



Alignment of words and actions? Government environmental attention and enterprise digital transformation

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ABSTRACT

This study employs a unique dataset of A-share listed companies from 2007 to 2021 to investigate the impact of government environmental attention on enterprise digital transformation (EDT) and its underlying mechanisms. Empirical findings document that in response to upholding organizational legitimacy, government environmental attention remarkably favors EDT. This core conclusion remains robust after addressing endogeneity concerns and alternative robustness tests. Mechanism analysis unveils that intensified government environmental attention propels companies to expedite green technology innovation, alleviate financing constraints, and enhance human capital quality, all accelerating EDT. Subsequent investigations indicate that heightened government environmental attention notably impacts EDT more for larger plants and highly polluting industries. In regions with lower financial development, government environmental attention serves as a reliable signaling mechanism, motivating EDT. These findings guide plants in accelerating EDT for enhanced sustainable development while shedding light on the evolving mechanisms of government attention allocation and EDT, which offers insights for future research on the correlation between government actions and corporate environmental governance.

1. Introduction

The digital economy facilitates environmental governance transformation towards informatization and intelligence, providing innovative solutions for pollution abatement (Hamann-Lohmer et al., 2023). Digitalizing enterprises plays a vital role in controlling pollution sources and reducing emissions (Zhang et al., 2023a). However, enterprise digital transformation (EDT) is complex due to technological barriers, risks, investments, and long cycles. In this context, some plants are hesitant or unable to undergo this transformation. While internal factors such as company characteristics and human capital impact EDT, the stakeholder role is often overlooked. Literature demonstrates that external policies including intellectual property protection (Wen and Deng, 2023), financial support (Mukul and Büyükoçkan, 2023), tax incentives (Indriastuti and Fuad, 2020), and environmental regulations (Guandalini, 2022) catalyze EDT.

In essence, the formulation and implementation of policies hinge on the allocation of governmental attention. Attention refers to how decision-makers assign limited cognitive resources and time to specific organizational concerns, leaving out others (Ocasio, 1997; Posner and

Rothbart, 2007). Governmental attention shapes actions and reflects resource distribution (Li et al., 2023e). However, the government's pursuit of performance legitimacy often brings about strategic preferences and fragmentation in attention allocation (Bao and Liu, 2022; Suchman, 1995), especially in emerging countries such as China and India where environmental degradation remains a pressing issue (Liu et al., 2023a; Liu et al., 2023b; Shi et al., 2023). In response to severe pollution, governments worldwide have been compelled to prioritize their focus on environmental concerns to elevate their legitimacy. A notable example is the signing of the Paris Climate Agreement by more than 190 countries, which aims to abate greenhouse gas emissions. As a result, a pivotal research inquiry arises: Can the increased environmental concerns of the government impact EDT as a strategy to enhance organizational legitimacy?

Indeed, government environmental attention drives plants to adopt advanced information and communication technologies, reforming operations and speeding up innovation. This attention also boosts financial support via fiscal measures and mitigates information gaps, easing financing during digitalization (Li et al., 2023e; Liao et al., 2022; Liu et al., 2023a). Furthermore, the government's emphasis on the

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environment cultivates external talent pools, urging plants to enhance their workforce's digital skills, and ensuring a talent base for transformation. Yet, under performance pressures, the extent to which the government authentically propels plants towards swift EDT for improved environmental management warrants meticulous scrutiny.

As the world's largest carbon dioxide emitter, China has set targets for peak carbon emissions and carbon neutrality, prompting local governments to focus more on environmental protection and take on greater governance responsibilities. In light of this, this paper examines whether and how government environmental attention influences EDT using Chinese public companies as samples. It applies organizational legitimacy theory to explain the pathways through which government environmental attention impacts EDT. Empirical analysis of listed companies on the Shanghai and Shenzhen stock exchanges from 2007 to 2021 demonstrates the marginal impact of government environmental attention on EDT. Robustness tests confirm the reliability of the results. The study also empirically investigates how government environmental attention shapes EDT via technological innovation, financing constraints, and human capital enhancement. Ultimately, this study scrutinizes the heterogeneous impact of government environmental attention on EDT, accounting for variables such as firm size, industry attributes, and financial markets.

This paper contributes to the literature in three ways. First, it explores the interaction between government and enterprises from an organizational legitimacy perspective, providing empirical evidence for explaining government and enterprise behavior based on institutional economics. By incorporating the theory of organizational legitimacy into the analytical framework, this paper examines the impact of government environmental attention on EDT. The work confirms the theoretical hypotheses proposed by [Acemoglu et al. \(2005\)](#) and provides new theoretical evidence for government participation in economic activities and shaping enterprise behavior.

Second, this paper measures government environmental attention using both environmental word frequency and textual semantics, providing a new approach to text analysis. Existing literature primarily relies on word frequency and overlooks the intensity of government environmental attention from a semantic perspective ([Chen et al., 2018](#); [Liu et al., 2023a](#)). This paper analyzes the emotional intensity of government environmental attention, offering a new measurement method for subsequent research.

Finally, this paper investigates the impact of government environmental attention on EDT from the perspective of attention allocation, enriching the research on antecedents of EDT. Existing literature mainly focuses on economic consequences ([Hamann-Lohmer et al., 2023](#); [Zhai et al., 2022](#); [Ziaie et al., 2021](#)), while this paper explores the interactive relationship between government environmental attention and EDT, validating its mechanism from the perspectives of enhancing technological innovation, improving human capital, and alleviating financing constraints. The findings provide new insights for exploring determinants influencing EDT and offer theoretical explanations for the causes of digital transformation.

The structure of this paper is organized as follows: [Section 2](#) reviews the literature and provides comprehensive theoretical analysis; [Section 3](#) outlines empirical research design; [Section 4](#) conducts empirical analysis; [Section 5](#) concludes the paper and suggests policies based on preceding discussions.

2. Literature review and theoretical considerations

2.1. Literature review

2.1.1. Research on EDT

A large bulk of the literature has corroborated the impact of EDT on environmental governance, with a primary focus on pollution abatement and emission control. In the context of pollution control, a multitude of studies have unveiled the acceleration of digital

technologies, which augments corporate accountability and performance in the realms of ESG ([Lu et al., 2023](#); [Zhao and Cai, 2023](#)). Moreover, a scholarly inquiry has revealed that EDT markedly amplifies the efficacy of green innovation in manufacturing enterprises, particularly within sectors characterized by substantial pollution ([Wen et al., 2022](#)). Concurrently, EDT notably heightens investment efficiency within corporate entities ([Zhang and Dong, 2023](#)), with spatial spillover implications ([Cheng et al., 2023](#)). Pertaining to emission reduction, [Yang et al. \(2023a\)](#) discerned that EDT attains objectives of energy conservation and emission abatement ([Li et al., 2023b](#)), notably benefiting energy-intensive plants via enhancements in carbon reduction performance ([Chwiłkowska-Kubala et al., 2023](#)). Furthermore, viewed through the lens of a dual dividend, multiple studies have documented that EDT significantly scales down the cost of debt financing, fostering improvement in both financial and environmental performance ([Sun et al., 2022](#)). This, in turn, contributes to enhancing the sustainable development performance of firms ([Chwiłkowska-Kubala et al., 2023](#); [Guo et al., 2023](#); [Li, 2022](#)).

Given the pivotal role of EDT in enhancing environmental governance, several scholarly works have probed the determinants driving EDT. In terms of corporate attributes, [Nguyen et al. \(2023\)](#) unearthed that heightened digital proactiveness and commitment to transformation within a company amplify the influence of organizational agility on EDT. Conversely, incongruence in organizational maturity heightens the jeopardy of digital transformation setbacks ([Hu et al., 2023](#)). Concerning digital transformation enablers, labor safeguards compel plants to recalibrate workforce composition, thereby furnishing pivotal human capital prerequisites for EDT ([Huang and Gao, 2023](#)). Additionally, regional digital infrastructure serves as an extrinsic impetus for EDT ([Wu et al., 2023](#)). Stakeholder impacts on EDT have also undergone examination. [Li et al. \(2023c\)](#) noted that concentrated customer presence obstructs firm-level digital transformation. Likewise, heightened financing constraints accentuate the adverse repercussions of customer concentration on EDT. [Du et al. \(2023\)](#) identified that non-family shareholders substantially facilitate the enactment of digital transformation strategies within family businesses via directorial appointments. Conversely, non-family shareholders yield constructive influence on family enterprises' digital transformation solely when holding substantial ownership stakes.

2.1.2. Research on government environmental attention

Governmental environmental attention acts as a regulatory force in corporate behavior. A vast body of literature has extensively examined the economic implications of public environmental policies. [Luo et al. \(2023\)](#) discovered that improving the urban business environment not only raises the probability of EDT but also increases its extent. [Wen and Deng \(2023\)](#) focused on intellectual property protection and found that enhancing these safeguards encourages plants to adopt cutting-edge technologies. Concerning specific environmental policies, [Su et al. \(2022\)](#) pointed out that green finance policies conserve corporate energy, particularly pronounced in highly concentrated industries. Additionally, low-carbon policies significantly spur innovation in high-carbon sectors, particularly in cities with robust research investments ([Yu et al., 2023](#)). Concurrently, [Chen et al. \(2023b\)](#) determined that tax incentives significantly drive EDT, with a more pronounced impact on firms facing notable financing constraints. [Zhao et al. \(2023\)](#) identified the pivotal role of government subsidies in guiding transformative development within enterprises, catalyzing digital transformation in manufacturing firms. Further research suggests that expanding local government debt can constrict corporate financing capacity, thus inhibiting EDT ([Yang et al., 2023b](#)).

Certain literature has probed the governmental role in corporate governance from the perspective of environmental attention. On a broader scale, [Bao and Liu \(2022\)](#) noted that each incremental rise in environmental attention brings about corresponding decreases of 4.2 % in the Air Quality Index, 4.5 % in inhalable particulate matter, and 7.4 %

in nitrogen dioxide concentrations. Moreover, Liu et al. (2023b) ascertained substantial promotion of regional pollutant reduction owing to governmental attention. Furthermore, Nguyen et al. (2023) unveiled that heightened government environmental attention not only advances renewable energy utilization but also bolsters the productivity of green growth. Some literature also examines the impact of government environmental attention on micro-level governance. In a separate analysis, Liu et al. (2023a) demonstrated that elevated government environmental attention leads to reduced corporate carbon emissions, notably affecting carbon reduction within high-pollution industry enterprises. From a macro perspective, Zhang et al. (2023b) identified notable stimulation of green innovation within heavily polluting industry enterprises via government environmental governance, concomitant with an observed crowding-out influence on alternative innovation pursuits. Additionally, it is noteworthy that this positive correlation exhibits variability across enterprises of varying sizes.

