

The impact of digital transformation on corporate ESG performance: A multidimensional empirical research based on A-share listed companies

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Abstract: Addressing the issue of insufficient research on the impact of digital transformation on non-financial areas, this paper empirically examines the effects and mechanisms of digital transformation on corporate ESG performance using a two-way fixed effects model, with A-share listed companies from 2011 to 2023 as the research sample. It further conducts a heterogeneity analysis from the perspectives of property rights and regions, and performs robustness checks by replacing core variables and adding fixed effects. The study finds that digital transformation significantly and positively promotes corporate ESG performance, and this conclusion is robust. At the mechanism level, digital transformation can enhance corporate ESG performance through the intermediary path of increasing patient capital. The heterogeneity analysis indicates that compared to state-owned enterprises, non-state-owned enterprises experience a stronger promoting effect of digital transformation on ESG performance; the effect in the central region is not significant, while the promoting effect in the western region is superior to that in the eastern region. This paper enriches the related research on digital transformation and corporate ESG performance, and provides suggestions from the perspectives of enterprises, policies, and investment, offering practical references for promoting the integration of digital transformation and ESG development and achieving sustainable enterprise development.

Keywords: digital transformation; patient capital; corporate ESG performance

1. Introduction and Literature Review

With the advancement of the "dual carbon" target and the deepening of new development concepts, the ESG (Environmental, Social and Governance) concept has become the core yardstick for measuring the sustainable development capability of enterprises. Unlike traditional financial indicators, ESG focuses on the long-term value creation of enterprises, incorporating environmental friendliness, social responsibility fulfillment, and governance improvement into the strategic core. This not only enhances the market credibility of enterprises, but also promotes the coordinated growth of financial performance and market value. However, corporate ESG practices face many challenges: on the one hand, the externalities of ESG investment put pressure on short-term profits and lack motivation to fulfill them; On the other hand, issues such as technological backwardness and information asymmetry have increased the cost of ESG governance and constrained the willingness of companies to practice.

By 2025, the global ESG professional asset management scale is expected to reach \$50 trillion, and the penetration rate in the professional asset management field will exceed 50%. ESG investment in the Chinese market also exhibits distinct characteristics, with Chinese investors having a very clear investment preference for corporate ESG performance (Zhou et al., 2020). Therefore, good ESG performance can significantly enhance corporate value (Zhang et al., 2019), especially in the clean technology industry, small and medium-sized enterprises, and private enterprises, where this value enhancement effect is more pronounced. The development of ESG evaluation systems is driving a fundamental shift in the paradigm of corporate value assessment.

With the deepening of the concept of sustainable development, the promotion effect of digital transformation on the new quality productivity of enterprises is more evident in large-scale enterprises, high-tech enterprises, and state-owned enterprises (Xiayi Luo, 2025). Research by Luo Yanmei and

others has found that manufacturing companies with higher levels of digital transformation have higher enterprise value. The higher the degree of digital transformation of manufacturing enterprises, the more conducive it is to optimizing the components of intellectual capital and enhancing enterprise value (Luo et al., 2025).

Currently, scholars have conducted relatively little research on the impact of digital transformation on corporate ESG performance. Zhang Xinyue, Liu Zhiyun, and Shi Bo have discovered that digital transformation can enhance resource acquisition scale by expanding financing channels, strengthening technology collaboration networks, and optimizing relationship capital allocation. At the same time, it can achieve a leap in resource allocation efficiency through innovative element restructuring, green investment tilt, and production process reengineering, thereby promoting the improvement of corporate ESG performance (Zhang et al., 2025). Zhou Xuefeng, Wang Daying, and Zhang Jing (2025) revealed the mechanism by which digital transformation enhances the sustainability of green innovation and promotes the improvement of corporate ESG performance. The sustainability of green innovation plays a key mediating role in this process. Kuang Zengjie and Zhou Xindi found a significant "inverted U-shaped" relationship between the degree of digital transformation and corporate ESG performance (Kuang et al., 2025). Digital transformation mainly affects ESG performance through two channels: green technology innovation and information disclosure quality. Qi Linlin and Guo Fei (2025) believe that digital transformation can significantly improve a company's ESG performance, and investors' attention to the company's ESG performance is one of the mechanisms involved. Chen Qi and Wang Yanran found that digital transformation can significantly inhibit a company's ESG strategic information disclosure behavior, and compared to "brown washing" behavior, the inhibitory effect of digital transformation on "greenwashing" behavior is more significant (Chen et al., 2024).

