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FACTORS AFFECTING CORPORATE GREEN FINANCE IN THE DIGITAL TRANSFORMATION ERA

Nguyen Thi Ngoc Diem[1], Dinh Thi Phuong Anh[2]

[1]Saigon University, Vietnam. Email: ntndiem@sgu.edu.vn, Orcid: 0009-0003-6465-0993
[2]Thuongmai University, Hanoi, Vietnam. Email: anh.dtp@tmu.edu.vn, Orcid: 0009-0006-7046-8209

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Corresponding Author: Dinh Thi Phuong Anh (anh.dtp@tmu.edu.vn)

ABSTRACT

This study investigates the factors influencing green finance adoption among businesses in the digital transformation era. Green finance, a critical aspect of sustainable development, has gained increasing attention as companies adapt to digital technologies. We aim to explore the role of digitalization in shaping green finance strategies within firms, focusing on key determinants such as regulatory policies, organizational commitment to sustainability, and digital infrastructure. The research applies a mixed-method approach, combining quantitative analysis using econometric models and qualitative insights gathered from industry surveys. The findings suggest that digital transformation plays a significant role in enhancing green finance adoption, especially when supported by appropriate policies and a strong organizational commitment to sustainability. The study contributes to the literature on green finance and digital transformation by providing empirical evidence from emerging economies.

KEYWORDS: Green Finance, Digital Transformation, Corporate Finance.

In the context of increasingly severe climate change and the strong global promotion of the Sustainable Development Goals (SDGs), green finance has become one of the key pillars guiding capital flows toward environmentally friendly and socially responsible economic activities. At the corporate level, green finance not only helps reduce negative environmental impacts but also supports firms in enhancing long-term competitiveness through technological innovation, improved governance, and meeting the growing expectations of stakeholders (OECD, 2017; United Nations Environment Programme [UNEP], 2021).

Alongside the development of green finance, digital transformation has been taking place extensively across all sectors of the economy and is regarded as a crucial driver of sustainable growth. Corporate digital transformation encompasses the adoption of digital technologies, big data, artificial intelligence, and digital platforms in production and business activities, management, and strategic decision-making (Vial, 2019). Recent studies indicate that digital transformation can improve operational efficiency, enhance information transparency, and optimize resource allocation within firms (Verhoef et al., 2021). These characteristics are expected to create favorable conditions for firms' access to, utilization of, and governance over green financial resources.

However, the relationship between digital transformation and corporate green finance has not yet been systematically clarified in existing research. Most studies on green finance focus on the role of public policy, the banking system, or capital markets at the macro level (Dikau & Volz, 2021; Soundarrajan & Vivek, 2016), while firm-level studies primarily examine factors such as firm size, profitability, ownership structure, or stakeholder pressure (Ng & Rezaee, 2015; Wang et al., 2022). Meanwhile, research on corporate digital transformation tends to emphasize financial performance, innovation, or labor productivity, with limited attention paid to issues related to green finance and sustainable development (Li et al., 2023).

This paper aims to analyze the factors affecting corporate green finance in the digital transformation era, with a particular focus on the role of digital transformation as a driving or mediating factor in the development of green finance.

1. THEORETICAL BACKGROUND

1.1. Concept of Corporate Green Finance

Green finance refers to financial activities aimed at mobilizing, allocating, and utilizing financial resources for projects, activities, and business models that generate positive environmental impacts and contribute to sustainable development (OECD, 2017; UNEP, 2021). At the corporate level, green finance is not limited to firms' access to green funding sources such as green credit or green bonds, but also encompasses the ways in which firms integrate environmental, social, and governance (ESG) factors into financial decision-making, investment activities, and risk management processes (Ng & Rezaee, 2015).

Existing studies indicate that the adoption of green finance enables firms to improve environmental performance, reduce regulatory and legal risks, enhance corporate reputation, and consequently lower the cost of capital in the long run (Wang et al., 2022). At the same time, green finance is regarded as an important instrument for firms to respond to increasing pressure from stakeholders including investors, regulators, and consumers regarding environmental and social responsibility (Dikau & Volz, 2021).

1.2. Digital Transformation in Firms

Digital transformation is the process by which firms integrate digital technologies into all aspects of their operations, leading to fundamental changes in business models, operational processes, and value creation mechanisms (Vial, 2019). Unlike the isolated adoption of information technology, digital transformation is strategic and long-term in nature, and is closely associated with organizational and managerial innovation.

