

The Impact of Digital Transformation on Corporate Greenwashing Behavior

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Abstract. This study examines the impact of digital transformation on corporate greenwashing behavior using data from 998 Chinese listed companies between 2015 and 2023. The findings suggest that digital transformation significantly reduces greenwashing by improving transparency and facilitating better environmental data management. Companies with larger sizes and higher financial leverage are more likely to engage in greenwashing, while those with higher environmental investments and female management tend to exhibit less greenwashing. Additionally, the study reveals that media attention plays a crucial role in reducing greenwashing by increasing external scrutiny, enhancing the credibility of environmental claims. However, executive stock incentives may weaken the effect of digital transformation on reducing greenwashing, as executives with high stock incentives are more inclined to exaggerate environmental commitments to boost short-term shareholder value. The research further highlights regional and industry differences, with digital transformation having a more significant impact in Eastern and Central China compared to the West. Overall, the study provides valuable insights into the role of digital transformation and external governance in mitigating corporate greenwashing, encouraging more transparent and responsible corporate behavior.

Keywords: Digital transformation; Corporate greenwashing; Transparency; Environmental data; Media attention.

1. Introduction

In recent years, Chinese companies have effectively reduced carbon emissions through green production methods such as energy conservation and emission reduction, laying a foundation for achieving the 2030 carbon peak goal. However, some companies, in order to create a false green image, have resorted to deceptive practices such as false data disclosure and selective environmental information disclosure. This behavior, known as "greenwashing," has attracted widespread societal attention [1]. Greenwashing refers to companies concealing negative environmental information or beautifying environmental data to create a false impression. As an unethical business practice, it not only undermines consumer and investor trust in a company's environmental responsibility but also severely affects the dissemination of environmental information and disrupts the construction of the green market system [2].

The governance of greenwashing by companies mainly relies on the green transformation of production methods and the active participation of external governance entities. However, the rapid changes in environmental policies, consumer preferences, and technological advancements have increased the uncertainty of corporate green transformation, making the process more dependent on a company's sensitivity to market changes, ability to seize opportunities, and capacity to reconfigure resources. Recent research indicates that digital technologies alone do not directly bring additional benefits, but when applied to promote digital transformation and enhance a company's dynamic capabilities, they can foster development and deliver additional benefits. In the case of green production methods, digital transformation helps companies overcome the limitations of time and space, effectively addressing the information isolation and data barriers in traditional markets, facilitating the flow and integration of green innovation elements, and improving information transparency between enterprises and external markets, thereby providing feasibility for implementing green production and external governance participation [3].

Although digital technologies provide new opportunities for green transformation, it remains unclear whether they can effectively curb corporate greenwashing behaviors and how they exert influence. Scholars generally believe that corporate greenwashing is driven by external pressures, particularly formal and informal pressures. From the perspective of environmental legitimacy, digital transformation can optimize resource allocation, enhance energy efficiency, and reduce carbon emissions, thus improving environmental performance and curbing greenwashing [4]. However, some studies suggest that digital transformation may lead to increased energy consumption and carbon emissions, and even have negative impacts on water resources, land use, and biodiversity, thus intensifying the environmental legitimacy pressure on companies and strengthening the motivation for greenwashing [5].

Furthermore, contingency theory posits that the influence of company strategies (such as digital transformation), resources, and capabilities should align with the external governance environment (such as media environment). The media, by reporting on a company's production and economic performance, conveys signals to the market and influences stakeholder decision-making, thereby playing an external governance role. Therefore, the impact of digital transformation on corporate greenwashing may be affected by changes in the media environment. This paper focuses on two aspects of the media environment: media attention (media coverage) and media tone (media sentiment), exploring how they moderate the relationship between digital transformation and corporate greenwashing. Media attention, through extensive reporting, not only provides a verification channel for digital environmental information, enhancing its readability but also attracts more potential partners, significantly impacting the role of resource integration and information advantages in the digital transformation process. At the same time, media sentiment may alter stakeholders' trust in a company's digital environmental information, influencing resource allocation and further affecting the effectiveness of digital transformation [6].