The existing literature mainly focuses on the economic consequences of EDT. The analysis of factors preceding EDT is primarily centered on internal aspects, such as firm attributes and stakeholder aspects, while external factors receive limited consideration. Therefore, this study investigates the relationship between government environmental attention and EDT. The primary objective is to determine whether and how government environmental attention impacts EDT.

2.2. Theoretical considerations

Organizational legitimacy involves the process by which organizations secure recognition and acceptance from various internal and external stakeholders, including regulative, normative, and cognitive legitimacy (Meyer and Rowan, 1977; Suchman, 1995; Zucker, 1977). In the context of the interplay between government environmental protection and EDT, both entities establish legitimacy through distinct avenues. On the one hand, recognizing the increasing importance of environmental protection for legitimacy, governmental authorities need to elevate environmental attention, promote digital technology adoption among local enterprises, address environmental constraints, and utilize digitalization to improve environmental governance within enterprises. On the other hand, digital transformation propels micro-level enterprise advancement, serving as a pivotal avenue for pollution reduction and cleaner production. Guided by government environmental attention, plants proactively embrace EDT, utilizing digital technologies to optimize resource allocation efficiency and reduce environmental harm in production. Hence, this paper posits that government environmental attention primarily expedites EDT via three dimensions: advancements in green technological innovation, alleviation of financing constraints, and enhancement of human capital.

2.2.1. Channel of green technological innovation

EDT is characterized by high risk, a substantial investment, and extended timelines, giving rise to an insufficient impetus for a comprehensive proactive approach to EDT. Motivated to maintain organizational legitimacy, heightened environmental attention from governments compels plants to expedite the exploration and application of green innovation, thereby propelling EDT (Zaoui and Souissi, 2020). On the one hand, elevated government environmental attention increases regulatory constraints, directing enterprises to promptly adopt green technologies for mitigating pollutant emissions from production processes (Wen et al., 2022). Escalating environmental policy constraints stimulates the corporate integration of cutting-edge information and communication technologies, catalyzing shifts in production, and intrinsically embodying technological advancement (Liao et al., 2022). On the other hand, reinforced government environmental attention amplifies environmental oversight, thereby enhancing regulatory legitimacy and normative legitimacy. Within local governmental structures, an incentivized “multiple commissions, multiple tasks” framework prevails, often marked by enforcement inefficiencies and inadequate

supervisory measures, particularly evident in many developing nations (Yang et al., 2023a). However, heightened government environmental attention augments environmental awareness and reinforces regulatory endeavors, thereby escalating repercussions for environmental non-compliance (Li, 2022). In this context, plants are impelled to amplify research investments in digital technologies to abate pollution and expedite the process of EDT, driven by attenuated revenue expectations resulting from enhanced environmental compliance (Guandalini, 2022).

2.2.2. Channel for alleviating financing constraints

EDT demands substantial capital, often exceeding internal cash flows' capacity to meet transformation needs. Coupled with inherent unpredictability in transformation outcomes, plants struggle to secure external funding, bringing about financing constraints. In this context, with the ongoing rise in government environmental attention, authorities implement proactive measures, including tax incentives and fiscal subsidies, to address financing constraints during EDT (Chen et al., 2023a; Wan et al., 2022). This, in turn, enhances environmental performance, preserving and bolstering legitimacy among higher-level government entities and the broader public. Specifically, on the one hand, enhanced governmental environmental attention contributes to corporate capital availability via mechanisms such as increased fiscal allocations and tax incentives, thereby alleviating financing constraints. Tax incentives augment corporate cash flows and reduce financing costs, encouraging digital transformation engagement (Chen et al., 2023b; Wan et al., 2022). Concurrently, government fiscal and interest subsidies improve corporate financial conditions, supporting digital innovation (Czarnitzki et al., 2011; Meng et al., 2024), in line with the imperative to boost legitimacy. On the other hand, elevated government environmental attention mitigates financing constraints tied to EDT by reducing information asymmetry. Enterprises seeking environmental incentives undergo rigorous government evaluation, signaling recognition to external stakeholders and decreasing information asymmetry, thus enhancing the attractiveness of capital market investments (Liao et al., 2022; Liu et al., 2023b). Government grants also signal policy alignment and strong government-business relationships, reducing information asymmetry in banking interactions and increasing loan limits to ease funding constraints in digital transformation efforts (Liu et al., 2023a).

2.2.3. Channel for enhancing human capital

As the government persistently focuses on environmental management, enterprises, in addition to the government, actively abate pollution by advancing digital transformation, aiming to reshape external legitimacy and regain competitive advantages (Guo et al., 2023; Zhai et al., 2022). Among these efforts, boosting human capital to facilitate digital transformation is a crucial initiative for governments and enterprises responding to the growing constraints of sustainable development (He et al., 2024; Tao et al., 2024). More specifically, the mechanism through which government environmental attention promotes EDT by enhancing human capital is as follows: On the one hand, governmental emphasis on environmental issues bolsters organizational leadership, providing substantial intellectual support for EDT (Mukul and Büyükoçkan, 2023; Zaoui and Souissi, 2020). Heightened government environmental attention stimulates talent concentration, establishing a robust pool for EDT. The allocation of environmental attention affects the acquisition of environmental data, streamlining interactions, and reducing information search costs. This facilitates access to localized information for talented individuals, contributing to the Siphon Effect and enriching the human resource pool (Li et al., 2024). On the other hand, heightened government environmental attention encourages enterprises to boost internal human capital. Managers, driven by environmental constraints and reputation incentives, mitigate opportunistic actions, enhancing responsiveness to digital technologies (Liu et al., 2024; Ren et al., 2022). This spurs the adoption of innovative technologies such as internet-based solutions, cloud computing, and big data analytics, revolutionizing traditional production (Meng et al.,

2024; O'sullivan, 2020). Moreover, the emphasis on environmental concerns propels investment in advanced machinery, replacing low-skilled labor, and amplifying the demand for educated workers. This optimization of human capital nurtures intrinsic motivation for digitalization (Ha et al., 2022).

Based on the comprehensive analysis, government environmental attention theoretically fosters EDT by alleviating financing constraints, improving innovation levels, and enhancing human capital allocation (see Fig. 1). Consequently, the essential hypothesis proposed in this paper is as follows:

Hypothesis 1. Government environmental attention facilitates the digital transformation of enterprises.

3. Methodology and data

3.1. Methodology

This study investigates the impact of government environmental attention on EDT. Following Zhuo and Chen (2023), we construct specification (1) for empirical analysis.

$$DIGIT_{fict} = \beta GEFOCUS_{ct} + \sum CONTROLS_{fict} + CONS_{fict} + \varphi_f + \theta_i + \lambda_c + \eta_t + \varepsilon_{fict} \quad (1)$$

where f , i , c , and t represent plant, industry, prefecture-level city, and year, respectively. $DIGIT$ is denoted as the level of EDT. $GEFOS$ is the variable of interest, capturing the magnitude of government environmental attention. $CONTROLS$ refers to a group of control variables, while $CONS$ represents the constant term. The parameter β estimates the specific impact of government environmental attention on EDT. The random error term ε is clustered at the firm level. To address potential estimation bias from omitted variables, this paper controls for individual effects (φ), year effects (η), industry effects (θ), and regional effects (λ). Detailed measurement methods for each variable are found in their respective definitions.

3.2. Variables specification

3.2.1. Enterprise digital transformation

This study employs keyword frequency counts from annual reports of publicly traded companies to act as a proxy measure for enterprise digital transformation (EDT). The vocabulary utilized in these reports

reflects the corporate future vision and strategic direction, offering insights into endorsed operational philosophies that guide future development. In practice, this study crafts a lexicon to evaluate EDT. This involves integrating artificial intelligence, big data, cloud computing, blockchain, and digital technology, widely examined in the existing literature (Li et al., 2023a; Tao et al., 2024; Zhai et al., 2022). To address heteroscedasticity concerns, this study employs the logarithm of the count to measure the frequency of EDT.

Fig. 2 depicts the temporal and industry-specific distribution of EDT. The left subplot displays the density distribution of EDT keyword frequency over the years. It shows an increasing trend since 2011, particularly after 2015. This highlights the growing emphasis on leveraging digital technologies to enhance operational efficiency. The right subplot illustrates the distribution of EDT keyword frequency across industries. It shows that industries such as manufacturing, information transmission, software and information technology services, transportation, storage and postal services, and electricity, heat, gas, and water production and supply exhibit a higher frequency of digital transformation keywords. These industries, except for information transmission, software, and information technology services, are known for their remarkable environmental implication, indirectly reflecting the environmental upgrading potential of EDT as well.

3.2.2. Government environmental attention

This study assesses government environmental attention via two dimensions: environmental word frequency and text sentiment. Inspired by Li et al. (2023e), we gauge the government's attention to the environment by examining the ratio of environmental vocabulary to the total segmented words in the annual government work reports of prefecture-level cities ($GESITY$). Furthermore, building on existing research (Bao and Liu, 2022; Liu et al., 2023a), we formulate an environmental dictionary for evaluating government attention, covering four dimensions: environmental awareness, pollution, energy consumption, and governance (see Appendix 1). Subsequently, using the jiebaR package, we tokenize the text data and rectify inaccuracies in machine-generated segmentations. This process involves breaking down the text into individual words, tallying the frequency of environmentally relevant terms listed in Appendix 1, and ultimately calculating the word frequency index of government environmental attention.

Simultaneously, the paper quantifies the intensity of government environmental attention from a textual sentiment perspective ($GEATT$). Leveraging the sentiment analysis module of the Baidu AI Open Platform, we analyze sentiments in environmentally related statements

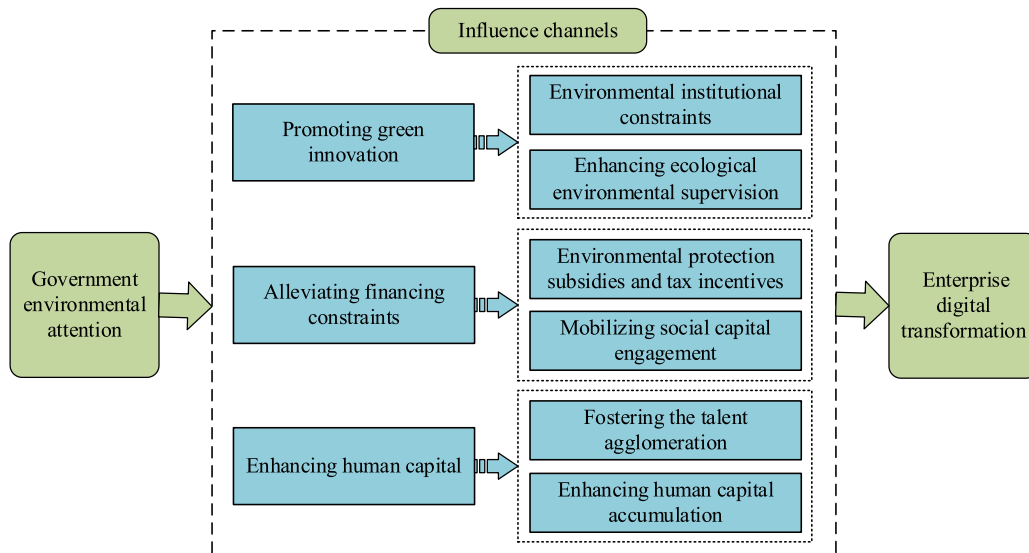


Fig. 1. Analytical framework.