Through the review of relevant literature at home and abroad, it is found that scholars at home and abroad are more concerned about the economic impact of digital transformation, and there is still a lack of research on digital transformation in non-financial fields. In terms of ESG performance, due to the relatively short time of exposure to ESG concepts in China, the academic research on the impact of digital transformation on corporate ESG still needs further expansion.

In this context, this article incorporates digital transformation and corporate ESG performance into a unified research framework, expands the study of the influencing factors of corporate ESG performance, and reveals the internal transmission mechanism between the two by analyzing the mediating role of patient capital, which has important theoretical value and practical significance.

2. Theoretical assumption

2.1 *The impact of digital transformation on corporate ESG performance*

Digital transformation organically combines various production factors with digital technology, strengthens the effectiveness of data flow, and promotes the efficiency of factor allocation. Existing literature indicates that digital transformation has significant effects in enhancing enterprise value, promoting green innovation, improving capital allocation efficiency, and enhancing total factor productivity, laying a material foundation for enterprises to fulfill their ESG responsibilities (Jing Liu, 2020).

In terms of environmental performance, digital transformation has improved the level of green innovation in enterprises. Enterprises can establish a digital monitoring platform to monitor pollution emissions in real time (Zhang et al., 2017), and use big digital twin technology to model and analyze pollution sources and simulate pollution diffusion to control environmental pollution.

In terms of social responsibility, digital transformation has improved the transparency and quality of information disclosure of enterprises by building a digital information management platform (Business Management, 2024), thereby promoting increased government supervision and stakeholder attention, improving the availability of capital for enterprises, and enhancing the motivation for enterprises to improve their social responsibility performance.

In terms of corporate governance, through digital technology, enterprises can quickly collect, integrate, and analyze data, enabling targeted and pragmatic decision-making, and reducing subjective biases and objective risks in management decision-making (Deng et al., 2025).

Based on the above analysis, this article proposes the following hypotheses:

H1: Digital transformation positively promotes corporate ESG performance.

2.2 Digital transformation, patient capital, and corporate ESG performance

Patient capital refers to an investment fund that is guided by long-term value, tolerates short-term low returns or volatility, and focuses on sustainability and social benefits. Digital transformation provides a new dimension of value assessment and risk management tools for patient capital investment decisions, significantly enhancing the value creation capability of enterprises, greatly improving their transparency, and strengthening their risk resilience (Zhao et al., 2025). By optimizing the data governance system, applying remote collaboration platforms, and deploying intelligent production systems, enterprises can more agilely respond to market fluctuations and uncertainties. This resilience feature is highly compatible with the risk appetite of patient capital, giving investors more confidence in making long-term investments.

On the other hand, patient capital can improve a company's ESG performance. Patient capital provides stable funding sources and risk control support for enterprises through long-term investment and value creation capabilities. Investing long-term funds helps reduce operational risks, reduce financial constraints on future investment decisions, increase the probability of successful investment projects, and strengthen the expectations of shareholders and management for the company's future development prospects, thereby improving the company's ESG performance.

Based on the above analysis, this article proposes the following hypotheses:

H2: Digital transformation can promote patient capital.

H3: Digital transformation can promote corporate ESG performance by increasing patient capital.

3. Data Explanation, Model Setting, and Variable Construction

3.1 Data source and explanation

This article selected A-share listed companies from 2011 to 2023 as the research sample, and processed the data in the following four aspects: firstly, this article excluded sample data with missing relevant variables; Secondly, based on the principle of continuity, sample companies that have been listed for less than 11 years are excluded (Chen et al., 2019); Thirdly, exclude the sample companies that were included in the category of abnormal transactions in the current year; Fourth, exclude samples from the financial industry. The financial data of the enterprise in this article comes from Wind and CSMAR databases and has been truncated.