This study uses data from 998 Chinese listed companies between 2015 and 2023 to examine the impact of digital transformation on corporate greenwashing behavior and explore the moderating role of media attention and media sentiment in this relationship. The research aims to reveal how digital transformation can reduce corporate greenwashing by enhancing transparency and optimizing resource management. Additionally, the study investigates the impact of factors such as company size, financial leverage, and ownership structure on greenwashing behavior, and analyzes how external governance mechanisms, particularly media oversight, further influence the effectiveness of digital transformation in reducing corporate greenwashing.

2. Theoretical Basis and Research Hypotheses

2.1 Theoretical Basis

Corporate "greenwashing" typically refers to the practice of companies disclosing false or exaggerated environmental information to shape a green image, and this behavior negatively impacts the company's long-term development and market trust. Corporate environmental responsibility and green innovation have become important factors influencing their long-term competitiveness [7]. With the increasing awareness of environmental issues and the strengthening of environmental regulations, companies have gradually realized that disclosing false environmental information not only risks public and government penalties but also leads to a loss of investor confidence, ultimately damaging the company's brand value and market position.

In recent years, digital transformation has become a key factor in enhancing corporate competitiveness and market adaptability. The application of digital technologies, especially the widespread use of big data, cloud computing, and artificial intelligence, not only enables companies to improve internal operational efficiency but also provides new opportunities for implementing green production methods [8-9]. Digital transformation helps companies better manage and optimize resource allocation, improve environmental performance, and enhance information transparency, thereby effectively reducing greenwashing behavior. Through digital platforms, companies can more

accurately collect and disclose environmental data, improve the verifiability of their environmental actions, and reduce the occurrence of false environmental claims [10].

Moreover, the implementation of corporate digital transformation is also influenced by the external environment, particularly the role of the media environment and external governance mechanisms. For instance, the media's attention to corporate environmental behaviors may help reduce greenwashing by increasing external oversight [11]. Additionally, shareholder structure and management incentives may moderate the impact of digital transformation on corporate greenwashing behavior. Companies with high equity incentives and strong governance structures are more likely to adopt transparent and realistic environmental measures when undergoing digital transformation, thereby reducing the likelihood of false disclosures [12-13].

2.2 Research Hypotheses

Based on the theoretical foundation outlined above, this paper proposes the following research hypotheses:

Hypothesis 1: Digital transformation helps to suppress corporate greenwashing behavior.

Digital transformation improves corporate operational efficiency and the transparency of environmental information, helping companies reduce the falsification of environmental data disclosures. During the digital transformation process, companies can better manage resources, optimize green production methods, and provide traceable and verifiable environmental data through digital platforms, which helps reduce the likelihood of greenwashing behavior. Therefore, digital transformation is expected to be an effective means of reducing corporate greenwashing.

Hypothesis 2: Companies with high equity incentives have a more significant "anti-greenwashing" effect in digital transformation.

High equity incentive mechanisms align the interests of management with the long-term development goals of the company. Management in companies with high equity incentives, due to their higher motivation for greenwashing, typically face greater external transparency pressure during the digital transformation process, which leads them to disclose more accurate environmental information. Therefore, companies with high equity incentives are more likely to effectively suppress greenwashing after implementing digital transformation.

Hypothesis 3: Media attention plays a moderating role between digital transformation and corporate greenwashing.

Media attention increases external supervision, promoting more transparent environmental information disclosures during digital transformation. Continuous media attention not only enhances the readability and trustworthiness of environmental information but also effectively restricts false behaviors in green information disclosures. Therefore, companies with higher media attention are more likely to reduce greenwashing after digital transformation.

3. Research Design

3.1 Sample Selection and Data Sources

In 2015, the "Internet Plus" action plan was first proposed in the government report, and since then, companies began applying digital technologies to their production and operations, driving the rapid development of corporate digital transformation. In this context, this study focuses on A-share listed companies from 2015 to 2023, investigating the impact of digital transformation on corporate greenwashing behavior. Corporate greenwashing mainly consists of ESG (Environmental, Social, and Governance) disclosure performance and ESG fulfillment performance. ESG disclosure scores are sourced from the Bloomberg ESG database, while ESG fulfillment performance comes from the Huazheng ESG ratings. Media coverage data is sourced from the CNRDS database, and data on digital transformation, financial indicators, company characteristics, and governance come from the CSMAR database.

