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Technology Empowerment and Institutional Pressure: A Study of the Impact of Digital Transformation on Financial Statement Information Quality–From the Perspective of Environmental, Social, and Governance (ESG) Greenwashing Governance

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Abstract

Against the background of the comprehensive green transformation of the economy and society, the relationship between digital transformation and corporate environmental disclosure has become increasingly prominent. Most existing studies focus on the effects of digital transformation on operating efficiency or environmental performance, but they have not answered whether digital transformation can improve environmental information quality and then transmit this improvement to the field of financial information. Using Chinese A-share listed companies from 2011 to 2021 as the research sample, this study empirically examines the effect of corporate digital transformation on financial statement information quality. The results show that digital transformation significantly inhibits ESG greenwashing, further reduces earnings management, and improves accounting information comparability. The mechanism analysis shows that digital transformation improves corporate information quality by strengthening internal control, alleviating financing constraints, and enhancing external supervision. The heterogeneity analysis shows that the governance effect of digital transformation is more significant in firms with greater information asymmetry and lower institutional ownership. The findings provide evidence for promoting high-quality corporate development and improving the information environment of the capital market.

Keywords

digital transformation, financial statement information quality, ESG greenwashing, internal control, information governance

1. Introduction

Digital transformation is a core driving force for high-quality economic development and an important engine for enterprises to enhance their core competitiveness. In 2024, the Ministry of Industry and Information Technology and several other departments issued the Special Action Plan for Digital Empowerment of Small and Medium-sized Enterprises (2025-2027), emphasizing the promotion of the digital transformation of small and medium-sized enterprises and new industrialization. Digital technology reshapes traditional corporate

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operating models through production processes, management models, information transmission, and other aspects, and improves corporate production efficiency [1], capital market performance [2], and corporate innovation [3]. However, existing research has not answered whether digital transformation can fundamentally improve firms' willingness to disclose information and thereby improve disclosure quality, particularly financial information quality.

As an important channel through which internal and external stakeholders obtain information, corporate financial reporting quality is the foundation for reducing information asymmetry and supporting the effective operation of capital markets. In recent years, repeated financial fraud cases and poor financial quality have drawn investors' attention to the limitations of traditional governance mechanisms. At the same time, the rise of corporate social responsibility and ESG has increasingly highlighted the importance of nonfinancial information quality. However, because of financing pressure or manipulation motives, some firms tend to symbolically disclose favorable ESG performance and exaggerate environmental performance, which constitutes ESG greenwashing (GW) [4, 5]. In particular, strategic disclosure behavior is cross-domain and consistent within the same firm. Firms may apply symbolic disclosure practices from nonfinancial information to financial reporting, thereby reducing financial reporting information quality. Therefore, in the context of digital transformation, can digital technology serve as an effective governance tool that reduces corporate ESG GW and transmits the governance effect to the financial field, thereby improving financial information quality?

In theory, digital transformation reduces information asymmetry, improves internal control quality, alleviates corporate financing constraints, increases external investor attention, and strengthens regulatory mechanisms, thereby encouraging firms to reduce selective disclosure. On this basis, this study uses A-share listed companies from 2011 to 2021 as the research sample, empirically examines the effect of digital transformation on corporate financial statement information quality, and tests the mediating effect of corporate ESG GW.

The marginal contributions of this study are as follows. First, it extends the economic consequences of digital transformation from the perspective of corporate information disclosure and expands the research focus from operating performance to information governance. Second, it enriches the factors affecting financial statement information quality from the perspective of technological empowerment. Third, it constructs a transmission chain from digital technology to nonfinancial information governance and then to financial information improvement, revealing the transmission mechanism through which digital technology affects information quality across different fields.

2. Literature Review and Research Hypotheses

2.1 Economic Consequences of Digital Transformation

Existing studies have examined the economic consequences of digital transformation at multiple levels and formed a rich research stream. At the macro level, digital transformation changes the industrial structure and is a key driver of total factor productivity [1]. At the micro level, existing studies indicate that digital transformation has positive effects on corporate operating performance, including technological innovation, labor productivity, and capital market performance [2, 3]. With the rise of ESG investment, research has begun to examine the effect of digital transformation on ESG performance. Hu et al. find that digital transformation significantly improves corporate ESG performance [6]. Chen and Li focus on selective environmental information disclosure and show that digital transformation inhibits ESG GW [7].