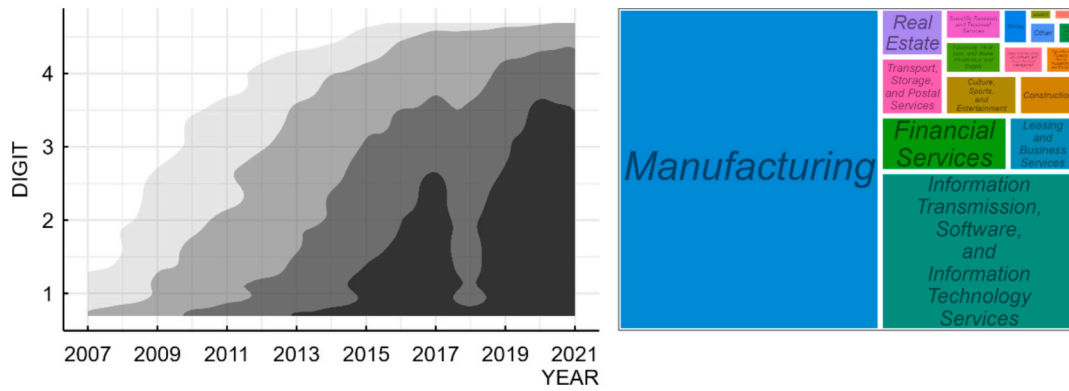


Fig. 2. Distribution of digital transformation terms.

within local government work reports. Indeed, Baidu sentiment analysis integrates sentiment lexicons and machine learning, employing bidirectional long short-term memory neural networks for precise sentiment judgment. This approach, compared to single sentiment analysis, enhances efficiency and accuracy. Moreover, the Baidu AI Open Platform relies on the extensive database of the Baidu search engine, providing a professional Chinese semantic analysis API to determine the text's attitude, opinions, and emotional polarity. This ensures the accurate measurement of the emotional intensity of environmental governance expressions in government work reports. The average sentiment scores of environmental governance statements are used to quantify the emotional intensity of government environmental attention.

Fig. 3 illustrates the distribution of government environmental attention across provincial administrative units in China. The left panel presents the distribution of government environmental attention measured by environmental word frequency. The right panel displays the sentiment tendency scores reflecting the emotional orientation of government environmental attention. Evidently, there is a notable concentration in the ecologically vulnerable central and western regions. This indicates the increased motivation of local governments in these areas to spur environmental protection and align with higher-level government policies.

3.2.3. Control variables

To keep away from the impact of confounding factors, this study controls for factors from two dimensions: macro and firm-level. Macro-level variables include per capita regional gross domestic product (PERGDP), fiscal pressure (PRESS), and urbanization (POP). Firm-level

variables encompass firm size (ASSET), leverage ratio (LEV), profitability (ROA), fixed asset growth rate (PPE), Cash ratio (CASH), Board size (DIRTOR), ownership structure (SOE), largest shareholder's shareholding proportion (FIRST), proportion of independent directors (INDEP), duality of chairman and CEO roles (DUAL), and industry competitiveness (HHI). Appendix 2 illustrates the measurement approaches of the variables.

3.3. Sample selection and data sources

This study examines samples of Shanghai and Shenzhen publicly traded companies from 2007 to 2021. The starting point aligns with the inception of the Chinese Accounting Standards for Enterprises on January 1, 2007. Notably, the introduction of fair value measurement under these standards is anticipated to lower equity capital expenses and improve investment efficiency. Modifications in accounting criteria affect the cash flows of plants undergoing EDT, thus mitigating financing constraints and impacting their digital metamorphosis.

The study's data on macro-level variables come from the China Urban Statistical Yearbook and specific regional statistical yearbooks. Firm-level variable data are obtained from the China Stock Market Accounting Research (CSMAR) and Chinese Research Data Services (CNRDS) databases, with some data manually supplemented via the cinfo website, an officially recognized platform for acquiring information disclosures from publicly listed companies in China. Additionally, textual data from government work reports are sourced from official websites of prefectural-level city governments.

To ensure study accuracy, the initial sample is processed as follows:

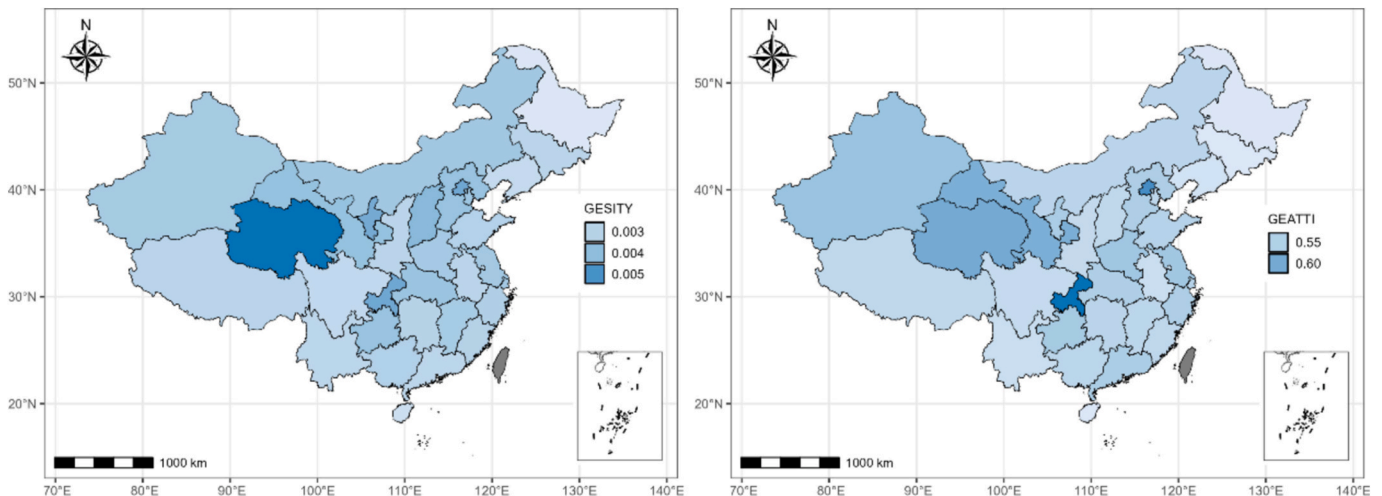


Fig. 3. Geographical distribution of government environmental attention.

(1) Removal of ST, delisted, or newly IPO-listed firms within the sample period; (2) Exclusion of companies from the financial and real estate sectors; (3) Selection of companies with consistent financial data over five years for data coherence; (4) Exclusion of firms with a debt-to-assets ratio exceeding 1; (5) Winsorization at 1 % and 99 % is applied to all continuous variables to address outliers' impact.

3.4. Descriptive statistics

Table 1 presents descriptive statistics for the main variables in this study. *DIGIT* has a mean of 2.025 and a median of 1.792, indicating mostly low levels of digital transformation in plants. The 10th and 90th percentiles are 0.693 and 3.761, respectively, showing remarkable variation in digital transformation degrees among plants in the sample. *GESITY* has an average and median of 0.003, with a minimal difference, indicating a reasonable distribution of environmental attention across distinct levels of government. *GEATTI* has an average of 0.557 and a median of 0.526. The 10th and 90th percentiles are 0.500 and 0.756, resulting in a variation of 0.256. This suggests a substantial disparity in government environmental attention among prefecture-level cities. The statistical attributes of the remaining controlled variables align with existing literature, indicating an elevated degree of data reliability (Ren et al., 2023; Zhai et al., 2022).

3.5. Univariate linearity tests

This study first investigates whether there is a linear relationship between government attention to the environment and EDT. Prior research has highlighted the non-linear impact of EDT on environmental governance (Ai et al., 2023). Hence, assessing linearity becomes crucial when examining the effect of government environmental attention on EDT using econometric models. Following Parteka (2010), this paper employs a Generalized Additive Model (GAM) for univariate analysis, which allows for capturing genuine statistical interconnections between variables without predefined specifications. To address GAM's susceptibility to outliers, enterprise-level data is aggregated to China's provincial-level data using mean computation. The specific computational methodology is outlined in Appendix 3.

The blue line in Fig. 4 represents the estimations yielded by the GAM. The collective outcomes of the GAM present a linear connection. The subsequent drop observed in the graph primarily results from the influence of a limited number of outlier observations. Concurrently, a linear model is adopted for fitting and estimation, as indicated by the red line. This linear model establishes a positive linear correlation between government environmental attention and EDT. Synthesizing the preceding analysis, this study concludes the presence of a linear link

between government environmental attention and EDT. Consequently, using a linear model to assess their net impact is justified. Additionally, this outcome provisionally supports hypothesis 1 proposed in this study.

4. Results and discussion

4.1. Baseline results

Table 2 presents the impact of government environmental attention on EDT. Columns (1)–(2) display the results of single-variable regressions. The estimates of *GESITY* and *GEATTI* are statistically significant, implying a positive effect of government focus on environmental concerns in enhancing EDT. These findings suggest that increased government attention to environmental matters encourages plants to actively adopt digital technologies for accelerated transformation. Columns (3)–(4) show results after incorporating control variables. In these columns, both *GESITY* and *GEATTI* remain statistically significant, indicating that heightened government environmental attention continues to foster EDT. In a nutshell, both *GESITY* and *GEATTI* demonstrate statistically significant and positive coefficients, supporting hypothesis 1 of this study.

This study expands existing research on the link between government environmental attention and corporate governance. Previous works, using word frequency analysis, constructed indicators for environmental attention, assessing governance effects on issues such as environmental innovation (Liao et al., 2022) and pollution control (Bao and Liu, 2022; Liu et al., 2023a). They found that heightened government attention to environmental matters improves corporate governance. In addition to word frequency analysis, this paper explores government environmental attention via text semantics, offering new insights for measurement. Additionally, this paper investigates the connection between government environmental attention and EDT, broadening understanding of the corporate governance impact of government environmental attention.

4.2. Robustness checks

To ensure the reliability of conclusions, this study uses robustness testing methods to explore the interplay between government environmental attention and EDT. The Instrumental variable strategy and Heckman model are exploited to address endogeneity concerns. Additional examinations involve alternate estimations for key variables, confounding factor exclusions, and regression model substitutions. These actions collectively bolster analysis rigor and further validate observed associations.