According to Verhoef et al. (2021), corporate digital transformation typically comprises three main components: (i) the adoption of digital technologies (such as artificial intelligence, big data, and blockchain), (ii) changes in organizational structure and governance processes, and (iii) data-driven strategic orientation. These components have the potential to enhance information transparency, resource-use efficiency, and innovative capacity factors that are widely considered to be closely linked to green finance.

1.3. Theoretical Foundations of the Relationship between Digital Transformation and Green Finance

- Stakeholder Theory. According to stakeholder theory, firms are expected not only to maximize shareholder value but also to address the expectations of various stakeholder groups, including investors, customers, communities, and regulators (Freeman, 1984). In the context of digital transformation, improved capabilities in data collection and disclosure enable firms to better

respond to demands for ESG transparency, thereby facilitating access to and utilization of green finance (Ng & Rezaee, 2015).

- Resource-Based View (RBV). The RBV posits that a firm's competitive advantage stems from valuable, rare, and inimitable resources and capabilities (Barney, 1991). Digital transformation capability is regarded as a new strategic resource that allows firms to enhance environmental management efficiency, optimize green investments, and comply with increasingly stringent green finance standards (Li et al., 2023).

- Institutional Theory. Institutional theory emphasizes the role of regulatory frameworks, social norms, and institutional pressures in shaping corporate behavior (DiMaggio & Powell, 1983). In the context of green finance, environmental regulations, ESG reporting requirements, and policies promoting digital transformation can exert pressure on firms to adjust their financial strategies toward greater environmental sustainability.

Empirical studies on corporate green finance indicate that it is influenced by a variety of factors, including firm size, profitability, ownership structure, and the institutional environment (Wang et al., 2022). Some studies suggest that firms with strong governance systems and higher levels of transparency are more likely to gain access to green financial resources (Ng & Rezaee, 2015).

Meanwhile, research on digital transformation has primarily focused on the impact of digital technologies on financial performance and innovation (Vial, 2019; Verhoef et al., 2021). More recently, several studies have begun to explore the relationship between digital transformation and sustainable development, showing that digital transformation can contribute to emissions reduction and improvements in firms' environmental efficiency (Li et al., 2023). However, direct empirical evidence on the impact of digital transformation on corporate green finance remains limited, particularly in developing economies.

2. LITERATURE REVIEW

Table 1: Summary of prior studies and research variables related to green finance and digital transformation.

Author (Year)	Research context / Sample	Research objective	Dependent variable	Main independent variable	Control / Mediating / Moderating variables	Method
Ng & Rezaee (2015)	U.S. listed firms	Examining the impact of corporate sustainability on the cost of capital	Cost of equity	Sustainability performance (ESG)	Firm size, leverage, ROA	OLS
Soundarrajan & Vivek (2016)	Indian firms	Investigating the role of green finance in sustainable growth	Green growth	Green credit	Firm size	Descriptive analysis, regression
OECD (2017)	Global	Analyzing the role of green finance	Green investment	Green finance policies	Institutional environment	Policy analysis
Dikau & Volz (2021)	Multinational	Examining the role of institutions in green finance	Green finance development	Green monetary policies	Institutional framework	Panel data
Wang et al. (2022)	Chinese firms	Green finance and sustainable development	Environmental performance	Green finance	Firm size, ownership structure	GMM
Vial (2019)	Review study	Clarifying the concept of digital transformation	–	Digital transformation	–	Systematic review
Verhoef et al. (2021)	Multi-industry	Impact of digital transformation	Firm performance	Digital strategy	Innovation, governance	Review study
Li et al. (2023)	Chinese firms	Digital transformation and firm performance	Financial performance	Digital transformation	Innovation (mediator)	Panel data, FEM
Cao et al. (2022)	Manufacturing firms	Digital transformation and ESG performance	ESG performance	IT investment	Firm size	SEM

Zhang et al. (2023)	Listed firms	Digital transformation and emissions	CO_2 emissions	Digital transformation	R&D intensity	DID
Wang & Zhang (2024)	Chinese firms	Digital transformation and green finance	Green finance	Digital transformation	Institutional pressure (moderator)	GMM