To improve the validity of the research results, this study excludes ST and *ST special companies, as well as samples with missing key variables, and applies a two-tailed 1% trimming to continuous variables. Additionally, to reduce multicollinearity, related variables are centralized before conducting interaction term analysis. Ultimately, 6,726 valid observations from 998 companies over the period from 2015 to 2023 are included.

3.2 Variable Definitions

Based on the theoretical framework, all variables in this study can be divided into dependent variables, independent variables, control variables, mediating variables, and moderating variables. The following are the specific definitions and measurement methods for each variable:

3.2.1 Dependent Variable

Corporate Greenwashing (Green_wash): Corporate greenwashing refers to companies creating a false green image by disclosing environmental behaviors that differ from their actual environmental actions. This variable is measured by assessing the discrepancy between the environmental information disclosed by the company and its actual environmental actions, based on the environmental disclosure content in the company's annual report.

3.2.2 Independent Variable

Digital Transformation (Digital_trans): Digital transformation refers to companies using digital technologies to innovate business processes, management models, and organizational structures, thereby enhancing competitiveness and market adaptability. This study measures the extent of digital transformation by the frequency of digital-related terms in the company's annual report, using the logarithmic value of term frequency as the indicator for this variable.

3.2.3 Control Variables

Company Size (Size): Company size is measured by the natural logarithm of total assets at year-end, reflecting the scale of the company's assets.

Company Age (Age): Company age is measured by the natural logarithm of the company's years since establishment plus one, reflecting the company's experience and history in the industry.

Financial Leverage (Lev): Financial leverage refers to the extent to which the company uses debt, calculated as the ratio of total liabilities at year-end to total assets at year-end.

Profitability (Roa): Profitability reflects the company's ability to generate profits using its assets, calculated as the ratio of net profit to average total assets.

Ownership Concentration (Top1): Ownership concentration is measured by the proportion of shares held by the largest shareholder, reflecting the concentration of the company's ownership structure.

Independent Director Governance (Indep): Independent director governance is measured by the ratio of independent directors to the total number of directors on the board, reflecting the proportion of independent directors in the company's governance structure.

Growth Potential (TobinQ): Growth potential is measured by the ratio of (market value of equity + net debt value) to total assets at year-end, reflecting the company's future growth prospects.

Collateralization (Tanasset): Collateralization is measured by the ratio of tangible assets to total assets at year-end, indicating the company's ability to pledge assets as collateral.

Gender Structure of Management (Female): The gender structure of management is measured by the proportion of women in the company's management team, reflecting the gender diversity of the company's leadership.

3.2.4 Mediating Variables

Environmental Agency Costs (EnvCost): Environmental agency costs refer to the costs incurred by companies in meeting environmental protection requirements and governance. This variable is measured by the company's expenditures on environmental protection.

Analyst Attention (lnAnaAttention): Analyst attention measures the level of attention analysts pay to the company, specifically calculated by the frequency of related terms in the company’s annual report.

Report Attention (lnReportAttention): Report attention is measured by the attention given to environmental reports in the company’s annual report, including factors such as report length and level of detail.

3.2.5 Moderating Variable

Executive Stock Incentives (EQ): Executive stock incentives refer to the mechanisms through which companies incentivize senior management through stock options and other means. This variable is measured by the proportion of shares held by executives and the details of the stock incentive plans disclosed in the company’s annual report.

Based on the model above, we propose the following regression model:

$$Green_wash_{it} = \alpha + \beta_1 Digital_trans_{it} + \beta_2 Digital_trans_{it} \times EQ_{it} + \beta_3 EnvCost_{it} + \beta_4 lnAnaAttention_{it} + \beta_5 lnReportAttention_{it} + \gamma X_{it} + \epsilon_{it}$$

In this model, we simultaneously consider the digital transformation, the effect of corporate governance (higher executive incentives), and the intermediate effect (environmental agency costs, report attention) on corporate greenwashing behavior.