4.2.1. Endogeneity

Government environmental attention is typically deemed exogenous to micro-level corporate behavior, shaped by macro-level governance factors. However, concerns regarding potential endogeneity remain, and this study addresses two key endogeneity issues. First, the potential for reverse causality arises, where an increased government emphasis on environmental matters may drive plants to expedite their digital transformation. Conversely, heightened government focus on environmental governance, accounting for local conditions, commonly results in specific environmental policies that involve input from local enterprises, especially significant local taxpayers. This implies potential endogeneity due to reverse causality in the research findings. Second, there is a challenge related to sample selection bias. In addition to complying with government-enforced environmental limitations, businesses may opt to relocate to regions with less emphasis on environmental protection. However, this study does not analyze the plants opting for such relocations, leading to potential sample self-selection bias influencing the research outcomes. To address these endogeneity concerns, this study employs instrumental variable methods and the Heckman model.

Table 1
Descriptive statistics.

Variables	Obs	Mean	SD	P10	Median	P90
<i>DIGIT</i>	18,161	2.025	1.200	0.693	1.792	3.761
<i>GESITY</i>	18,161	0.003	0.001	0.002	0.003	0.005
<i>GEATTI</i>	18,161	0.557	0.088	0.500	0.526	0.756
<i>PERGDP</i>	18,161	1.151	0.513	0.527	1.151	1.737
<i>PRESS</i>	18,161	0.500	0.767	0.040	0.268	1.198
<i>POP</i>	18,161	0.374	0.309	0.092	0.260	0.909
<i>ASSET</i>	18,161	22.292	1.467	20.687	22.040	24.289
<i>LEV</i>	18,161	0.417	0.214	0.145	0.401	0.708
<i>ROA</i>	18,161	0.039	0.072	0.000	0.040	0.106
<i>PPE</i>	18,161	0.175	0.146	0.017	0.141	0.380
<i>CASH</i>	18,161	0.179	0.144	0.043	0.137	0.374
<i>DIRTOR</i>	18,161	2.121	0.214	1.946	2.197	2.398
<i>SOE</i>	18,161	0.244	0.430	0.000	0.000	1.000
<i>FIRST</i>	18,161	0.332	0.148	0.156	0.310	0.543
<i>INDEP</i>	18,161	0.378	0.054	0.333	0.364	0.429
<i>DUAL</i>	18,161	0.319	0.466	0.000	0.000	1.000
<i>HHI</i>	18,161	0.071	0.096	0.014	0.043	0.135

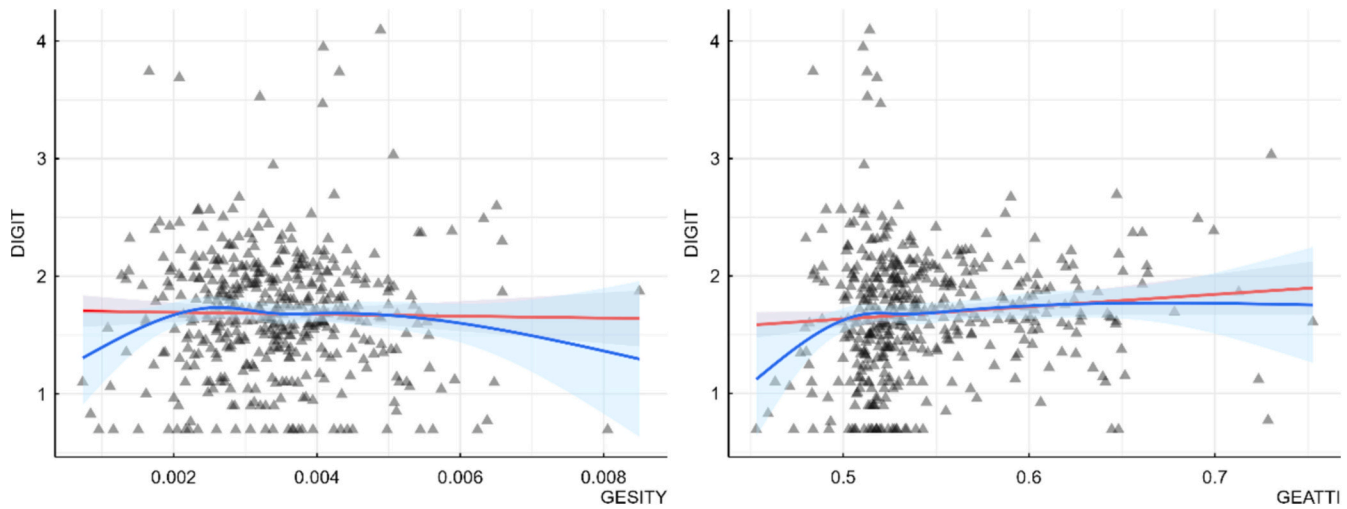


Fig. 4. Linearity tests.

(1) 2SLS

To counter reverse causality, this study employs the spherical distance between prefecture-level city government offices and Beijing's administrative office, along with the count of Confucian temples in the firm's operational city, as instrumental variables, utilizing a two-stage least squares regression method. The rationale for these choices is twofold: First, as China's political hub, closer proximity to Beijing suggests greater local government influence, potentially impacting heightened government environmental attention amidst central government emphasis. Second, Confucian temples, carrying traditional values such as "benevolence towards all" and "harmony between heaven and humanity," align with ecological responsibility, rendering them pertinent as instruments. Moreover, the geographical distance to Beijing and the historical nature of Confucian temples ensure their exogeneity, unaffected by digital transformation undertakings.

Columns (1)–(2) of Table 3 present the estimations from the instrumental variable. Initial assessments encompass tests for instrument validity. The Anderson LM statistic holds remarkable significance at the 1 % level, signifying rejection of the null hypothesis of instrument underidentification. Furthermore, the Cragg-Donald Wald F statistic substantially surpasses the 10 % critical value for the Stock-Yogo weak instrument test, indicating the nonexistence of weak instrument concerns. Regression findings establish the statistical significance of *GESITY* and *GEATTI* estimates for *DIGIT*. This implies that despite addressing concerns of bidirectional causality, government environmental attention persists in catalyzing EDT.

(2) Heckman regression

This study employs the Heckman strategy to address sample selection bias. First, sub-variables are created using the mean values of *GESITY* and *GEATTI*. Covariates such as firm size (*ASSET*), leverage ratio (*LEV*), profitability (*ROA*), fixed asset investment (*PPE*), ownership nature (*SOE*), ownership concentration (*FIRST*), and independent director proportion (*INDEP*) are included in a probit regression as control variables. Subsequently, the resulting predicted values from the regressions are used to calculate the inverse Mills ratios (*IMRGESITY*, *IMGEATTI*), which are then incorporated into the baseline model for further analysis.

Columns (3)–(4) of Table 3 present the estimates of the Heckman strategy. Importantly, the estimates of *IMRGESITY* and *IMGEATTI* are statistically significant, revealing the presence of sample selection bias in the research sample. Consequently, addressing this bias within the empirical analysis is justified. Meanwhile, the regression findings for *GESITY* and *GEATTI* on *DIGIT* maintain significance, affirming the

robustness of the research conclusion even after controlling for sample selection bias. This underscores the capacity of heightened government environmental focus to accelerate EDT.

4.2.2. Other robustness checks

(1) Alternative Econometric Models

This study employs textual word frequencies to gauge EDT, which manifests a non-negative nature and distinct right-skewed distribution. In this context, the direct application of traditional OLS regression somewhat brings about bias. To address this, we adopt the panel Tobit strategy tailored for right-skewed truncated distributions. This choice enhances the regression's precision by counteracting potential interference in methodological biases. Table 4, specifically columns (1)–(2), presents results from employing the Tobit model to estimate government allocation of environmental attention and EDT.

(2) Lagging explanatory variables of interest

Governments typically emphasize environmental concerns by enacting regulatory documents that impose restrictions. The Government Work Report guides government authorities for the subsequent year. However, the policy process and its impact on EDT involve a temporal delay. Ignoring this delay hampers the accurate assessment of the net impact of the government's environmental attention allocation. Taking this into consideration, this paper incorporates a one-period lag (*L.GESITY*, *L.GEATTI*) into the variables of interest, reinserted into the baseline strategy for re-estimation. Columns (3)–(4) in Table 4 illustrate the estimated outcomes of government environmental attention in the subsequent period on EDT.

(3) Reassessing explanatory variables of interest

China's local governments follow an upward accountability system (Zhou, 1993; Zhou et al., 2003). Lower-level governments integrate discussions on environmental protection and management, particularly in crucial policy documents like government work reports, influenced by higher-level governments' emphasis on environmental protection. This integration bolsters legitimacy and gains recognition from higher authorities. However, promotion incentives prompt local governments to prioritize economic development over environmental conservation in practice. To do so, this study reassesses government environmental concerns via the count of locally issued environmental policy documents (*ENPOL*) and the ratio of government environmental expenditure to

Table 2
Baseline regression results.

VARIABLES	(1)	(2)	(3)	(4)
	DIGIT	DIGIT	DIGIT	DIGIT
<i>GESITY</i>	0.018** (2.420)		0.016** (2.239)	
<i>GEATTI</i>		0.563*** (5.899)		0.402*** (4.323)
<i>PERGDP</i>			0.036 (1.443)	0.039 (1.552)
<i>PRESS</i>			−0.002 (−0.093)	−0.005 (−0.192)
<i>POP</i>			−0.004 (−0.221)	−0.004 (−0.243)
<i>ASSET</i>			−0.201*** (−8.128)	−0.198*** (−8.026)
<i>LEV</i>			0.030 (0.341)	0.044 (0.501)
<i>ROA</i>			0.044 (0.403)	0.046 (0.424)
<i>PPE</i>			0.495*** (3.801)	0.494*** (3.802)
<i>CASH</i>			0.412*** (4.802)	0.394*** (4.616)
<i>DIRTOR</i>			−0.258*** (−2.818)	−0.259*** (−2.840)
<i>SOE</i>			−0.008 (−0.283)	0.003 (0.128)
<i>FIRST</i>			0.627*** (3.381)	0.604*** (3.248)
<i>INDEP</i>			0.156 (0.626)	0.159 (0.638)
<i>DUAL</i>			0.040 (1.531)	0.038 (1.465)
<i>HHI</i>			0.301** (2.463)	0.296** (2.421)
<i>FIRM FE</i>	Y	Y	Y	Y
<i>YEAR FE</i>	Y	Y	Y	Y
<i>INDUSTRY FE</i>	Y	Y	Y	Y
<i>CITY FE</i>	Y	Y	Y	Y
<i>CONS</i>	−2.128*** (−86.959)	−2.383*** (−44.749)	2.391*** (3.927)	2.146*** (3.515)
N	18,161	18,161	18,161	18,161
Adj R ²	0.721	0.722	0.729	0.730

Notes: Table 2 presents the estimates of the baseline regression, focusing on government environmental attention—the explanatory variable of interest—measured by the ratio of ecological terms to the total segmented terms in annual government work reports of prefecture-level cities (*GESITY*), as well as the emotional tone of environmental expressions (*GEATTI*). The key independent variable, enterprise digital transformation (*DIGIT*), is quantified by keyword frequency counts in annual disclosures of publicly listed companies. The regression outcomes are all controlled for plant, year, industry, and prefectural city fixed effects. Detailed explanations of other variables are provided in Appendix 2. Robust t-statistics are given in parentheses. The standard errors for all models are adjusted for city-level clustering. *, ** and *** denote statistical significance at the 10 %, 5 % and 1 % levels, respectively.

general public expenditure (*EPEXP*). The ENPOL data are manually compiled from the PKU Law Database, while the *EPEXP* data are sourced from the China National Research Data Service (CNRDS). Table 4, columns (5)–(6), displays the outcomes of this adjusted estimation.