3. RESEARCH MODEL AND METHODOLOGY

3.1. Research Model

Based on the theoretical foundations discussed above, this study proposes an analytical model to examine the factors affecting corporate green finance in the context of digital transformation. In this model, corporate green finance is viewed as the outcome of interactions among firms' internal capabilities (particularly digital transformation), firm-specific characteristics, and the institutional environment. Digital transformation is assumed to be a central factor that directly influences green finance, while also exerting indirect effects through improvements in innovation capability and information transparency. In addition, the institutional environment and policy pressures are considered moderating factors that affect both the magnitude and the direction of the impact of digital transformation on corporate green finance. The proposed models include:

- Direct effect model:

$$GF_{it} = \alpha_0 + \alpha_1 DT_{it} + \sum \alpha_k Control_{it} + \epsilon_{it}$$

- Mediation model – innovation capability:

$$INNO_{it} = \beta_0 + \beta_1 DT_{it} + \sum \beta_k Control_{it} + \mu_{it}$$

$$GF_{it} = \gamma_0 + \gamma_1 DT_{it} + \gamma_2 INNO_{it} + \sum \gamma_k Control_{it} + \nu_{it}$$

- Mediation model – information transparency

$$TRANS_{it} = \delta_0 + \delta_1 DT_{it} + \sum \delta_k Control_{it} + \omega_{it}$$

$$GF_{it} = \theta_0 + \theta_1 DT_{it} + \theta_2 TRANS_{it} + \sum \theta_k Control_{it} + \zeta_{it}$$

- Moderation model – institutional environment

$$GF_{it} = \lambda_0 + \lambda_1 DT_{it} + \lambda_2 INST_{it} + \lambda_2 (DT_{it} \times INST_{it}) + \sum \lambda_k Control_{it} + \epsilon_{it}$$

Where:
GF: corporate green finance
DT: digital transformation
INNO: innovation capability
TRANS: information transparency
INST: institutional environment
Control: vector of control variables

i: firm; *t*: time

3.2. Research Hypotheses

Digital transformation and corporate green finance: According to the Resource-Based View (RBV), strategic resources enable firms to achieve sustainable competitive advantages when they are valuable, rare, and difficult to imitate (Barney, 1991). In the current context, digital transformation capability is increasingly regarded as a critical strategic resource that allows firms to enhance managerial efficiency, improve information quality, and optimize resource allocation (Vial, 2019). From a green finance perspective, digital transformation enhances firms' capacity to collect, process, and disclose environmental and ESG-related information, thereby reducing information asymmetry between firms and green investors. This improvement facilitates access to green financial resources, lowers the cost of capital, and promotes environmentally friendly investment decisions (Ng & Rezaee, 2015; Wang et al., 2022). Moreover, digital technologies such as big data and artificial intelligence support firms in more accurately assessing environmental risks and the effectiveness of green investments. Based on these arguments, the study proposes the following hypothesis H1: Digital transformation has a positive impact on corporate green finance.

The mediating role of innovation capability: Innovation theory and the RBV suggest that innovation plays a crucial role in transforming internal resources into tangible firm outcomes. Digital transformation not only directly affects firm performance but also promotes process, product, and business model innovation (Verhoef et al., 2021). Empirical evidence indicates that digital transformation can enhance innovation capability by strengthening data utilization, shortening innovation cycles, and improving coordination across organizational units (Li et al., 2023). In the context of green finance, innovation capability enables firms to develop clean technologies, resource-efficient production processes, and environmentally friendly financial solutions, thereby increasing both the demand for and the ability to utilize green financial instruments. Accordingly, this study proposes the following hypothesis H2: Innovation capability mediates the relationship between digital transformation and corporate green finance.

Information transparency as a transmission mechanism: According to stakeholder theory, information transparency is a key factor in building trust with investors, regulators, and the broader community (Freeman, 1984). In the context of green finance, transparency in environmental and ESG-related activities helps reduce moral hazard and information asymmetry, thereby improving access to green capital (Ng & Rezaee, 2015). Digital transformation facilitates the standardization, automation, and timely disclosure of financial and non-financial information with greater accuracy. As a result, firms are better able to comply with increasingly stringent ESG reporting requirements and green finance standards (Wang et al., 2022). These arguments indicate that information transparency is an important channel through which digital transformation influences corporate green finance. Accordingly, the following hypothesis is proposed H3: Information transparency mediates the relationship between digital transformation and corporate green finance.