4. Empirical Results and Analysis

4.1 Descriptive Statistics

As shown in Table 1, from the descriptive statistical analysis, it can be observed that most companies are at the initial stage of digital transformation, and the majority of companies have relatively large sizes, with relatively mild greenwashing behavior. However, there are significant differences in financial leverage, profitability, and environmental investment among companies, suggesting that there may be a certain relationship between digital transformation and corporate environmental behavior. In particular, the differences in environmental agency costs and analyst attention may further influence corporate decision-making in environmental matters. The gender structure of management and ownership concentration may also play a role in the company's environmental behavior, indicating that the company’s decision-making mechanism and governance structure have an important impact on greenwashing behavior.

Table 1 Descriptive Statistics of Key Variables

Variable	N	Mean	SD	Min	p50	Max
Green wash	36426	0.200	0.400	0	0	1
Digital ~1 w	36426	1.690	1.420	0	1.610	5.240
Size w	35926	22.27	1.300	19.96	22.06	26.34
Age w	35926	3	0.310	2.080	3.040	3.610
Lev w	35926	0.410	0.210	0.0600	0.400	0.920
Roa w	35925	0.0300	0.0700	-0.290	0.0400	0.200
Top1 w	35926	0.330	0.150	0.0800	0.310	0.740
Indep w	35923	0.380	0.0500	0.330	0.360	0.570
TobinQ w	35386	2.060	1.350	0.830	1.630	8.820
Tanasset w	35925	0.930	0.0900	0.520	0.960	1
Female w	35926	0.210	0.120	0	0.200	0.530
EnvCost w	36339	0.200	0.780	0	0	5.590
lnAnaAtten~w	36397	1.370	1.060	0	1.390	3.560
lnReportAt~w	36397	1.660	1.330	0	1.610	4.470

4.2 Benchmark Regression Analysis

The regression results indicate that digital transformation significantly suppresses corporate greenwashing behavior, suggesting that digitalization improves corporate transparency. Company size and financial leverage have a positive impact on greenwashing behavior, meaning that larger companies and those with higher leverage are more likely to engage in greenwashing. Profitability and ownership concentration also have a significant effect on greenwashing behavior, with more profitable companies being more likely to engage in greenwashing. Environmental agency costs and the presence of female management have a negative impact, indicating that these companies tend to engage in more authentic environmental behavior. Over time, especially after 2019, corporate greenwashing behavior has increased year by year. Industry differences also suggest that greenwashing behavior varies across different industries. As shown in Table 2.

Table 2 Benchmark Regression Results on the Impact of Digital Transformation on Corporate Greenwashing

(1)	Green wash
Digital_trans1_w	-0.0152***
	-0.00145
Size_w	0.0841***
	-0.00206
Age_w	-0.0149**
	-0.00701
Lev_w	0.126***
	-0.0125
Roa_w	0.110***
	-0.0329
Top1_w	-0.0790***
	-0.0143
Indep_w	0.749
	-1.656
TobinQ_w	-0.00800***
	-0.00168
Tanasset_w	-0.254***
	-0.0227
Female_w	-0.0872***
	-0.0178

4.3 Robustness Test Results

4.3.1 Replacing the Core Variable "Digital Transformation"

The regression results after replacing the core variable "digital transformation" indicate that digital transformation (Digital_trans2_w) still has a significant negative impact on corporate greenwashing behavior (coefficient = -0.127***), suggesting that digital transformation helps reduce false environmental behaviors by companies. At the same time, company size (Size_w) has a significant positive impact on greenwashing behavior (coefficient = 0.0813), indicating that larger companies are more likely to use greenwashing to improve their public image. Financial leverage (Lev_w) and profitability (Roa_w) also have significant positive impacts, suggesting that companies with high leverage and strong profitability are more likely to engage in greenwashing under pressure. Ownership concentration (Top1_w) shows a negative impact (coefficient = -0.0729), indicating that higher ownership concentration helps suppress greenwashing behavior, likely due to the closer supervision and governance structure by shareholders. Environmental agency costs (Tanasset_w) and female management (Female_w) have a negative impact, further suggesting that higher environmental investment and the presence of female management are associated with a reduction in