By and large, after rigorous endogeneity and robustness tests, the estimates concerning the government environmental attention and EDT demonstrate significant positive effects. The robustness and reliability of

Table 3
Endogenous treatments.

VARIABLES	(1)	(2)	(3)	(4)
	DIGIT	DIGIT	DIGIT	DIGIT
<i>GESITY</i>	3.285** (2.184)		0.015** (2.117)	
<i>GEATTI</i>		12.062*** (3.273)		0.352*** (3.849)
<i>IMRGESITY</i>			0.759* (1.709)	
<i>IMGEATTI</i>				0.963*** (3.402)
<i>CONTROLS</i>	Y	Y	Y	Y
<i>FIRM FE</i>	Y	Y	Y	Y
<i>YEAR FE</i>	Y	Y	Y	Y
<i>INDUSTRY FE</i>	Y	Y	Y	Y
<i>CITY FE</i>	Y	Y	Y	Y
<i>CONS</i>	−	−	1.300 (1.401)	3.560*** (4.958)
N	18,161	18,161	18,161	18,161
Adj R ²	−23.26	−1.518	0.729	0.730

Notes: (i) Geographical coordinates of prefectural city government offices and the Beijing government office, along with data on Confucian temples in prefectural cities, originate from the Chinese Research Data Services (CNRDS) database. The shortest distance between prefecture-level city government offices and Beijing's administrative office is calculated through a function within the “philentropy” package in the R software.

(ii) Robust t-statistics are given in parentheses. The standard errors for all models are adjusted for city-level clustering. Detailed explanations of control variables are provided in Appendix 2. *, ** and *** denote statistical significance at the 10 %, 5 % and 1 % levels, respectively.

the key finding that increased governmental focus on environmental protection enhances corporate digitalization are firmly established and persistently unaffected by diverse external conditions.

4.3. Channels

The study confirms that heightened government environmental attention stimulates plants to accelerate EDT. This consistency withstands endogeneity assessments and additional robustness checks. However, this paper has yet to verify how precisely government emphasis on environmental concerns triggers EDT.

Theoretical analysis highlights that government authorities play a dual role in promoting EDT. First, with an intensified environmental focus, government authorities induce plants to accelerate green innovation by enacting regulatory policies and employing financial incentives. This leads to increased cash flows and reduced financing costs, fostering swift EDT. Second, heightened environmental attention from local governments facilitates talent aggregation, forming a workforce foundation for companies pursuing EDT. Additionally, government oversight of environmental regulations motivates corporate executives to enhance digital literacy for reputation maintenance. In a similar vein, aligning with local government preferences, companies expedite the acquisition and utilization of intelligent equipment, urging employees to refine their skills. Ultimately, this process advances EDT.

Following existing literature (Li et al., 2023d; Yan et al., 2023), this study constructs specification (2) to uncover the mechanisms by which government environmental attention shapes EDT.

$$\begin{aligned}
 MEDI_{fict} &= \beta GEFOCUS_{ct} + \sum CONTROLS_{fict} + CONS_{fict} + \varphi_f + \theta_i + \lambda_c + \eta_t + \varepsilon_{fict} \\
 DIGIT'_{fict} &= \beta GEFOCUS_{ct} + \alpha MEDI_{fict} + \sum CONTROLS_{fict} + CONS_{fict} + \varphi_f + \theta_i + \lambda_c + \eta_t + \varepsilon_{fict}
 \end{aligned} \tag{2}$$

Table 4
Alternative robustness tests.

VARIABLES	(1) DIGIT	(2) DIGIT	(3) DIGIT	(4) DIGIT	(5) DIGIT	(6) DIGIT
<i>GESITY</i>	0.015*** (2.853)					
<i>GEATTI</i>		0.372*** (5.063)				
<i>L.GESITY</i>			0.013* (1.807)			
<i>L.GEATTI</i>				0.406*** (4.274)		
<i>ENPOL</i>					0.035** (2.057)	
<i>EPEXP</i>						0.749*** (3.947)
<i>CONTROLS</i>	Y	Y	Y	Y	Y	Y
<i>FIRM FE</i>	Y	Y	Y	Y	Y	Y
<i>YEAR FE</i>	Y	Y	Y	Y	Y	Y
<i>INDUSTRY FE</i>	Y	Y	Y	Y	Y	Y
<i>CITY FE</i>	Y	Y	Y	Y	Y	Y
<i>CONS</i>	2.149*** (7.312)	1.953*** (6.567)	2.443*** (4.013)	2.189*** (3.583)	2.413*** (3.960)	−34.865*** (−3.662)
N	18,161	18,161	16,924	16,924	18,161	18,161
Adj R ²	–	–	0.719	0.720	0.729	0.729

Notes: Robust t-statistics are given in parentheses. The standard errors for all models are adjusted for city-level clustering. Detailed explanations of control variables are provided in [Appendix 2](#). *, ** and *** denote statistical significance at the 10 %, 5 % and 1 % levels, respectively.

Table 5
Channel of green technological innovation.

VARIABLES	(1) GINNOVA	(2) GINNOVA	(3) DIGIT	(4) DIGIT
<i>GESITY</i>	0.018*** (3.606)		0.015** (2.123)	
<i>GEATTI</i>		0.244*** (12.426)		0.402*** (4.372)
<i>GINNOVA</i>			0.034** (2.433)	0.037*** (2.595)
<i>CONTROLS</i>	Y	Y	Y	Y
<i>FIRM FE</i>	Y	Y	Y	Y
<i>YEAR FE</i>	Y	Y	Y	Y
<i>INDUSTRY FE</i>	Y	Y	Y	Y
<i>CITY FE</i>	Y	Y	Y	Y
<i>CONS</i>	4.233*** (8.515)	6.409*** (61.645)	2.290*** (3.764)	2.038*** (3.336)
N	18,161	18,161	18,161	18,161
Adj R ²	0.832	0.822	0.729	0.730

Notes: Robust t-statistics are given in parentheses. The standard errors for all models are adjusted for city-level clustering. Detailed explanations of control variables are provided in [Appendix 2](#). *, ** and *** denote statistical significance at the 10 %, 5 % and 1 % levels, respectively.

where *MEDI* represents a mediator involving green technological innovation, financial constraints, and human capital. Following previous research ([Fang et al., 2021](#); [Zhang et al., 2023b](#)), this study gauges corporate green innovation through green invention patent applications, applying a logarithmic transformation (*GINNOVA*) to alleviate estimation bias. Financial constraints are evaluated using the SA index developed by [Hadlock and Pierce \(2010\)](#) (*STRAIN*). Moreover, human capital is proxied by per capita training expenses, reflecting the quality of enterprise human capital (*HUCAP*). The definitions of the remaining variables align with specification (1).

4.3.1. Channel of green technological innovation

[Table 5](#) exemplifies the estimation of green innovation channels. In columns (1)–(2), the estimate of *GESITY* on *GINNOVA* is 0.018, with statistical significance at the 1 % level. Similarly, the coefficient of *GEATTI* is notably positive and statistically significant at the 1 % level, implying that heightened government environmental attention

accelerates faster green technological innovation. Transitioning to columns (3)–(4), the regression results indicate a remarkable positive correlation between *GINNOVA* and *DIGIT*. The magnitudes of *GESITY* and *GEATTI* are 0.015 and 0.402 respectively, diminishing compared to baseline regression levels. By and large, intensified government environmental attention propels plants to expedite technological innovation. This acceleration is facilitated through the adoption of innovative environmentally conscious technologies, thereby enhancing EDT. This empirical observation reinforces the theoretical mechanism expounded in this study.

The mentioned empirical results indirectly support and broaden the prevailing research conclusions. [Liao et al. \(2022\)](#) discovered that attention to policies and consumers substantially affects the firms' adoption of environmental innovation strategies, particularly among micro-level corporate leaders. In contrast, this paper examines macro-level governments' attention allocation, revealing that governmental environmental attention drives EDT via green technological innovation, thus extending the findings of [Liao et al. \(2022\)](#). In a similar vein, this

Table 6
Channel of financial constraints.

VARIABLES	(1) STRAIN	(2) STRAIN	(3) DIGIT	(4) DIGIT
<i>GESITY</i>	−0.010*** (−7.140)		0.016** (2.208)	
<i>GEATTI</i>		−0.241*** (−12.404)		0.394*** (4.289)
<i>STRAIN</i>			−0.046*** (−2.772)	−0.047*** (−2.600)
<i>CONTROLS</i>	Y	Y	Y	Y
<i>FIRM FE</i>	Y	Y	Y	Y
<i>YEAR FE</i>	Y	Y	Y	Y
<i>INDUSTRY FE</i>	Y	Y	Y	Y
<i>CITY FE</i>	Y	Y	Y	Y
<i>CONS</i>	−4.263*** (−40.971)	−4.122*** (−40.350)	2.434*** (4.005)	2.201*** (3.612)
N	18,161	18,161	18,161	18,161
Adj R ²	0.820	0.822	0.729	0.730

Notes: Robust t-statistics are given in parentheses. The standard errors for all models are adjusted for city-level clustering. Detailed explanations of control variables are provided in [Appendix 2](#). *, ** and *** denote statistical significance at the 10 %, 5 % and 1 % levels, respectively.

conclusion also strengthens prior research linking government environmental awareness with corporate efforts for eco-conscious innovation (Fang et al., 2021).

4.3.2. Channel of acquiring financing

Table 6 illustrates estimates related to the government's environmental attention in mitigating financing constraints. In columns (1)–(2), the estimates of *GESITY* and *GEATTI* are unfavorable and statistically significant at the 1 % level, indicating that heightened government environmental attention diminishes corporate financing constraints. In columns (3)–(4), the significantly negative magnitude of *STRAIN* at the 1 % level indicates that eased financing constraints promote EDT. Compared to the baseline regression, the t-statistics for *GESITY* and *GEATTI* decrease, suggesting that *STRAIN* partially absorbs the impact of government attention allocation (*GESITY*, *GEATTI*). Collectively, this analysis affirms that increased environmental attention diminishes corporate financing constraints, fostering EDT, and supporting the second proposed mechanism.