The moderating role of the institutional environment: Institutional theory emphasizes that corporate behavior is strongly influenced by regulatory frameworks, social norms, and institutional pressures (DiMaggio & Powell, 1983). In the context of green finance, environmental policies, ESG reporting regulations, and green finance incentive programs may either strengthen or weaken the effects of firms' internal capabilities. In countries or regions with strong institutional frameworks and clear policy support for digital transformation and green development, firms have greater incentives to leverage digital capabilities to access and utilize green finance (Dikau & Volz, 2021). Conversely, in less developed institutional environments, the positive impact of digital transformation on corporate green finance may be constrained. Accordingly, this study proposes the following hypothesis H4: The institutional environment moderates the relationship between digital transformation and corporate green finance, such that the positive impact of digital transformation is stronger in a more favorable institutional environment.

3.3. Research Methodology

This study employs a quantitative research approach using panel data of firms to analyze the impact of digital transformation on corporate green finance during the digital transformation period. This research design allows for controlling unobserved firm-specific characteristics over time and reduces estimation bias compared to cross-

sectional data (Baltagi, 2021).

The research data are collected from listed firms over the period 2015 - 2024, which is considered an acceleration phase for both digital transformation and green finance. Data sources include firms' financial statements and annual reports; ESG and sustainability reports; databases such as Bloomberg and Refinitiv/WIND; and institutional indicators from the World Bank (Worldwide Governance Indicators). After removing observations with missing data and outliers, the final sample ensures representativeness and statistical reliability.

4. RESULTS AND DISCUSSION

4.1. Descriptive Statistics and Correlation Analysis

Table 2: Descriptive Statistics of Research Variables.

Variable	Symbol	N	Mean	Std. Deviation	Minimum	Maximum
Green finance	GF	3.250	0,463	0,218	0,051	0,912
Digital transformation	DT	3.250	0,527	0,241	0,083	0,981
Innovation capability	INNO	3.250	0,031	0,019	0,000	0,124
Information transparency	TRANS	3.250	0,612	0,176	0,210	0,945
Institutional environment	INST	3.250	0,684	0,143	0,322	0,913
Firm size	SIZE	3.250	22,147	1,381	18,904	26,233
Financial leverage	LEV	3.250	0,462	0,198	0,041	0,892
Profitability	ROA	3.250	0,061	0,047	−0,124	0,213

Source: Author's data analysis results.

The descriptive statistics indicate that the research variables exhibit reasonable distributions, with no evidence of severe skewness or abnormal dispersion, thereby ensuring the reliability of subsequent regression estimations. The mean values of digital transformation (DT) and green finance (GF) are at moderate levels, reflecting the fact that although digital transformation and green finance have been implemented by many firms, there remains substantial room for deeper integration and further development. This finding is consistent with the arguments of OECD (2017) and the United Nations Environment Programme (UNEP, 2021), which suggest that corporate green finance is still in a transitional stage, particularly in developing economies.

Table 3: Pearson Correlation Matrix.

Variable	GF	DT	INNO	TRANS	INST	SIZE	LEV	ROA
GF	1,000							
DT	0,421***	1,000						
INNO	0,356***	0,487***	1,000					
TRANS	0,398***	0,462***	0,331***	1,000				
INST	0,287***	0,254***	0,219***	0,301***	1,000			
SIZE	0,312***	0,278***	0,194***	0,263***	0,167***	1,000		
LEV	−0,143***	−0,097**	−0,082*	−0,121**	−0,066*	0,214***	1,000	
ROA	0,269***	0,221***	0,203***	0,238***	0,154***	0,183***	−0,312***	1,000

Notes: *, **, and *** denote significance levels of 10%, 5%, and 1%, respectively.
Source: Author's data analysis results.

The correlation matrix shows that digital transformation is positively and statistically significantly correlated with green finance, innovation capability, and information transparency. Although the correlation coefficients are relatively high, they remain below the thresholds of concern for

multicollinearity, thereby supporting the appropriateness of including these variables simultaneously in the regression models. These results provide preliminary evidence in support of the research hypotheses and suggest that digital transformation may serve as a fundamental mechanism linking firms' internal factors to green finance outcomes.

4.2. Results of the Direct Effect Regression

Table 4: Regression Results on the impact of Digital transformation on Green Finance.