GW is essentially a strategic or symbolic form of impression management. Firms selectively disclose favorable environmental and social information and exaggerate environmental performance, thereby conveying environmental performance to the capital market that does not match reality [8]. Existing studies indicate that performance pressure [9], financing needs [4], and executive overconfidence [10] affect corporate GW. Similarly, corporate GW and financial information manipulation have highly similar origins. When firms face financial distress or financing constraints, executives not only disclose and amplify favorable environmental information but also have stronger incentives to engage in earnings management and even financial fraud.

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Most literature on the economic consequences of digital transformation focuses on its direct effects, including operating performance and ESG performance, but does not further examine whether the reduction in ESG GW brought by digital transformation affects traditional financial information quality.

2.2 Effect of Digital Transformation on Information Disclosure Quality

As an organizational change process driven primarily by data elements, digital transformation embeds digital technologies into internal business operations and information transmission systems. It makes corporate business activities traceable, reduces internal information frictions and human intervention, optimizes operation management and information transmission, and improves internal control quality [7].

Digital transformation has a positive effect on the transparency of firms' operating environments and business strategies. It enables firms to communicate their development goals and paths to the outside world more effectively, reduces information asymmetry between firms and external investors, helps investors identify corporate value and risk more accurately, and lowers the costs of collecting and assessing information, thereby alleviating financing constraints [11]. Improved financing conditions reduce firms' incentives to obtain financing through strategic behavior and thus improve information disclosure quality.

Digital transformation increases the availability of corporate information and continuously sends positive signals to the market about stronger innovation capability, improved governance, and better future growth, thereby attracting more analysts to follow and study the firm [2]. External attention creates external monitoring pressure, increases the probability that information manipulation will be identified and the associated penalty cost, and thereby restrains incentives for GW and financial manipulation.

On this basis, this study proposes the following hypotheses:

H1: Corporate digital transformation significantly inhibits ESG GW.

H2: Digital transformation indirectly improves financial statement information quality by inhibiting ESG GW.

3. Research Design

3.1 Sample Selection and Data Sources

China's digital economy entered a stage of rapid development after 2011, and Huazheng ESG rating data gradually began to cover the capital market during this period. Therefore, this study uses Chinese A-share listed firms from 2011 to 2021 as the research sample. To better identify the effect of digital transformation on corporate information disclosure, the sample is processed as follows: (1) firms designated for special treatment (ST) or particular transfer (PT) during the sample period are excluded; (2) firms in the financial and insurance industries are excluded; (3) observations with missing values for the main variables are excluded; and (4) to reduce the effect of extreme values, all continuous variables are winsorized at the 1st and 99th percentiles. The final sample contains 10,872 firm-year observations.

Digital transformation data are obtained from the annual reports of listed companies. ESG rating data are obtained from the Bloomberg database and the Huazheng ESG database. Corporate financial and governance data are obtained from the China Stock Market & Accounting Research (CSMAR) database, and the internal control index is obtained from the DIB Internal Control and Risk Management Database (DIB database).

3.2 Variable Definitions

3.2.1 Dependent Variables

This study uses the degree of earnings management (*DA*) and accounting information comparability (*COMP*) to measure financial statement information quality. For earnings management, the Jones model is used to estimate firm-level discretionary accruals, and the absolute value is taken as the measure. A larger value indicates lower earnings management quality. For accounting information comparability, this study follows De Franco et al. [12] and calculates the comparability of accounting systems across firms in the same industry. A larger value indicates greater comparability of accounting information among firms and higher information quality.

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3.2.2 Mediating Variable

Following Chen and Li, this study measures ESG GW using the gap between a firm's selectively disclosed ESG score and its substantive ESG score [7]. Bloomberg ESG and Huazheng ESH are used as the ESG disclosure score and the actual ESG score, respectively, and the scores are standardized at the industry level. The difference between the standardized disclosure score and the standardized actual score is then defined as ESG GW. A larger difference indicates a greater divergence between the firm's "words" and "actions" and thus more severe GW.