Liu et al. (2023a) uncovered fiscal subsidies as a means through which government environmental attention cuts corporate carbon emissions. However, their macroscopic study lacks micro-level validation. Another study confirmed that enhanced corporate information disclosure due to government environmental attention ameliorates information asymmetry (Fang et al., 2021). Yet, the effects on corporate financing constraints remain unverified. This study's micro-level validation further documents that governmental environmental emphasis reduces information asymmetry within firms, thus alleviating innovation-related financial limits.

4.3.3. Channel of human capital

Table 7 displays the association between government environmental attention and the human capital channel in EDT. In columns (1)–(2), the coefficients of *GESITY* and *GEATTI* are statistically significant and positive, indicating that heightened government environmental attention motivates companies to improve employee skill training, thereby enhancing human capital quality. In columns (3)–(4), the estimate of *HUCAP* on *DIGIT* is significantly positive at the 5 % statistical level, suggesting that improved company human capital skills drive EDT. Simultaneously, in comparison to the baseline regression, both the coefficients and t-statistics of *GESITY* and *GEATTI* decrease. This implies that increased government environmental attention enhances the quality of corporate human capital, speeding up EDT via continuous human capital progress. This analysis underscores that enhancing corporate

human capital is a crucial pathway for the impact of government environmental attention on EDT, validating the third proposed theoretical mechanism.

This discovery broadens the scope of research on the influence of governmental environmental attention via diverse channels. Existing scholarly literature emphasizes the impact of government environmental attention on corporate governance via mechanisms such as promoting green innovation and alleviating information asymmetry (Liao et al., 2022; Wen et al., 2022). However, empirical evidence supporting the human capital pathway is limited. The success of EDT relies on the enhancement of human capital. In response to increasing government environmental attention, plants are compelled to enhance human capital for innovative digital applications. This improvement optimizes production processes and enhances eco-friendly capabilities, aligning with evolving environmental expectations.

After the preceding empirical scrutiny, this study draws the following conclusions: Government initiatives to boost environmental allocation expedite corporate green innovation, mitigate financing constraints, and enhance human capital accumulation, thereby encouraging EDT.

4.4. Further analysis

In essence, enhancing government environmental attention propels EDT. However, disregarding the impacts varying with corporate attributes and external conditions creates a misconception that government environmental attention universally empowers all EDT. This misperception distorts the comprehension of the government's role in driving this transformation. To comprehend the relationship between government environmental attention and EDT, this study undertakes a multifaceted analysis covering three perspectives: market environment, corporate characteristics, and industry attributes. According to Guo et al. (2023), this article verifies using specification (3).

$$DIGIT_{fict} = \beta_0 GEFOCUS_{ct} + \beta_1 ADJVAR_{fict} + \beta_2 GEFOCUS_{ct} \times ADJVAR_{fict} + \sum \text{CONTROLS}_{fict} + \text{CONS}_{fict} + \varphi_f + \theta_i + \lambda_c + \eta_t + \varepsilon_{fict} \quad (3)$$

where *ADJVAR* represents moderator variables, reflecting the heterogeneity in firm size, heavily polluting industries, and market characteristics. The coefficient β_2 captures the relationship between moderator variables and government environmental attention for driving EDT. Other parameters follow specification (1).

4.4.1. Firm magnitude

Large enterprises, with their extensive operations, have a considerable impact on the local environment, prompting expedited EDT. In the same vein, they also attract greater public and government scrutiny, making them pivotal in local environmental governance. As a result, government environmental attention dramatically aids these plants in meeting environmental legitimacy standards. Moreover, sizable enterprises are more likely to secure government environmental subsidies, further stimulating their digital transformation.

To investigate the impact of government environmental attention on EDT across firm sizes, this study employs a dummy variable (*LARGE*) based on average year-end total assets. When added to specification (3) and presented in Table 8, Columns (1)–(2), the findings highlight statistically significant and positive coefficients for interaction terms *GESITY* \times *LARGE* and *GEATTI* \times *LARGE*, passing the significance test at the 5 % level or higher. These results indicate that heightened government environmental attention more strongly drives digital transformation in larger enterprises.

4.4.2. Heavily polluting industries

As major pollutant contributors, polluting industries draw both public and local government focus. Intensified environmental attention

Table 7
Channel of human capital.

VARIABLES	(1) <i>HUCAP</i>	(2) <i>HUCAP</i>	(3) <i>DIGIT</i>	(4) <i>DIGIT</i>
<i>GESITY</i>	0.002*** (3.435)		0.015** (2.094)	
<i>GEATTI</i>		0.033*** (5.493)		0.381*** (4.156)
<i>HUCAP</i>			0.378** (2.307)	0.364** (2.225)
<i>CONTROLS</i>	Y	Y	Y	Y
<i>FIRM FE</i>	Y	Y	Y	Y
<i>YEAR FE</i>	Y	Y	Y	Y
<i>INDUSTRY FE</i>	Y	Y	Y	Y
<i>CITY FE</i>	Y	Y	Y	Y
<i>CONS</i>	0.962*** (20.750)	0.945*** (20.375)	2.071*** (3.280)	1.859*** (2.937)
<i>N</i>	18,161	18,161	18,161	18,161
Adj R ²	0.316	0.316	0.729	0.730

Notes: Robust t-statistics are given in parentheses. The standard errors for all models are adjusted for city-level clustering. Detailed explanations of control variables are provided in Appendix 2. *, ** and *** denote statistical significance at the 10 %, 5 % and 1 % levels, respectively.

Table 8
Heterogeneity analysis.

VARIABLES	(1) <i>DIGIT</i>	(2) <i>DIGIT</i>	(3) <i>DIGIT</i>	(4) <i>DIGIT</i>	(5) <i>DIGIT</i>	(6) <i>DIGIT</i>
<i>GESITY</i>	−0.015 (−0.910)		−0.021 (−1.385)		0.006 (0.671)	
<i>GEATTI</i>		−0.307 (−1.254)		−0.382 (−1.590)		0.168 (1.317)
<i>LARGE</i>	−0.106 (−1.624)	−0.418*** (−2.906)				
<i>GESITY</i> × <i>LARGE</i>	0.035** (2.048)					
<i>GEATTI</i> × <i>LARGE</i>		0.789*** (3.029)				
<i>GESITY</i> × <i>HEAVE</i>			0.044*** (2.670)			
<i>GEATTI</i> × <i>HEAVE</i>				0.880*** (3.403)		
<i>FINAD</i>					−0.106** (−2.487)	−0.261*** (−2.778)
<i>GESITY</i> × <i>FINAD</i>					0.021* (1.951)	
<i>GEATTI</i> × <i>FINAD</i>						0.398** (2.419)
<i>CONS</i>	2.484*** (4.106)	2.545*** (4.130)	2.434*** (4.001)	2.216*** (3.643)	2.399*** (3.943)	2.247*** (3.689)
<i>CONTROLS</i>	Y	Y	Y	Y	Y	Y
<i>FIRM FE</i>	Y	Y	Y	Y	Y	Y
<i>YEAR FE</i>	Y	Y	Y	Y	Y	Y
<i>INDUSTRY FE</i>	Y	Y	Y	Y	Y	Y
<i>CITY FE</i>	Y	Y	Y	Y	Y	Y
N	18,161	18,161	18,161	18,161	18,161	18,161
Adj R ²	0.729	0.730	0.729	0.730	0.729	0.730

Note: (i) The heavily polluting industries in this study include coal mining and washing, petroleum and natural gas extraction, black metal ore mining and dressing, non-ferrous metal ore mining and dressing, textile industry, leather, fur, feather, and footwear manufacturing, papermaking and paper products industry, petroleum processing, coking, and nuclear fuel processing industry, chemical raw materials and chemical products manufacturing, chemical fiber manufacturing, rubber and plastic products industry, non-metallic mineral products industry, black metal smelting and processing industry, non-ferrous metal smelting and processing industry, and electricity and heat production and supply industry. The China Securities Regulatory Commission revised the Guidelines for Industry Classification of Listed Companies in 2012, assigning the following codes to these heavily polluting industries: B06, B07, B08, B09, C17, C19, C22, C25, C26, C28, C29, C30, C31, C32, D44. (ii) Robust t-statistics are given in parentheses. The standard errors for all models are adjusted for city-level clustering. Detailed explanations of control variables are provided in [Appendix 2](#). *, ** and *** denote statistical significance at the 10 %, 5 % and 1 % levels, respectively.

heightens corporate compliance pressure, accelerating EDT and environmental governance. To do so, this study asserts that bolstered government environmental efforts notably drive EDT in heavily polluting industries.

This study examines the impact of government environmental attention on EDT across industries. Using the National Economic Industry Classification Standard, this paper creates the sub-variable *HEAVE* for heavily polluting sector plants (refer to note (i) in [Table 8](#)). [Table 8](#), columns (3)–(4), presents empirical findings with substantial positive estimates at the 1 % level for interaction terms *GESITY* × *HEAVE* and *GEATTI* × *HEAVE*. In a nutshell, heightened government environmental attention accelerates EDT in heavily polluting industries.

4.4.3. Financial market development

Theoretically, increased government environmental attention diminishes information asymmetry in banking, easing corporate financing constraints and promoting EDT. Yet, the impact on signaling depends on financial market development. In less structured systems, limited information flow hampers external financing, necessitating vital alternative cues like environmental subsidies. This highlights that in regions with weak financial sectors, heightened government environmental attention notably boosts EDT.

Columns (5)–(6) of [Table 8](#) concisely illustrate the estimated impacts of government environmental attention on EDT across regions with varying degrees of financial market development. Drawing from [Chen et al. \(2021\)](#) and [Niu et al. \(2022\)](#), this study employs the count of financial institutions at the prefectural level to construct a variable (*FINAD*) representing regional financial market development. Regions

below the national median count are deemed underdeveloped (assigned 1), while those exceeding it are developed (assigned 0). In columns (5)–(6), interaction term estimates—specifically *GESITY* × *FINAD* and *GEATTI* × *FINAD*—display positive, statistically significant coefficients at the 10 % level or higher. This underscores increased government attention to environmental concerns, distinctly influencing EDT in underdeveloped financial markets.

The preceding study elucidates that heightened government environmental attention dramatically molds EDT. This influence is mediated via variables such as company size, industry characteristics, and the state of financial market development. Remarkably, the effect of government environmental attention on EDT is particularly evident in larger enterprises and those operating within heavily polluting sectors. Moreover, the role of government environmental attention in accelerating EDT is more pronounced in regions with limited financial market development.