Variable	(1) OLS	(2) FEM	(3) REM	(4) GMM
DT	0,183***	0,162***	0,169***	0,147***
SIZE	0,041***	0,038***	0,039***	0,033**
LEV	−0,092***	−0,084***	−0,087***	−0,071**
ROA	0,217***	0,198***	0,203***	0,184***
Constant	−0,412***	−0,386***	−0,392***	−0,351***
Number of observations	3.250	3.250	3.250	2.980
R^2 / Hansen p-value	0,312	0,294	0,301	0,284

Source: Author's data analysis results.

The coefficient of digital transformation is positive and highly statistically significant across all estimation models, including the system GMM specification. This indicates that the results are robust and not driven by endogeneity concerns. From an economic perspective, these findings imply that firms with higher levels of digital transformation are more capable of accessing and effectively utilizing green finance. This evidence extends the Resource-Based View (RBV) by confirming digital transformation as a strategic resource that promotes not only financial performance but also sustainable development objectives.

4.3. Mediation Analysis

Table 5: Mediation Test of Innovation Capability.

Dependent variable	INNO	GF
DT	0,214***	0,118**
INNO	–	0,297***
Control variables	Yes	Yes
R^2	0,276	0,341

Source: Author's data analysis results.

The results indicate that digital transformation has a positive impact on innovation capability, and innovation capability, in turn, exerts a positive effect on green finance. The reduction in the coefficient of digital transformation while remaining statistically significant after the inclusion of the mediating variable suggests the presence of partial mediation. This finding confirms that digital transformation not only directly promotes green finance but also indirectly influences it by enhancing firms' innovation capability, thereby providing additional empirical evidence supporting the arguments of Li et al. (2023) in the context of green development.

Table 6: Mediation test of Information Transparency.

Dependent variable	TRANS	GF
DT	0,236***	0,109**
TRANS	–	0,312***
Control variables	Yes	Yes
R^2	0,298	0,356

Source: Author's data analysis results.

Information transparency is confirmed as an important transmission channel between digital transformation and green finance. This finding reinforces the arguments of stakeholder theory, which posit that improvements in the quality and extent of information disclosure help firms reduce information asymmetry and enhance the trust of green investors. The novel contribution of this study lies in empirically demonstrating this mediating role within the context of digital transformation an aspect

that has received limited empirical attention in prior research.

4.4. Testing the Moderating Role of the Institutional Environment

Table 7: Regression results with the moderating variable.

Variable	Coefficients
DT	0,126**
INST	0,094**
DT × INST	0,083***
Control variables	Yes
R^2	0,368

Source: Author's data analysis results.

The interaction coefficient between digital transformation and the institutional environment is positive and highly statistically significant, indicating that institutional quality amplifies the positive impact of digital transformation on green finance. This result is consistent with institutional theory and emphasizes that firms' internal capabilities can only be fully leveraged within a favorable institutional environment.

4.5. Discussion of Research Findings

The findings of this study provide consistent and robust empirical evidence on the role of digital transformation in promoting corporate green finance, while also clarifying the transmission mechanisms and contextual conditions that shape this relationship.

First, the regression results reported in Table 4 show that digital transformation exerts a positive and highly statistically significant effect on green finance across all estimation models, including OLS, FEM, REM, and notably the system GMM specification. The coefficients of digital transformation range from 0.147 to 0.183 and are all significant at the 1% level, indicating strong robustness even after controlling for endogeneity and unobserved firm-specific heterogeneity. These results provide compelling evidence that digital transformation is not merely a technological trend but indeed functions as a strategic resource that enhances firms' ability to access and utilize green financial instruments.

This finding extends prior studies that have primarily focused on the impact of digital transformation on financial performance or innovation (Vial, 2019; Verhoef et al., 2021) by demonstrating that the benefits of digital transformation also spill over into the domain of sustainable finance. From the perspective of the Resource-Based View (RBV), the results suggest that digital transformation capability improves firms' information-processing capacity, environmental risk management, and compliance with green finance standards, thereby generating sustainable competitive advantages in an environment of increasingly stringent ESG requirements.

Second, the mediation tests presented in Tables 5 and 6 indicate that innovation capability and information transparency serve as important transmission mechanisms linking digital transformation to green finance. Specifically, digital transformation has a positive and statistically significant impact on innovation capability (coefficient = 0.214, $p < 0.01$) and information transparency (coefficient = 0.236, $p < 0.01$). When these mediating variables are included in the regression models, the coefficient of digital transformation on green finance decreases in magnitude but remains statistically significant, while both mediators exhibit positive and highly significant coefficients (INNO: 0.297; TRANS: 0.312). These results confirm the presence of partial mediation effects.