greenwashing behavior. Company age (Age_w) and the proportion of independent directors (Indep_w) did not show significant effects in this model, possibly indicating that these two factors have a relatively weak impact on greenwashing behavior. Overall, the results after replacing the core variable are consistent with expectations, further confirming the significant impact of digital transformation, financial leverage, company size, and other factors on greenwashing behavior. As shown in Table 3.

Table 3 Robustness Test Results with Replaced Core Variable "Digital Transformation"

Variable	Coefficient	Std. Error
Digital_trans2_w	-0.127***	-0.00867
Size_w	0.0813***	-0.00205
Age_w	-0.00814	-0.00696
Lev_w	0.137***	-0.0125
Roa_w	0.0957***	-0.0328
Top1_w	-0.0729***	-0.0142
Indep_w	0.778	-1.653
TobinQ_w	-0.00778***	-0.00167
Tanasset_w	-0.214***	-0.0226
Female_w	-0.0759***	-0.0178

4.3.2 Using Double Clustering Standard Errors

The regression results using double clustering standard errors show that digital transformation (Digital_trans2_w) still has a significant negative impact on corporate greenwashing behavior (coefficient = -0.127), indicating that digital transformation can effectively suppress false environmental behaviors by companies. Company size (Size_w) also has a significant positive impact on greenwashing behavior (coefficient = 0.0813), suggesting that larger companies are more likely to engage in greenwashing to enhance their image. Financial leverage (Lev_w) also shows a significant positive impact (coefficient = 0.137), indicating that companies with high leverage are more likely to use greenwashing to alleviate market pressures. Ownership concentration (Top1_w) has a significant negative impact on greenwashing behavior (coefficient = -0.0729), suggesting that higher ownership concentration helps suppress greenwashing, possibly due to stronger shareholder supervision. Environmental investment (Tanasset_w) also has a significant negative impact on greenwashing behavior (coefficient = -0.214), indicating that companies with higher environmental investments tend to engage less in greenwashing. Female management (Female_w) has a negative impact (coefficient = -0.0759), further suggesting that female management contributes to promoting more transparent and authentic environmental behaviors. As shown in Table 4.

Table 4 Regression Results Using Double Clustering Standard Errors

(1)	Green wash
Digital_trans2_w	-0.127*** (0.00913)
Size_w	0.0813*** (0.00453)
Age_w	-0.00814 (0.00911)
Lev_w	0.137*** (0.0110)
Roa_w	0.0957 (0.0572)
Top1_w	-0.0729** (0.0294)
TobinQ_w	-0.00778* (0.00403)
Tanasset_w	-0.214***

	(0.0588)
Female_w	-0.0759***
	(0.0161)
_cons	-1.379***
	(0.104)
N	35340
R ²	0.140
adj. R ²	0.139

4.4 Heterogeneity Test Results

4.4.1 Differences in Ownership Types

The heterogeneity test results indicate that the impact of digital transformation, company size, financial leverage, ownership concentration, environmental investment, and female management on greenwashing behavior differs between state-owned and private companies. Although both types of companies generally show similar performance on these factors, state-owned enterprises exhibit more significant effects in terms of ownership concentration, environmental investment, and female management. Specifically, the impact of digital transformation, environmental investment, and ownership concentration on reducing greenwashing behavior is stronger in state-owned enterprises, while in private companies, financial leverage and profitability have a more significant effect on greenwashing behavior. Overall, differences in ownership types play an important moderating role in corporate greenwashing behavior. As shown in Table 5.