5. Conclusion and implications

The emergence of the digital economy introduces new approaches to abate pollutants and greenhouse gas emissions internationally. Facilitating EDT plays a key role in reducing pollution sources, curbing resource wastage, and mitigating emissions. Stakeholders, notably governmental bodies, actively create guiding policies. Yet, resource allocation hinges on attention allocation by authorities. Heightened focus on environmental preservation could externally drive EDT, with noteworthy implications for global environmental standards, underscoring its significance.

This study employs organizational legitimacy theory to explore the mechanisms underlying the impact of government environmental attention on EDT. Using data from A-share listed companies in Shanghai and Shenzhen stock markets from 2007 to 2021, this paper examines the impact of government environmental attention on EDT. Key findings are as follows: (1) In general, the government's heightened environmental attention favors EDT. Robust baseline regression results remain after addressing endogeneity with instrumental variable methods and the Heckman model. Alternative econometric models, lagging core variables, and varying measurement approaches also support the primary findings. (2) In terms of the mechanism analysis, strengthened government environmental attention enhances environmental constraints, prompting technological innovation, improving access to fiscal resources, and alleviating financing constraints. It also enhances talent accumulation and human capital quality, contributing to EDT. (3) Further investigation reveals that government attention to environmental preservation more significantly impacts EDT for large enterprises and those in heavily polluting sectors. In regions with lower financial development, government environmental attention operates as an effective signaling mechanism, enhancing enterprise digitalization.

This paper contributes in three key areas. First, it applies organizational legitimacy theory to analyze the impact of government environmental attention on EDT. The findings validate the theoretical hypothesis of the institutional foundation proposed by [Acemoglu et al. \(2005\)](#), providing a novel theoretical basis for governments to influence corporate behavior via institutions. Second, the paper assesses government environmental attention from two dimensions: environmental word frequency and text semantics. This expands the measurement framework, offering a new approach for systematically analyzing government environmental attention through text analysis. Lastly, from the perspective of government behavior, the paper explores the interactive relationship between government environmental attention and EDT, verifying impact mechanisms by enhancing technological innovation, improving human capital, and alleviating financing constraints. This research not only introduces a new approach to exploring macro-level determinants shaping EDT but also provides a logical theoretical explanation for the causes of EDT.

The research findings have the following policy implications: (1) Government authorities, particularly in developing nations, should heighten their focus on environmental concerns, driving enterprises towards digital transformation. Given the scarcity of attention as a resource, adopting a proactive perspective when addressing ecological matters is recommended. This approach reduces the cost of environmental attention and endorses strategic actions conducive to digital progress, facilitating effective execution and avoiding potential decision-making pitfalls of rhetoric. (2) Optimizing resource allocation to strengthen the supply for enterprise digitalization is paramount. Government entities should reinforce intellectual property protection

for digital technologies and data assets, and enhance oversight and evaluation mechanisms for policies such as government subsidies and tax incentives. Moreover, a greater emphasis should be placed on enhancing regional talent attraction, cultivating digital-related professionals, and providing comprehensive digital skills training for enterprises, ensuring ample human resources for transformation. (3) Enterprises should leverage digital transformation to boost technological innovation and seamlessly integrate digital technology into core business functions. This integration aims to decrease energy consumption in production, enhance resource efficiency, and advance the overall sustainability of enterprise operations.

This study bears some limitations. First, this study relies exclusively on research data from China. Consequently, while the findings hold relevance for emerging economies, their extension to other nations, particularly developed ones, is circumscribed. To alleviate this, forthcoming research could validate the conclusions using data from developed countries. Second, intergovernmental actions exhibit spatial correlation. Given this study's micro-level enterprise dataset, it cannot substantiate the spatial implications of government environmental attention on EDT across diverse regions. Addressing this requires employing macro-level data to evaluate spatial spillover effects. Lastly, due to the absence of specific data, text analysis is employed to measure EDT. In the future, innovative methodologies will be pivotal for the precise quantification of EDT and for enhancing estimation precision.

CRediT authorship contribution statement

Peihao Shi: Writing – original draft, Visualization, Validation, Supervision, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Qinghua Huang:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Funding acquisition.

Declaration of competing interest

We declare that we have no financial and personal relationships with other people or organizations that can inappropriately influence our work, there is no professional or other personal interest of any nature or kind in any product, service and/or company that could be construed as influencing the position presented in, or the review of, the manuscript entitled.

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Appendix 1

Table 1
Statistical lexicon of government environmental attention.

Objective	Dimension	Keywords
Governmental environmental attention	Environmental awareness	Environmental protection; Ecological preservation; Afforestation; Fostering a green and sustainable environment; Promoting low-carbon practices; Reducing emissions; Maintaining ecological balance; Ensuring environmental quality; Enhancing air quality; Achieving clear skies; Pristine water bodies; Uncontaminated land; Cultivating green spaces; Expanding forests; Preserving vegetation; Creating livable spaces; Tree planting; Reforestation; Embracing lush landscapes; Azure skies; Establishing ecological barriers; Conserving water sources; Upholding soil retention.
	Environmental pollution	Pollution; Wastewater discharge; Chemical oxygen demand; Sulfur dioxide; Carbon dioxide; Particulate matter; PM2.5; Ammonia nitrogen; Nitrogen oxides; Atmospheric pollution; Pollutants; Airborne dust; Dustfall; Waste; Garbage; Emissions.

(continued on next page)

Table 1 (continued)

Objective	Dimension	Keywords
	Energy consumption	Water consumption; Energy consumption; Resource depletion; Conservation; Intensification; Energy resources; Renewable energy; Clean energy; Coal-to-electricity conversion; Coal-to-gas conversion; Centralized heating; Reuse; Recycling.
	Environmental governance	Environmental protection; Pollution prevention and control; Pollution abatement; Pollution governance; Pollution control; Wastewater treatment; Sewage treatment; Environmental impact assessment; Environmental inspection; Harmless treatment of household waste; River chief system; Lake chief system; Environmental cooperation; Coordinated governance; Interdepartmental collaboration; Public participation; Border areas; Resource sharing; Transfer; Joint prevention; Joint control; Joint governance; Integrated watershed management; Collaborative protection; Synergistic pollution control.

Appendix 2

Table 2

Variable definition.

Variables	Variable description
<i>DIGIT</i>	Natural logarithm of one plus the count of digital transformation-related terms in corporate annual reports.
<i>GESITY</i>	Ratio of specific environmental-related terms to the total number of words in government reports.
<i>GEATTI</i>	The results are obtained by analyzing the environmental protection-related text set in government work reports using the sentiment tendency analysis module in the Baidu AI Open Platform.
<i>PERGDP</i>	Ratio of regional gross domestic product to total population.
<i>PRESS</i>	(regional fiscal expenditure - fiscal revenue) / fiscal revenue
<i>POP</i>	Ratio of urban employed population to the year-end registered population.
<i>ASSET</i>	Logarithm of one plus total assets.
<i>LEV</i>	Ratio of total liabilities to total assets.
<i>ROA</i>	Ratio of net profit to average total assets.
<i>PPE</i>	Ratio of net fixed assets to total assets.
<i>CASH</i>	Ratio of operating cash flow to total assets.
<i>DIRTOR</i>	Logarithm of the total number of members on the corporate board of directors.
<i>SOE</i>	1 is assigned to state-owned enterprises; 0 otherwise.
<i>FIRST</i>	Equity ownership percentage held by the largest shareholder.
<i>INDEP</i>	Ratio of independent to total directors on the board.
<i>DUAL</i>	1 is assigned when the Chairman also serves as the CEO, 0 otherwise.
<i>HHI</i>	Primary business revenue-to-industry total revenue ratio.
<i>FIRM</i>	A set of dummy variables representing plants.
<i>YEAR</i>	A set of dummy variables representing years.
<i>INDUSTRY</i>	Industry Dummy Variable Set, using the two-digit industry codes specified in the 2012 “Guidelines for Industry Classification” by the China Securities Regulatory Commission.
<i>CITY</i>	A set of dummy variables representing prefecture-level cities.

Appendix 3

This study employs a Generalized Additive Model (GAM) to investigate the relationship between government environmental attention and EDT. The GAM uses non-linear smoothing terms for model fitting, avoiding the need for predetermined specifications of how dependent and independent variables interact. This approach helps validate possible linear associations among variables. Following Parteka (2010), this study formulates specification (1) to assess the link between government environmental attention and EDT.

$$DIGIT_{fict} = g(GEFOCUS_{ct}) + CONS_{fict} + \varepsilon_{fict} \quad (1)$$

where $g(\cdot)$ acts as a smoothing function to reveal the interrelation between government environmental attention and EDT. The interpretations of other parameters are in line with those discussed in the basic specification (1). Assuming the kernel density estimation of the stochastic variable $g(GEFOCUS_{ct})$ follows a Gaussian kernel function, the equation conforms to the distribution specified by model (2):

$$f_x(x_i, x_0, h) = \frac{1}{\sqrt{2\pi}} \exp \left[-\frac{(x_i - x_0)^2}{2h^2} \right] \quad (2)$$

In Eq. (2), $f_x(x_i, x_0, h)$ represents the probability density of x_i at x_0 , with h as the smoothing parameter controlling the bandwidth around x_0 . A larger bandwidth implies a finer kernel density estimation for x_i near x_0 . Estimation outcomes from the GAM are displayed in Fig. 4 of the main text.

Data availability

Data will be made available on request.

References

Acemoglu, D., Johnson, S., Robinson, J.A., 2005. Institutions as a fundamental cause of long-run growth. In: *Handbook of Economic Growth*, 1, pp. 385–472.