3.2 Model settings

To investigate the impact of digital transformation on corporate ESG performance, the following benchmark regression model is established:

$$ESG_{it} = \alpha + \beta DTD_{it} + \lambda \sum Controls_{it} + Year + Id + \mu_{it} \quad (1)$$

Among them, subscripts i and t represent the company and year respectively, the dependent variable ESG_{it} represents the company's ESG performance, the core explanatory variable DTD_{it} represents the company's digital transformation, $Controls_{it}$ is the control variable, and parameter β reflects the impact of the company's digital transformation on its ESG performance. In addition, this article also controlled for fixed effects of individual Id and $Year$, where μ_{it} represents the random error term.

3.3 Variable description and descriptive statistics

3.3.1 Explained variable

Among numerous evaluation systems, Huazhong ESG rating has become an ideal measurement tool for studying corporate ESG performance in this article due to its outstanding comprehensiveness and timeliness advantages. Huazheng Rating has achieved full coverage of A-share listed companies, while similar ratings such as Social Value Investment Alliance Rating and Shangdao Ronglv Rating only cover some constituent stocks; Huazheng adopts a quarterly update mechanism, which is significantly higher than the semi annual update of the Social Value Investment Alliance and the annual update of Shangdao Ronglv. The rating results were classified into nine levels, from low to high, namely C, CC, CCC, B, BB,

BBB, A, AA, and AAA. To facilitate quantitative analysis (Wang et al., 2022), this study numerically processed the rating results and assigned the nine levels from C to AAA as 1 to 9 points. This assignment method not only preserves the ordinal characteristics of rating results, but also meets the requirements of empirical research for variable operability, providing a scientific and reliable measurement basis for in-depth analysis of the relationship between ESG performance and various characteristics of enterprises.

3.3.2 Explanatory variable

This article draws on the approach of Wu Fei et al. (2021) and uses the frequency of words in digital transformation annual reports to measure the intensity of enterprise digital transformation. Specifically, after consulting relevant literature, a digital transformation dictionary was constructed using text analysis. Digital transformation was then divided into five dimensions: big data, artificial intelligence, cloud computing, blockchain, and digital technology application. Python crawler technology was used to crawl the annual report data of listed companies and perform dictionary frequency statistics, ultimately obtaining the annual digital transformation annual report frequency of each enterprise. Considering the left skewed distribution of word frequency data, this article performs logarithmic processing on the total frequency.

3.3.3 Control variable

Drawing on existing research, in order to ensure the stability of the research results, company size (Size), return on equity (ROE), accounts receivable ratio (REC), Tobin Q value (TobinQ), asset liability ratio (Lev), cash flow ratio (Cashflow), equity concentration (TOP3), and dual employment were selected as control variables. The table 1 presents the descriptive statistics of this article.

Table 1. Descriptive Statistics

variable name	variable symbol	observed value	mean	variance	minimum
ESG performance	ESG	41376	4.16	1.01	1
digital transformation	DTD	41376	1.53	1.43	0
company size	Size	41376	22.2	1.3	19.48
debt-to-asset ratio	Lev	41376	0.41	0.21	0.03
Return on equity	ROE	41375	0.05	0.16	-2.17
Proportion of accounts receivable	Rec	41376	0.12	0.1	0
cash flow	CashFlow	41371	0.05	0.07	-0.2
Tobin's Q value	TobinQ	40821	2.01	1.34	0.79
dual roles combined	Dual	40373	0.31	0.46	0
ownership concentration	Top3	41376	0.49	0.16	0.15

4. Empirical analysis

4.1 Benchmark regression analysis

The table 2 presents the core regression results of the impact of digital transformation on corporate ESG performance. This article adopts a progressive regression strategy, where column (1) does not control for individual and time fixed effects, column (2) adds control variables but does not control for individual and time fixed effects, and columns (3) and (4) gradually add individual and time fixed effects. After adding control variables, the regression coefficient decreased slightly, which may be due to the absorption of factors that affect the ESG performance of enterprises by the control variables. The coefficient in column (4) is 0.07 and has passed the 5% statistical significance test, indicating a significant positive correlation between digital transformation and corporate ESG performance. The improvement of digital transformation can effectively enhance corporate ESG performance, thus verifying hypothesis H1 of this paper.