3.2.3 Explanatory Variable

This study uses text analysis and Python to collect the frequencies of keywords related to digital transformation, including "artificial intelligence," "blockchain," "cloud computing," "big data," and "digital technology applications," from the annual reports of listed companies. The natural logarithm of the total keyword frequency plus one is used as a proxy for the degree of digital transformation (*DT*).

3.2.4 Control Variables

Following the existing literature [13, 14], this study controls for the following firm-level characteristics that may affect information disclosure quality: firm size (*Size*), leverage (*Lev*), return on assets (*ROA*), Tobin's Q (*TobinQ*), cash flow ratio (*Cashflow*), board size (*Board*), ownership concentration (*Top1*), institutional ownership (*Inst*), chief executive officer and board chair duality (*Dual*), and state ownership (*SOE*).

3.3 Model Specification

This study first tests H1, namely, the effect of digital transformation on corporate ESG GW. The following baseline regression model (1) is constructed:

$$GW_{i,t} = \alpha_0 + \alpha_1 DT_{i,t} + \alpha_2 Controls_{i,t} + \lambda_i + \mu_t + \varepsilon_{i,t} \quad (1)$$

Here, GW_{it} is the degree of ESG GW of firm i in year t, and DT_{it} is the level of digital transformation of firm i in year t. $Controls_{it}$ is a set of firm-level control variables. λ_i and μ_t denote firm and time fixed effects, respectively; ε_{it} is the random disturbance term. α_1 represents the effect of digital transformation on corporate ESG GW.

To further test H2, this study follows Wen et al. and constructs model (2) based on the baseline regression model (2) [15]:

$$Quality_{i,t} = \alpha_0 + \alpha_1 DT_{i,t} + \alpha_2 GW_{i,t} + Controls_{i,t} + \lambda_i + \mu_t + \varepsilon_{i,t} \quad (2)$$

Here, $Quality_{it}$ is the variable measuring financial statement information quality, represented by the degree of earnings management (*DA*) and accounting information comparability (*COMP*). The remaining variables are consistent with model (1). If α_1 and α_2 are both significant, the mediating effect is established.

4. Empirical Results and Analysis

4.1 Descriptive Statistics

Table 1 reports the descriptive statistics of the main variables. The mean of *DA* is 0.048 and the standard deviation is 0.071, indicating substantial differences in earnings quality across firms. The mean of *GW* is 0.014, with a minimum of -2.145 and a maximum of 2.366, further indicating significant variation across firms in the inconsistency between ESG "words and actions." The mean of *DT* is 1.521 and the standard deviation is 1.368.

Table 1: Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
DA	10872	0.048	0.071	0.001	0.287
COMP	10872	0.002	0.082	-0.142	0.158
GW	10872	0.014	1.173	-2.145	2.366
DT	10872	1.521	1.368	0.000	4.836

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4.2 Baseline Regression Results

Column (1) of Table 2 shows the effect of digital transformation on corporate ESG GW. After controlling for firm and year fixed effects and firm-level control variables, the regression coefficient of *DT* is significantly negative at the 1% level, with a coefficient of -0.071. This indicates that a one-unit increase in digital transformation is associated with an average 7.1% decrease in ESG GW, supporting H1.

Columns (2) and (4) of Table 2 show the regression results for the effect of digital transformation on financial information disclosure quality. The results indicate that digital transformation significantly improves financial statement quality. In columns (3) and (5) of Table 3, this study estimates the mediating-effect model (2). The results show that the regression coefficient of *GW* on *DA* is significantly positive, whereas that on *COMP* is significantly negative, and the absolute value of the *DT* coefficient is smaller than that in the regression without the mediating variable. This indicates that ESG GW has a significant mediating effect on the path through which digital transformation improves financial statement quality, supporting H2.