Table 5 Heterogeneity Test Results: Differences in Ownership Types

	(1)	(2)
	Green_wash	Green_wash
Digital_trans1_w	-0.0109***	-0.0164***
	(0.00323)	(0.00171)
Size_w	0.0859***	0.0879***
	(0.00397)	(0.00278)
Age_w	-0.0579***	0.00183
	(0.0157)	(0.00848)
Lev_w	0.106***	0.134***
	(0.0252)	(0.0156)
Roa_w	0.150*	0.0593
	(0.0828)	(0.0380)
Top1_w	-0.185***	-0.0399**
	(0.0286)	(0.0183)
Indep_w	1.831	0.318
	(1.348)	(1.834)
TobinQ_w	-0.0108***	-0.00650***
	(0.00399)	(0.00192)
Tanasset_w	-0.507***	-0.135***
	(0.0479)	(0.0271)
Female_w	-0.149***	-0.0760***
	(0.0411)	(0.0210)

4.4.2 Regional Differences (East, Central, West)

The regional difference test results show that companies in the East, Central, and West regions exhibit different responses in terms of greenwashing behavior. Digital transformation has a significant negative impact on companies in the East and Central regions (coefficients of -0.0151 and -0.0173, respectively), but it does not have a significant effect in the West (coefficient = -0.00722). Company size has a significant positive impact on greenwashing behavior in all regions, with the strongest impact in the Central region (coefficient = 0.104***). Financial leverage has the most significant impact on greenwashing behavior in the East (coefficient = 0.148***), while its effect is weaker in

the Central and West regions. Ownership concentration has a significant negative impact on greenwashing behavior in all three regions, indicating that companies with higher ownership concentration are more likely to suppress greenwashing behavior, especially in the Central region. Environmental investment has a significant negative impact on greenwashing behavior in all regions, with the strongest effect in the West. Female management only has a significant negative impact on greenwashing behavior in the East (coefficient = -0.0986***), while there is no significant effect in the Central and West regions. Overall, there are differences in corporate greenwashing behavior across regions, with the impact of digital transformation, company size, financial leverage, and environmental investment being more significant in the East.

As shown in Table 6.

Table 6 Heterogeneity Test Results: Regional Differences

	(1)	(2)	(3)
	Green_wash	Green_wash	Green_wash
Digital_transl_w	-0.0151*** (0.00164)	-0.0173*** (0.00437)	-0.00722 (0.00474)
Size_w	0.0810*** (0.00236)	0.104*** (0.00611)	0.0808*** (0.00616)
Age_w	-0.0132* (0.00792)	-0.00375 (0.0207)	-0.0787*** (0.0227)
Lev_w	0.148*** (0.0146)	0.0555 (0.0345)	0.0841** (0.0357)
Roa_w	0.0983*** (0.0375)	0.0596 (0.0945)	0.165* (0.0998)
Top1_w	-0.0504*** (0.0165)	-0.166** (0.0392)	-0.123*** (0.0427)
Indep_w	1.032 (1.642)	-4.242* (2.308)	0.971 (1.981)
TobinQ_w	-0.00802*** (0.00198)	-0.00418 (0.00445)	-0.0126*** (0.00478)
Tanasset_w	-0.237*** (0.0266)	-0.276*** (0.0588)	-0.321*** (0.0686)
Female_w	-0.0986*** (0.0206)	-0.0380 (0.0493)	-0.0350 (0.0537)

4.4.3 Industry Differences (Technology-Intensive, Asset-Intensive, Labor-Intensive)

The industry difference test results show significant differences in the response to greenwashing behavior across technology-intensive, asset-intensive, and labor-intensive industries. In technology-intensive and labor-intensive industries, digital transformation has a significant negative impact on greenwashing behavior (coefficients of -0.00763 and -0.00874, respectively), while it has no significant effect in the asset-intensive industry (coefficient = 0.00260). Company size has a significant positive impact on greenwashing behavior in all industries, with the strongest impact in the labor-intensive industry (coefficient = 0.0958***). Financial leverage has a more significant impact in technology-intensive and asset-intensive industries (coefficients of 0.170 and 0.165, respectively), while its effect is relatively weaker in the labor-intensive industry (coefficient = 0.0912***). Ownership concentration has a significant negative impact on greenwashing behavior in both technology-intensive and asset-intensive industries, while there is no significant effect in the labor-intensive industry. Environmental investment has a significant negative impact on greenwashing behavior in all industries, with the strongest effect in the asset-intensive industry (coefficient = -0.434***). Female management has a significant negative impact on greenwashing behavior only in the labor-intensive industry (coefficient = -0.166***), while there is no significant effect in the technology-intensive and asset-intensive industries. Overall, the impact of factors such

as digital transformation, company size, financial leverage, ownership concentration, and environmental investment on greenwashing behavior varies in different types of industries [14-15]. As shown in Table 7.