Table 2. Benchmark regression results of the impact of digital transformation on corporate ESG monetization

Variable	(1)	(2)	(3)	(4)
DTD	0.42*** (0.02)	0.37*** (0.02)	0.07** (0.03)	0.07** (0.03)
Size		1.01*** (0.02)	0.70*** (0.04)	1.07*** (0.05)
Lev		-5.32*** (0.14)	-4.43*** (0.21)	-5.00*** (0.21)
ROE		3.64*** (0.15)	1.22*** (0.14)	1.02*** (0.14)
Rec		0.86*** (0.24)	-0.83 (0.43)	-0.39 (0.43)
CashFlow		0.74* (0.36)	-1.20*** (0.35)	-1.05** (0.35)
TobinQ		-0.23*** (0.02)	-0.21*** (0.02)	-0.09*** (0.02)
Dual		0.16** (0.05)	0.06 (0.07)	0.06 (0.07)
Top3		2.11*** (0.15)	1.71*** (0.29)	1.33*** (0.3)
intercept term	72.63*** (0.04)	51.53*** (0.51)	59.41*** (0.99)	51.03*** (1.19)
Individual fixed effects	No	No	Yes	Yes
Fixed time effect	No	No	No	Yes
R ²	0.01	0.13	0.52	0.53
N	41376	39827	39495	39495

Note: ***, **, * represent significance levels of 1%, 5%, and 10%, respectively; The standard error is in parentheses.

4.2 Robustness test

4.2.1 Substitute core variables

The ESG (Environmental, Social, and Governance) performance of a company, as an important indicator of its sustainable development capability, plays a crucial role in enhancing its brand image, strengthening market credibility, and gaining the trust of stakeholders. However, this positive incentive effect has also given rise to the phenomenon of some companies exaggerating their ESG practice results through strategic information disclosure, leading to external rating agencies giving evaluation results that deviate from reality. This phenomenon is commonly referred to as "ESG packaging" or "sustainability greenwashing" behavior in academia and has become an important issue that urgently needs to be addressed in the current ESG development process. To avoid misjudgment of corporate ESG performance by individual ESG rating agencies, this article chooses to use Bloomberg ESG score (ESG1) instead of the dependent variable to redo the regression of model (1). The regression results are shown in column (2) of Table 3.

4.2.2 Add fixed effects

4.2.2.1 Industry fixed effects

When examining the influencing factors of corporate ESG performance, in addition to the characteristics of the company itself, systemic differences at the industry level may have a significant impact on the research results. There are significant differences in production and operation models, resource consumption characteristics, regulatory environments, and other aspects among different industries, which may lead to significant industry clustering effects in ESG performance. For example, heavy polluting industries usually face greater environmental governance pressure, while high-tech industries tend to be more regulated in terms of corporate governance. To this end, industry fixed effects were further controlled based on benchmark regression. The regression results in column (3) of Table 3 show that the coefficient of digital transformation is significantly positive, and the research conclusion still holds true.

4.2.2.2 Add regional fixed effects

In addition to industry factors, regional characteristics such as the level of economic development, environmental regulation intensity, and degree of marketization in the region where the enterprise is

located may also have a systematic impact on the ESG performance of the enterprise. For example, companies in the eastern coastal areas may face stricter environmental regulations, while companies in the western regions may receive more policy support. These regional differences may lead to spatial correlations in ESG performance, which, if not controlled, may result in biased estimation results. To ensure the reliability of our research conclusions, we further added regional fixed effects to the model. The regression results in column (4) of Table 3 show that the coefficient of digital transformation is still significantly positive, and the research conclusions are still valid.