Table 2: Baseline Regression Results

Variable	(1)	(2)	(3)	(4)	(5)
	GW	DA	DA	COMP	COMP
DT	-0.071***	-0.004***	-0.003***	0.015***	0.012***
	(-4.82)	(-3.01)	(-2.83)	(4.58)	(4.12)
GW			0.003***		-0.004***
			(4.15)		(-5.01)
Controls	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
N	10,872	10,872	10,872	10,872	10,872
Adj. R^2	0.103	0.227	0.231	0.185	0.192

*Note: t-values are shown in parentheses; *** p < 0.01, ** p < 0.05, and * p < 0.1. The same applies below.*

(3) Mechanism Tests

To further clarify the pathways through which digital transformation operates, this study tests the mechanisms through internal control, financing constraints, and external supervision. The DIB internal control quality index, the Kaplan-Zingales (*KZ*) index, and analyst attention are used as the respective measures. The results are shown in Table 3. The results indicate that digital transformation significantly improves corporate internal control quality, alleviates financing constraints, and attracts greater analyst attention. These results are consistent with the theoretical analysis and show that digital transformation improves corporate information disclosure quality through the three mechanisms of internal control, financing alleviation, and external pressure.

Table 3: Mechanism Tests

Variable	(1)	(2)	(3)
	Internal Control Quality	Financing Constraints	Analyst Attention
DT	0.077**	-0.114***	0.101***
	(2.43)	(-5.67)	(6.89)
Controls	YES	YES	YES
Firm FE	YES	YES	YES
Year FE	YES	YES	YES
N	10,872	10,872	10,872
Adj. R^2	0.319	0.456	0.422

5. Heterogeneity Analysis and Robustness Tests

5.1 Heterogeneity Analysis

To further examine heterogeneity in the governance effect of digital transformation, this study conducts group regressions based on the medians of information asymmetry and institutional ownership. The results show that the effect of digital transformation on improving information disclosure is more significant in firms with greater information asymmetry and lower institutional ownership. This indicates that digital transformation can more effectively substitute for traditional governance mechanisms and realize the benefits of digital technology.

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5.2 Robustness Tests

To ensure the reliability of the conclusions, this study conducts a series of robustness tests: (1) instrumental variable method: the interaction between the number of telephones per 10,000 people in each city in 1984 and the number of national Internet users in the previous year is used as an instrumental variable, and two-stage least squares regression is performed to reduce the interference of endogeneity with the conclusions; (2) lagged variables: the core explanatory variable *DT* is lagged by one and two periods; (3) replacement of the explanatory variable: Huazheng ESG is replaced with Wind ESG and *GW* is recalculated; and (4) placebo test: corporate disclosure scores and actual scores are randomly constructed and the regression is re-estimated. The conclusions of this study remain valid after these robustness tests.

6. Conclusions and Implications

Using Chinese A-share listed firms from 2011 to 2021 as the research sample, this study empirically examines the effects of digital transformation on financial and nonfinancial information quality and the associated transmission mechanisms. The conclusions are as follows: (1) digital transformation significantly inhibits corporate ESG GW; (2) the governance effect of digital transformation on nonfinancial information disclosure is transmitted to financial statements and improves corporate financial statement information disclosure quality; and (3) digital transformation improves information disclosure quality by improving internal control quality, alleviating financing constraints, and increasing external attention.

The conclusions of this study have policy and practical implications for improving corporate information disclosure quality in the context of the comprehensive digital transformation of small and medium-sized enterprises. By embedding digital transformation in daily operations and strategic decision-making, firms can improve operating efficiency. Digital transformation is also an important strategic tool for improving information disclosure quality and reducing information frictions with the capital market. During digital transformation, firms should avoid the short-sighted idea of pursuing “digitalization for the sake of digitalization.” They should apply digital transformation more effectively to corporate governance and reshape internal governance through digital technology, thereby improving information disclosure quality. Regulators should actively guide firms in using digital technology to improve external information disclosure systems. They should also strengthen reviews of the quality of corporate ESG and social responsibility disclosures and realize the transmission effect of improved nonfinancial information disclosure.

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Conflicts of Interest

The authors declare no conflict of interest.

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