Table 7 Heterogeneity Test Results: Industry Differences

	(1)	(2)	(3)
	Green_wash	Green_wash	Green_wash
Digital_trans1_w	-0.00763*** (0.00176)	0.00260 (0.00597)	-0.00874*** (0.00270)
Size_w	0.0732*** (0.00289)	0.0692*** (0.00583)	0.0958*** (0.00353)
Age_w	0.00127 (0.00894)	-0.0307 (0.0216)	-0.0388*** (0.0123)
Lev_w	0.170*** (0.0168)	0.165*** (0.0373)	0.0912*** (0.0207)
Roa_w	0.0356 (0.0425)	0.418*** (0.103)	0.0245 (0.0562)
Top1_w	-0.0529*** (0.0194)	-0.256*** (0.0404)	-0.0350 (0.0241)
Indep_w	-2.279 (1.583)	-2.413 (1.959)	0.860 (1.657)
TobinQ_w	-0.0120*** (0.00206)	-0.0206*** (0.00605)	0.00307 (0.00299)
Tanasset_w	-0.216*** (0.0309)	-0.434*** (0.0770)	-0.215*** (0.0357)
Female_w	-0.00489 (0.0232)	-0.0160 (0.0568)	-0.166*** (0.0299)

4.5 Moderating Effect Results

The moderating effect results show that executive stock incentives (EQ_w) and digital transformation (Digital_trans1_w) have significant moderating effects on the relationship with corporate greenwashing behavior. Specifically, the negative impact of digital transformation on greenwashing behavior (coefficient = -0.0137) remains significant, indicating that digital transformation helps suppress corporate greenwashing behavior. Meanwhile, executive stock incentives (EQ_w) have a significant positive impact on greenwashing behavior (coefficient = 0.529), suggesting that executives with high stock incentives are more likely to use greenwashing to enhance the company's image. The coefficient of the interaction term (interaction_Q) is -0.118 and significant, indicating that executive stock incentives moderate the impact of digital transformation on greenwashing behavior to some extent. Specifically, the increase in executive stock incentives weakens the inhibitory effect of digital transformation on greenwashing behavior, possibly because executives with high stock incentives focus more on short-term shareholder interests and are inclined to exaggerate environmental commitments to enhance the company's image.

Other control variables, such as company size (Size_w), financial leverage (Lev_w), environmental investment (Tanasset_w), and female management (Female_w), still significantly affect greenwashing behavior. Among them, company size and financial leverage show a significant positive relationship with greenwashing behavior, while environmental investment and female management show a significant negative relationship, indicating that these factors help reduce greenwashing behavior.

Table 8 Moderating Effect of Executive Stock Incentives on the Relationship Between Digital Transformation and Corporate Greenwashing

(1)	Green_wash
Digital_trans1_w	-0.0137***

	(0.00358)
EQ_w	0.529*** (0.160)
interaction_Q	-0.118** (0.0562)
Size_w	0.0837*** (0.00392)
Age_w	0.0113 (0.0131)
Lev_w	0.178*** (0.0250)
Roa_w	0.139** (0.0608)
Top1_w	-0.00205 (0.0279)
Indep_w	-0.293 (2.257)
TobinQ_w	-0.0148*** (0.00311)
Tanasset_w	-0.134*** (0.0408)
Female_w	-0.134*** (0.0327)

5. Summary

This study examines the effect of digital transformation on corporate greenwashing behavior using data from 998 Chinese listed companies between 2015 and 2023. The results indicate that digital transformation significantly reduces greenwashing by improving transparency and resource management, making it harder for companies to exaggerate their environmental efforts. However, factors such as company size, financial leverage, and profitability are positively correlated with greenwashing, while environmental investment and female management have a negative relationship with greenwashing behavior. The study also explores the moderating role of media attention and sentiment. It finds that media coverage enhances the transparency of environmental disclosures, reducing greenwashing, while media sentiment can affect stakeholders' trust in environmental claims. Moreover, executive stock incentives were found to weaken the effect of digital transformation on reducing greenwashing, as high incentives may encourage executives to exaggerate environmental commitments.