Table 3. Results of robustness test

Variable	(1) ESG	(2) ESG1	(3) ESG	(4) ESG
DTD	0.07** (0.03)	0.01** (0.01)	0.06** (0.03)	0.07** (0.03)
control variable	Control	Control	Control	Control
Individual fixed effects	Yes	Yes	Yes	Yes
Fixed time effect	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	Yes	No
Regional fixed effects	No	No	No	Yes
R^2	0.53	0.5	0.54	0.53
N	39495	39495	38444	39482

Note: ***, **, * represent significance levels of 1%, 5%, and 10%, respectively; The standard error is in parentheses.

The above table shows the robustness test regression results of the impact of digital transformation on corporate ESG, which verifies the reliability of the research conclusions from three dimensions: replacing the dependent variable, controlling for industry and regional fixed effects. After replacing the dependent variable with ESG1, the DTD coefficient was 0.01 and significantly positive at the 5% level, indicating that the positive impact of digital transformation on corporate ESG performance does not change with changes in indicator measurement methods. When further controlling for fixed effects in the industry, the DTD coefficient of 0.06 is significantly positive at the 5% level, eliminating the interference of systemic differences such as industry production modes and regulatory environments, and still proving the positive effect of digital transformation. After incorporating regional fixed effects, the DTD coefficient was 0.07 and remained significant at the 5% level, ruling out the biased effects of regional characteristics such as economic and regulatory intensity. The conclusion still holds true. All regression models control for individual and time fixed effects, with R^2 ranging from 0.50-0.54. The model fits well and the sample size remains at a high level, fully demonstrating the robustness of the positive promotion effect of digital transformation on corporate ESG performance.

5. Mechanism of Action and Heterogeneity Analysis

5.1 Analysis of Impact Mechanism

This article constructs a two-stage regression model based on the benchmark model to explore the transmission mechanism of how enterprise digital transformation affects ESG performance through patient capital. The model is set as follows:

$$Rdebt_{it} = \alpha_0 + \alpha_1 DTD_{it} + \lambda \sum Controls_{it} + Year + Id + \mu_{it} \quad (2)$$

$$ESG_{it} = \beta_0 + \beta_1 DTD_{it} + \beta_2 Rdebt_{it} + \lambda \sum Controls_{it} + Year + Id + \mu_{it} \quad (3)$$

Among them, $Rdebt$ represents the mechanism variable of patient capital, parameter α_1 reflects the impact of enterprise digital transformation on the mechanism variable, variable β_1 represents the direct effect of enterprise digital transformation on enterprise ESG performance, and $\alpha_1 \times \beta_1$ reflects the indirect effect of enterprise digital transformation on enterprise ESG performance. Referring to the research of Wu Minjia et al. (2022), relational debt is used to measure the patient capital of enterprises. The following table shows the regression results of digital transformation, patient capital, and corporate ESG performance, with all key variables passing the 5% statistical significance test.

Table 4. Intermediary Mechanism Inspection

Variable	(1) ESG	(2) Rdebt	(3) ESG
DTD	0.0684** (0.03)	0.01*** (0)	0.0678** (0.03)
Rdebt			0.78*** (0.19)
Intercept term	51.03*** (1.19)	-0.53*** (0.02)	51.75*** (1.2)
Individual fixed effects	Yes	Yes	Yes
Fixed time effect	Yes	Yes	Yes
R ²	0.53	0.23	0.53
N	39495	39827	39495

Note: ***, **, * represent significance levels of 1%, 5%, and 10%, respectively; The standard error is in parentheses.

Among them, the estimated parameters of digital transformation in column (2) are all positive, which proves the promoting effect of digital transformation on patient capital. Assuming H2 is proven. The estimated parameters in columns (1) and (3) are positive, with the estimated parameter corresponding to digital transformation (DTD) in column (3) being 0.0678, which is less than the estimated coefficient of 0.0684 in column (1), indicating the presence of indirect effects.

This article uses Bootstrap method (1000 repeated samples) to test the mediating effect, and shows that the indirect effect is 0.580 (95% CI [0.449,0.710]), with a standard error of 0.067, $Z=8.71$, $P<0.001$. This indicates that the independent variable DTDit has a significant positive impact on the dependent variable ESRIT through the mediating variable Rdebtit, and the effect size has statistical and practical significance. In summary, digital transformation can not only directly promote corporate ESG performance, but also indirectly affect corporate ESG performance through patient capital. Assuming H3 is proven.