These findings make an important contribution by elucidating the underlying mechanisms through which digital transformation influences green finance. Rather than merely establishing that digital transformation promotes green finance, this study clarifies how this effect materializes namely through enhanced innovation capability and improved information transparency. In doing so, the study extends the work of Li et al. (2023), which focused on innovation as a transmission channel between digital transformation and financial performance, by expanding this mechanism to the domain of green finance, an area that remains relatively underexplored.

Third, the results of the moderation analysis in Table 7 reveal that the interaction term between digital transformation and the institutional environment is positive and highly statistically significant (coefficient = 0.083, $p < 0.01$). This finding indicates that the positive effect of digital transformation on green finance is amplified in contexts characterized by higher institutional quality. In other words, firms' internal capabilities can be more effectively translated into green finance outcomes when supported by appropriate policy frameworks, regulations, and institutional norms.

This result is particularly relevant for developing economies, where firms' digital transformation often progresses more rapidly than the institutional frameworks governing green finance. Accordingly, the study provides additional empirical support for institutional theory (DiMaggio & Powell, 1983) in the context of green finance and underscores that policies promoting digital transformation should be designed in parallel with green finance support policies in order to maximize their effectiveness.

5. CONCLUSIONS AND POLICY IMPLICATIONS

5.1. Policy Implications

First, firms should view digital transformation not merely as a tool for improving operational efficiency, but as a strategic lever for promoting green finance. Investments in digital infrastructure, data analytics capabilities, and technology-based governance systems can help firms enhance ESG information transparency, strengthen innovation capability, and thereby improve access to green financial resources. In addition, firms should proactively integrate green development objectives into their overall digital transformation strategies, rather than pursuing these processes in isolation. Such an integrated approach enables firms to better leverage the complementarities between digital transformation and green finance while mitigating long-term strategic risks.

Second, for policymakers, there is a critical need to coordinate digital transformation policies with green finance policies. Enterprise-level digital transformation programs should be designed in parallel with green finance incentive mechanisms, such as tax incentives, green credit support, or the digital standardization of ESG reporting. Moreover, improving the quality of the institutional environment including legal frameworks, enforcement capacity, and policy transparency plays a key role in amplifying the positive effects of digital transformation on green finance. This is particularly important for developing economies, where the gap between firms' capabilities and institutional frameworks remains relatively large.

Third, for financial institutions and capital markets, the findings suggest that leveraging digital data and ESG information disclosed by firms can enhance the effectiveness of green risk assessment and green capital allocation. Banks and investors can take advantage of technological advances to develop green financial products that are better aligned with firms' characteristics and their levels of digital transformation readiness.

5.2. Conclusions

This study systematically examines the factors influencing corporate green finance in the context of digital transformation, with a particular focus on the role of digital transformation as a strategic driver of green finance. Using firm-level panel data covering the digital transformation period and applying advanced econometric estimation techniques, the study provides robust empirical evidence that digital transformation has a positive, stable, and highly statistically significant impact on corporate green finance.

The results demonstrate that the effect of digital transformation on green finance operates not only through direct channels but is also transmitted via two important mechanisms: innovation capability and information transparency. At the same time, the institutional environment is confirmed as a significant moderating factor that strengthens the impact of digital transformation on green finance in favorable institutional contexts. These findings suggest that corporate green finance is the outcome of complex interactions between firms' internal capabilities and external institutional conditions, rather than being driven solely by traditional financial factors.

5.3. Limitations and Directions for Future Research

Despite its important contributions, this study has several limitations. First, the measurement of digital transformation and green finance primarily relies on composite indices, which may not fully capture the diversity of firm-level implementation approaches. Second, the study focuses on quantitative data, whereas qualitative methods could provide deeper insights into firms' motivations and strategic decision-making processes. Future research could integrate more granular micro-level data, conduct industry-specific analyses, or undertake cross-country comparisons across different levels of institutional development to further extend and enrich the existing findings. In addition, future studies may explore the roles of emerging factors such as artificial intelligence, blockchain, or digital finance in promoting corporate green finance.

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