they are in a stage of gradual development and improvement. After applying a logarithmic transformation to the digital transformation index, its mean value is approximately 1.59, with a variance of about 1.34, suggesting that the sample firms exhibit varying degrees of progress in digital transformation, with a noticeable level of dispersion. Regarding the control variables, after standardization, their values all fall within the range of 0 to 1, facilitating unified processing and comparison in subsequent regression analysis. This approach effectively controls for potential interference from other factors, ensuring the accuracy and reliability of the research findings.

3.2. Regression Results Analysis

Table 2 displays the baseline regression results under different scenarios. Column (1) shows the baseline regression without control variables. The two-way fixed effects regression without control variables is presented in column(2). Moreover,Column(3) includes control variables and displays the individual fixed effects regression. In column(4), the time fixed effects regression is shown without control variables. Finally, column (5) provides the results for the two-way fixed effects regression with control variables included. The regression tests in all five scenarios passed the F-test, indicating that all five models are overall significant. Specifically, the degree of corporate digital transformation has a significantly positive impact on the ESG coupling index in all cases, suggesting that digital transformation can effectively enhance corporate ESG coupling performance. This may be attributed to the fact that digital transformation promotes ESG improvement through pathways such as information transparency, governance optimization, and intelligent environmental management.

In the robustness tests, three approaches were employed: the first-order lag test (ESG-CCD_LAG), trimming the first and last years (ESG-CCD_s), and replacing the ESG coupling index with the coordination coefficient (ESG-CD). The specific results are presented in Table 3. Column (1) contains the robustness test using the first-order lag test. In column (2), the robustness test involves trimming the data by removing observations from the first and last years, specifically 2015 and 2022. And column (3) shows the robustness test where the dependent variable has been replaced. From the regression results of the three tests, the coefficients of Digital are 0.0155, 0.0139, and 0.0184, respectively, all of which are significant at the 5% level. This strongly indicates that the positive impact of digital transformation on ESG-CCD is robust, confirming the reliability of the baseline regression results.

In the endogeneity test, we followed existing literature and used the first-order lag of digital transformation as an instrumental variable (IV). The results, shown in Table 4, include: Column(1):

First-stage regression results. Column(2): Second-stage regression results.Both stages of the regression results are statistically significant, and the test passed the over-identification test. This indicates that the study successfully addressed endogeneity concerns, confirming the robustness of the findings.

Table 2 Regression Results Analysis

Variables	(1)	(2)	(3)	(4)	(5)
Digital	0.0150*** (3.48)	0.0189*** (3.04)	0.0192*** (3.03)	0.0194*** (3.07)	0.0187*** (3.84)
Control	No	No	Yes	Yes	Yes
Constants	0.6656*** (3.48)	0.6266*** (41.72)	0.6299*** (11.61)	0.6257*** (11.72)	0.6321*** (11.38)
Adjusted R-sq	0.1137	0.1808	0.2126	0.2537	0.3483
n	800	800	800	800	800
Individual Fixed Effect	No	Yes	Yes	No	Yes
Time Fixed Effect	No	Yes	No	Yes	Yes

Table 3 Results of Robustness Tests

Variables	(1) ESG-CCD_LAG	(2) ESG-CCD_s	(3) ESG-CD
Digital	0.0155** (2.30)	0.0139*** (3.04)	0.0184*** (4.05)
Control	Yes	Yes	Yes
Constants	0.6046*** (5.14)	0.5546*** (5.62)	0.4062*** (6.07)
Adjusted R-sq	0.1777	0.0808	0.2226
n	800	800	800
Individual Fixed Effect	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes

Table 4 Results of Endogeneity Tests

Variables	(1) Digital	(2) ESG-CCD
IV_Digital	0.3627*** (9.18)	
Digital		0.0336* (1.88)
Control	Yes	Yes
Constants	0.2803 (0.51)	0.8424*** (9.20)
Adjusted R-sq	0.8137	0.5397
n	800	800
Individual Fixed Effect	Yes	Yes
Time Fixed Effect	Yes	Yes

In the context of the global digitalization wave sweeping across various industries, an in-depth exploration of the impact of digital transformation on the coupling and coordination level of corporate ESG is not only of great practical significance but also provides theoretical support for optimizing corporate sustainable development strategies.