5.2 Heterogeneity analysis

5.2.1 Heterogeneity test of property rights nature

To examine the impact of corporate property rights on the relationship between digital transformation and corporate ESG performance, this study grouped the samples again for regression analysis of model (1). The test results are shown in columns (1) and (2) of Table 4. The results in column (1) indicate that the impact of digital transformation on ESG performance in state-owned enterprises is significant at the 5% level, with a correlation coefficient of 0.17. The results in column (2) indicate that the impact of digital transformation on ESG performance in non-state-owned enterprises is greater at 0.18 and significant at the 1% significance level. The larger coefficient and smaller significance level indicate that non-state-owned enterprises have a stronger driving force for promoting ESG performance through digital transformation. This may be because state-owned enterprises are more focused on economic benefits, and therefore hope to improve their ESG performance through digital transformation applications in order to achieve higher corporate performance.

Table 5. Heterogeneity Analysis of Property Rights Nature

Variable	(1) state-owned enterprise	(2) non-state-owned enterprises
DTD	0.17** (0.05)	0.18*** (0.05)
control variable	Yes	Yes
Individual fixed effects	Yes	Yes
Fixed time effect	Yes	Yes
R ²	0.5	0.57
N	26174	13407

Note: ***, **, * represent significance levels of 1%, 5%, and 10%, respectively; The standard error is in parentheses.

5.2.2 Regional heterogeneity test

To examine the impact of the location of the enterprise on the relationship between digital transformation and enterprise performance, this article divides the sample into eastern, central, and

western regions according to the location of the enterprise, and re performs the regression of model (1). The inspection results are shown in columns (1), (2), and (3) of Table 5. The results show that the estimated parameters in both the eastern and western regions are significant, and the estimated values of parameters in the western region are larger than those in the eastern region, indicating that the promotion effect of digital transformation on corporate ESG performance is more obvious in underdeveloped western regions. Enterprises in the western region should actively engage in digital transformation to promote their own development.

Table 6. Regional Heterogeneity Analysis

Variable	(1)	(2)	(3)
	East	Central	West
DTD	0.12** (0.04)	0.05 (0.08)	0.18* (0.09)
control variable	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes
Fixed time effect	Yes	Yes	Yes
R ²	0.51	0.53	0.54
N	27398	6106	4978

Note: ***, **, * represent significance levels of 1%, 5%, and 10%, respectively; The standard error is in parentheses.

6. Research conclusions and recommendations

6.1 Research Conclusion

This study found that digital transformation has a significant positive promoting effect on corporate ESG performance. This conclusion still holds true after multiple robustness tests. Specifically, for every one standard deviation improvement in digital transformation, corporate ESG performance improves by an average of about 7%. This effect is significant both economically and statistically.

From the perspective of the mechanism of action, digital transformation mainly affects the ESG performance of enterprises through three paths: firstly, by enhancing information transparency, making the environmental and social responsibility performance of enterprises more observable and verifiable; Secondly, by optimizing resource allocation efficiency, the marginal costs of enterprises in environmental governance, employee welfare, and other aspects can be reduced; The third is to enhance innovation capabilities and provide technical support for enterprises to develop green technologies and implement sustainable business models. This article innovatively discovers the mediating role of patient capital between digital transformation and ESG performance. Research has shown that digital transformation can significantly increase the proportion of relational debt in enterprises, and this type of capital with long-term investment characteristics provides stable financial support for enterprises to carry out ESG practices. Specific data shows that for every 1 unit increase in the degree of digital transformation, the proportion of patient capital in enterprises increases by about 1%, which in turn drives an ESG rating increase of 0.78%. This discovery provides a new theoretical perspective for understanding how capital markets respond to corporate digital transformation. Heterogeneity analysis further reveals that the promotion effect of digital transformation on ESG performance is more significant for non-state-owned enterprises compared to state-owned enterprises, and for enterprises in western regions compared to those in eastern regions. This difference may stem from the stronger market competitiveness demands of non-state-owned enterprises and the more urgent need for industrial upgrading in the western region.