Finally, the research highlights regional and industry differences, with digital transformation having a stronger effect on greenwashing in the East and Central regions compared to the West. The findings suggest that digital transformation, along with external governance mechanisms like media attention, plays a key role in mitigating corporate greenwashing, providing insights for both policymakers and corporate leaders aiming for more sustainable business practices.

References

- [1] Huang Rongbing, Chen Wei, Wang Kaihui. External financing needs, impression management, and corporate greenwashing. *Comparative Economic and Social Systems*. Vol. 2019 (3), p. 81-93.
- [2] Nygaard A, Silkoset R. Sustainable development and greenwashing: how blockchain technology information can empower green consumers. *Business Strategy and the Environment*. Vol. 2023, 32(6), p. 3801-3813.

- [3] Teece D J, Pisano G, Shuen A. Dynamic capabilities and strategic management. *Strategic Management Journal*. Vol. 1997, 18(7), p. 509-533.
- [4] Shao Y, Xu K, Shan Y G. Leveraging corporate digitalization for green technology innovation: the mediating role of resource endowments. *Technovation*. Vol. 2024, 133, p. 102999.
- [5] Zhan Y, Tan K H. An analytic infrastructure for harvesting big data to enhance supply chain performance. *European Journal of Operational Research*. Vol. 2020, 281(3), p. 559-574.
- [6] Sun Z, Sun X, Wang W, et al. Digital transformation and greenwashing in environmental, social, and governance disclosure: does investor attention matter? *Business Ethics, the Environment & Responsibility*. Vol. 2023, 34(1), p. 81-102.
- [7] Waibel M W, Steenkamp L P, Moloko N, et al. Investigating the effects of smart production systems on sustainability elements. *Procedia Manufacturing*. Vol. 2017, 8, p. 731-737.
- [8] Zhong X, Chen W, Ren G. The impact of corporate social irresponsibility on emerging-economy firms' long-term performance: an explanation based on signal theory. *Journal of Business Research*. Vol. 2022, 144, p. 345-357.
- [9] Wu Xiangcong, Zheng Guohong. Does media attention have a supervisory role in major shareholder illegal share reductions? *Foreign Economic and Management*. Vol. 2021, 43(11), p. 86-103.
- [10] Yu Yan, Wang Xueying, Hao Jinxing, et al. Does the fragrance of wine fear a deep alley? The signal of manufacturing enterprises' digital transformation and capital market pricing. *Nankai Business Review*. Vol. 2024, 24(8), p. 185-196.
- [11] Fan Xiaoyun, Wang Yedong, Wang Daoping, et al. Heterogeneity analysis of financial text information content from different sources—based on the mixed-text sentiment measurement method. *Management World*. Vol. 2022, 38(10), p. 78-101.
- [12] Zhang Guosheng, Wei Xinxian, Li Xinjue. Corporate digitalization, resource arrangement, and long-tail market satisfaction. *China Soft Science*. Vol. 2024 (3), p. 119-128.
- [13] Arinze C A, Ajala O A, Okoye C C, et al. Evaluating the integration of advanced IT solutions for emission reduction in the oil and gas sector. *Engineering Science & Technology Journal*. Vol. 2024, 5(3), p. 639-652.
- [14] Xu T, Sun Y, He W. Government digitalization and corporate greenwashing. *Journal of Cleaner Production*. Vol. 2024, 452, p. 142015.
- [15] Chen Xiaochun, Qin Saiyi. News multi-ownership subjects and the estrangement of special duty works—based on a micro-observation of oral news. *Editor's Friend*. Vol. 2024 (4), p. 95-102.