The heterogeneity test results, as shown in Table 5, indicate a significant difference in the impact of digital transformation on the ESG coupling coordination index between state-owned and non-state-owned enterprises. Specifically, for non-state-owned enterprises, the regression coefficient of digital transformation is 0.0250,and it is statistically significant at the 5% level. This suggests that digital transformation significantly enhances the ESG coupling coordination level of non-state-owned enterprises. A possible explanation is that non-state-owned enterprisesdriven by market competition pressure and external governance mechanisms,are more inclined to leverage digital technologies to optimize resource allocation,improve information transparency, and strengthen their capacity to fulfill social responsibilitie, thereby promoting the coordinated development of ESG factors.

In contrast, for state-owned enterprises, the regression coefficient is 0.0119 but does not pass the significance test, indicating that the impact of digital transformation on the ESG coupling coordination index of state-owned enterprises is relatively limited. One possible reason is that state-owned enterprises, constrained by institutional factors, are more influenced by policy directives and administrative interventions in their business decisions. While digital transformation can improve management efficiency to some extent, it has not yet played a significant role in enhancing ESG coordination capabilities. Additionally, state-owned enterprises inherently have an advantage in fulfilling social responsibilities, and their ESG performance is more influenced by policy incentives. As a result, the marginal effect of digital transformation in state-owned enterprises is relatively weaker.

Table 5 Results of Heterogeneity Tests

Variables	(1) NSOEs	(2) SOES
Digital	0.0250*** (2.61)	0.0119 (0.146)
Control	Yes	Yes
Constants	0.6127*** (8.14)	0.6665*** (7.97)
Adjusted R-sq	0.1737	0.1250
n	400	400
Individual Fixed Effect	Yes	Yes
Time Fixed Effect	Yes	Yes

In summary, the heterogeneity analysis reveals that the impact of digital transformation on the ESG coupling coordination index varies significantly depending on the ownership structure of enterprises. Compared to state-owned enterprises, non-state-owned enterprises exhibit a more proactive ESG response in the process of digital transformation, providing a new perspective for promoting corporate digital upgrading and sustainable development. In the future, policymakers and corporate managers should fully consider the differences in digital transformation across enterprises with different ownership structures and develop targeted digital development strategies. This approach will better facilitate the coordinated optimization of ESG performance, ultimately achieving high-quality and sustainable development in the digital society.

4. Conclusions

Based on a two-way fixed effects model, this study systematically explores the impact of corporate digital transformation on the ESG coupling coordination index. The research results indicate the following: On the one hand, digital transformation significantly promotes the ESG coupling coordination index of enterprises, suggesting that improvements in digital capabilities help drive coordinated development in environmental, social, and governance aspects. On the other hand, the ESG coupling coordination index of non-state-owned enterprises is more sensitive to digital transformation, showing a strong positive effect, whereas the impact of digital transformation on the

ESG coupling coordination index of state-owned enterprises is not significant. Based on these findings, this paper proposes the following targeted policy recommendations:

(1) Promote Digital Transformation to Enhance ESG Coupling Coordination. Strengthen digital infrastructure development and encourage enterprises to increase investment in digital technologies. Promote the application of artificial intelligence (AI), blockchain, big data, and other technologies in environmental governance, corporate social responsibility fulfillment, and corporate governance to enhance the digital support for ESG synergy. Establish a nationwide ESG data-sharing platform to standardize and improve the transparency of corporate ESG disclosures.

(2) Further Optimize the Digital Transformation Strategies of State-Owned Enterprises to Enhance ESG Promotion EffectsTo improve the ESG coordination effects of digital transformation in state-owned enterprises, it is essential to deepen mixed-ownership reforms by encouraging greater participation of non-state capital in corporate governance, introducing market-oriented performance evaluation mechanisms, and reducing administrative intervention.

(3) Strengthen the Market-Driven Role of Digital Transformation in Non-State-Owned Enterprises to Enhance ESG Coordination Optimize the digital development environment by improving the market-based supply of digital infrastructure, reducing the cost of access to advanced digital technologies for non-state-owned enterprises, and encouraging the use of digital tools to enhance ESG management capabilities.

(4) Differentiate and Promote Digital Regulatory Innovation to Enhance the Contribution of Digital Transformation to ESG For state-owned enterprises, the focus should be on improving digital governance capabilities by constructing a data-driven ESG evaluation system and enhancing the role of policy guidance.

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