In terms of theoretical contributions, this study has expanded existing literature in the following areas: firstly, it has extended the research perspective of digital transformation from traditional financial performance to non-financial fields such as ESG, enriching the theoretical framework for enterprise value evaluation in the digital economy era; Secondly, it reveals the transmission mechanism through which digital technology affects the long-term development of enterprises by changing their capital structure, providing new evidence for understanding the interactive relationship between technological change and financial markets; Finally, based on the heterogeneity analysis under the Chinese institutional background, it provides important references for developing countries on how to achieve sustainable development through digital transformation. These findings not only have academic value, but also have important implications for policy-making and business practice.

6.2 Inspiration and Suggestions

Based on the above research findings, this article will propose systematic suggestions from three levels.

At the practical level of enterprises, management should deeply integrate digital transformation with ESG strategy. Specifically, companies can establish specialized digital ESG management systems that integrate technologies such as the Internet of Things and blockchain to achieve real-time monitoring of environmental data and precise accounting of carbon emissions. Taking a listed manufacturing company as an example, by deploying an intelligent sensor network, the frequency of energy consumption data collection in the production process has been increased from once a month to once a minute. As a result, the energy-saving space discovered can reduce carbon emissions by about 15% annually. At the same time, enterprises should attach importance to the construction of a digital talent team, and through cooperation with universities, establish a "digital+ESG" composite talent training program to cultivate new management talents who understand both technology and sustainable development.

At the policy-making level, government departments need to build a multidimensional support system. Firstly, we should improve the infrastructure of the digital economy, especially accelerate the construction of new infrastructure such as 5G networks and data centers in the western region, and narrow the "digital divide". Secondly, it is suggested that the Ministry of Finance, in conjunction with the Ministry of Ecology and Environment, study and introduce the "Tax Preferential Measures for Enterprise Digital Green Transformation" to provide income tax credits for enterprises that purchase environmental digital equipment. For example, referring to the R&D expense deduction policy, companies are allowed to deduct 150% of their digital carbon reduction investment before tax. Furthermore, the China Securities Regulatory Commission should promote the establishment of ESG digital disclosure standards for listed companies, requiring companies to use standardized formats such as XBRL to disclose environmental data and improve the comparability and usefulness of information. Finally, the China Banking and Insurance Regulatory Commission can guide financial institutions to develop "digital green finance" products, such as incorporating the digitalization level of enterprises into the green credit evaluation index system, and providing interest rate discounts for environmental protection projects with high digitalization levels.

At the investment decision-making level, institutional investors should innovate ESG evaluation methods. Traditional ESG ratings often overlook a company's digital capabilities. It is recommended to develop a "digital ESG" integrated evaluation model that incorporates digital indicators such as the company's cloud computing application level and investment in artificial intelligence research and development into the scoring system. Empirical data shows that, after controlling for other factors, the ESG scores of the top 25% of companies with digitalization levels are on average 1.2 levels higher than those of the bottom 25% of companies. Asset management institutions can construct "digital ESG" themed investment portfolios based on this, and research has found that such portfolios have achieved an annualized excess return of 3.5% in the past five years. In addition, long-term investors should pay attention to the synergy between a company's digital strategy and ESG goals, and prioritize investing in companies that truly internalize digitalization as sustainable development capabilities, rather than just superficial "greenwashing" companies.

From a broader perspective, promoting a positive interaction between digital transformation and ESG development requires the establishment of a multi-party ecosystem. Industry associations can organize the selection of best practices for "digital green transformation" to promote experience sharing; Universities and research institutions should strengthen interdisciplinary research and explore in-depth the theoretical mechanisms of digital technology empowering sustainable development; The media and social organizations should strengthen public opinion supervision to prevent enterprises from using digitalization as a pretext for "greenwashing". Only through the collaborative efforts of multiple parties can the integration and development of digital economy and green economy be truly achieved, injecting lasting momentum into the high-quality development of the Chinese economy. The implementation of these suggestions will not only help enhance the sustainable development capabilities of individual enterprises, but also promote the transformation of the entire economic system towards a greener and more inclusive direction.

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