- Ai, Y., Chi, Z., Sun, G., Zhou, H., Kong, T., 2023. The research on non-linear relationship between enterprise digital transformation and stock price crash risk. *N. Am. J. Econ. Finance* 68, 101984.
- Bao, R., Liu, T., 2022. How does government attention matter in air pollution control? Evidence from government annual reports. *Resour. Conserv. Recycl.* 185, 106435.
- Chen, J., Zhu, D., Ding, S., Qu, J., 2023a. Government environmental concerns and corporate green innovation: evidence from heavy-polluting enterprises in China. *Bus. Strateg. Environ.* 1–17.
- Chen, Y., Cheng, L., Lee, C.-C., Wang, C.-s., 2021. The impact of regional banks on environmental pollution: evidence from China's city commercial banks. *Energy Econ.* 102, 105492.
- Chen, Z., Kahn, M.E., Liu, Y., Wang, Z., 2018. The consequences of spatially differentiated water pollution regulation in China. *J. Environ. Econ. Manag.* 88, 468–485.
- Chen, Z., Xiao, Y., Jiang, K., 2023b. The impact of tax reform on firms' digitalization in China. *Technol. Forecast. Soc. Chang.* 187, 122196.
- Cheng, Y., Zhou, X., Li, Y., 2023. The effect of digital transformation on real economy enterprises' total factor productivity. *Int. Rev. Econ. Financ.* 85, 488–501.
- Chwilkowska-Kubala, A., Cyfert, S., Malewska, K., Mierzejewska, K., Szumowski, W., 2023. The impact of resources on digital transformation in energy sector companies. The role of readiness for digital transformation. *Technol. Soc.* 74, 102315.
- Czarnitzki, D., Hanel, P., Rosa, J.M., 2011. Evaluating the impact of R&D tax credits on innovation: a microeconomic study on Canadian firms. *Res. Policy* 40 (2), 217–229.
- Du, S., Ma, L., Li, Z., Ma, C., 2023. Non-family shareholder governance and the digital transformation of family firms: evidence from China. *Corp. Gov.: Int. Rev.* 32 (1), 89–115.
- Fang, Z., Kong, X., Sensoy, A., Cui, X., Cheng, F., 2021. Government's awareness of environmental protection and corporate green innovation: a natural experiment from the new environmental protection law in China. *Econ. Anal. Policy* 70, 294–312.
- Guandalini, I., 2022. Sustainability through digital transformation: a systematic literature review for research guidance. *J. Bus. Res.* 148, 456–471.
- Guo, X., Li, M., Wang, Y., Mardani, A., 2023. Does digital transformation improve the firm's performance? From the perspective of digitalization paradox and managerial myopia. *J. Bus. Res.* 163, 113868.
- Ha, L.T., Huang, T.T.L., Thanh, T.T., 2022. Is digitalization a driver to enhance environmental performance? An empirical investigation of European countries. *Sustain. Prod. Consum.* 32, 230–247.
- Hadlock, C.J., Pierce, J.R., 2010. New evidence on measuring financial constraints: moving beyond the KZ index. *Rev. Financ. Stud.* 23 (5), 1909–1940.
- Hamann-Lohmer, J., Bendig, M., Lasch, R., 2023. Investigating the impact of digital transformation on relationship and collaboration dynamics in supply chains and manufacturing networks – a multi-case study. *Int. J. Prod. Econ.* 262, 108932.
- He, Q., Lassala, C., Currás-Móstoles, R., 2024. Can family CEOs promote enterprises' digital transformation? An analysis based on ability-willingness paradox. *Int. Entrep. Manag. J.* 1–25.
- Hu, Y., Che, D., Wu, F., Chang, X., 2023. Corporate maturity mismatch and enterprise digital transformation: evidence from China. *Financ. Res. Lett.* 53, 103677.
- Huang, Y., Gao, Y., 2023. Labor protection and the digital transformation of enterprises: empirical evidence from China's social insurance law. *Financ. Res. Lett.* 57, 104169.
- Indriastuti, M., Fuad, K., 2020. Impact of covid-19 on digital transformation and sustainability in small and medium enterprises (smes): a conceptual framework. In: Paper Presented at the Conference on Complex, Intelligent, and Software Intensive Systems.
- Li, C., Huo, P., Wang, Z., Zhang, W., Liang, F., Mardani, A., 2023a. Digitalization generates equality? Enterprises' digital transformation, financing constraints, and labor share in China. *J. Bus. Res.* 163, 113924.
- Li, G., Jin, Y., Gao, X., 2023b. Digital transformation and pollution emission of enterprises: evidence from China's micro-enterprises. *Energy Rep.* 9, 552–567.
- Li, L., 2022. Digital transformation and sustainable performance: the moderating role of market turbulence. *Ind. Mark. Manag.* 104, 28–37.
- Li, M., Liu, N., Kou, A., Chen, W., 2023c. Customer concentration and digital transformation. *Int. Rev. Financ. Anal.* 89, 102788.
- Li, Q., Tang, Y., Wei, W., et al., 2024. Environmental decentralization, local governments' environmental attention and environmental pollution: an empirical evidence from establishment of River Chief System in China. *Environ. Dev. Sustain.* <https://doi.org/10.1007/s10668-023-04424-1>.
- Li, S., Gao, L., Han, C., Gupta, B., Alhalabi, W., Almakdi, S., 2023d. Exploring the effect of digital transformation on Firms' innovation performance. *J. Innov. Knowl.* 8 (1), 100317.
- Li, S., Miao, X., Feng, E., Liu, Y., Tang, Y., 2023e. Urban governmental environmental attention allocation: evidence from China. *J. Urban Plan. Dev.* 149 (1).
- Liao, Z., Lu, J., Yu, Y., Zhang, Z., 2022. Can attention allocation affect firm's environmental innovation: the moderating role of past performance. *Tech. Anal. Strat. Manag.* 34 (9), 1081–1094.
- Liu, X., Cifuentes-Faura, J., Zhao, S., Wang, L., 2023a. Government environmental attention and carbon emissions governance: firm-level evidence from China. *Econ. Anal. Policy* 80, 121–142.
- Liu, X., Cifuentes-Faura, J., Zhao, S., Wang, L., 2024. The impact of government environmental attention on firms' ESG performance: evidence from China. *Res. Int. Bus. Financ.* 67, 102124.
- Liu, Z., Tang, Y., Wilson, J., Tao, X., Lv, B., Wang, Z., et al., 2023b. Influence of government attention on environmental quality: an analysis of 30 provinces in China. *Environ. Impact Assess. Rev.* 100, 107084.
- Lu, Y., Xu, C., Zhu, B., Sun, Y., 2023. Digitalization transformation and ESG performance: evidence from China. *Bus. Strateg. Environ.* 33 (2), 352–368.
- Luo, Y., Cui, H., Zhong, H., Wei, C., 2023. Business environment and enterprise digital transformation. *Financ. Res. Lett.* 57, 104250.
- Meng, X., Kong, F., Fu, H., Li, S., Zhang, K., 2024. Is more always better? How government ecological attention influences corporate environmental responsibility: empirical evidence from Chinese listed companies. *Ecol. Indic.* 159, 111686.
- Meyer, J.W., Rowan, B., 1977. Institutionalized organizations: formal structure as myth and ceremony. *Am. J. Sociol.* 83 (2), 340–363.
- Mukul, E., Büyükoçkan, G., 2023. Digital transformation in education: a systematic review of education 4.0. *Technol. Forecast. Soc. Chang.* 194, 122664.
- Nguyen, D.K., Broekhuizen, T., Dong, J.Q., Verhoef, P.C., 2023. Leveraging synergy to drive digital transformation: a systems-theoretic perspective. *Inf. Manag.* 60 (7), 103836.
- Niu, G., Jin, X., Wang, Q., Zhou, Y., 2022. Broadband infrastructure and digital financial inclusion in rural China. *China Econ. Rev.* 76, 101853.
- Ocasio, W., 1997. Towards an attention-based view of the firm. *Strateg. Manag. J.* 18 (S1), 187–206.
- O'Sullivan, J.N., 2020. The social and environmental influences of population growth rate and demographic pressure deserve greater attention in ecological economics. *Ecol. Econ.* 172.
- Parteka, A., 2010. Employment and export specialisation along the development path: some robust evidence. *Rev. World Econ.* 145 (4), 615–640.
- Posner, M.I., Rothbart, M.K., 2007. Research on attention networks as a model for the integration of psychological science. *Annu. Rev. Psychol.* 58, 1–23.
- Ren, S., Jiang, K., Tang, G., 2022. Leveraging green HRM for firm performance: the joint effects of CEO environmental belief and external pollution severity and the mediating role of employee environmental commitment. *Hum. Resour. Manag.* 61 (1), 75–90.
- Ren, T., Liu, X., Ding, J., 2023. Intergenerational dynamics of digital transformation in family firms. *Technol. Soc.* 74, 102261.
- Shi, P., Yin, L., Wu, C., 2023. Voting by mouth: media attention and environmental governance. *Environ. Sci. Pollut. Res.* 30 (47), 103996–104014.
- Su, Z., Guo, Q., Lee, H.-T., 2022. Green finance policy and enterprise energy consumption intensity: evidence from a quasi-natural experiment in China. *Energy Econ.* 115, 106374.
- Suchman, M.C., 1995. Managing legitimacy - strategic and institutional approaches. *Acad. Manag. Rev.* 20 (3), 571–610.
- Sun, C., Zhang, Z., Vochozka, M., Vozňáková, I., 2022. Enterprise digital transformation and debt financing cost in China? s A-share listed companies. *Oecon. Copernic.* 13 (3), 783–829.
- Tao, Y., Lu, H., Ye, Y., Wu, H., 2024. Does the firms' digital transformation drive environmental innovation in China? *Sustain. Dev.* 32 (3), 2139–2152. <https://doi.org/10.1002/sd.2769>.
- Wan, Q., Miao, X., Afshan, S., 2022. Dynamic effects of natural resource abundance, green financing, and government environmental concerns toward the sustainable environment in China. *Resour. Policy* 79.
- Wen, H., Zhong, Q., Lee, C.-C., 2022. Digitalization, competition strategy and corporate innovation: evidence from Chinese manufacturing listed companies. *Int. Rev. Financ. Anal.* 82, 102166.
- Wen, J., Deng, Y., 2023. How does intellectual property protection contribute to the digital transformation of enterprises? *Financ. Res. Lett.* 104340.
- Wu, W., Wang, S., Jiang, X., Zhou, J., 2023. Regional digital infrastructure, enterprise digital transformation and entrepreneurial orientation: empirical evidence based on the broadband China strategy. *Inf. Process. Manag.* 60 (5), 103419.
- Yan, L., Ling, X., Wang, Z., Xu, Y., 2023. Can mixed-ownership reform boost the digital transformation of state-owned enterprises? *Econ. Anal. Policy* 79, 647–663.
- Yang, G., Nie, Y., Li, H., Wang, H., 2023a. Digital transformation and low-carbon technology innovation in manufacturing firms: the mediating role of dynamic capabilities. *Int. J. Prod. Econ.* 263, 108969.
- Yang, Y., Chen, W., Yu, Z., 2023b. Local government debt and corporate digital transformation: evidence from China. *Financ. Res. Lett.* 57, 104282.
- Yu, H., Peng, F., Yuan, T., Li, D., Shi, D., 2023. The effect of low-carbon pilot policy on low-carbon technological innovation in China: reexamining the porter hypothesis using difference-in-difference-in-differences strategy. *J. Innov. Knowl.* 8 (3), 100392.
- Zaoui, F., Souissi, N., 2020. Roadmap for digital transformation: a literature review. *Procedia Comput. Sci.* 175, 621–628.
- Zhai, H., Yang, M., Chan, K.C., 2022. Does digital transformation enhance a firm's performance? Evidence from China. *Technol. Soc.* 68, 101841.
- Zhang, H., Dong, S., 2023. Digital transformation and firms' total factor productivity: the role of internal control quality. *Financ. Res. Lett.* 57, 104231.
- Zhang, W., Zhang, T., Wang, S., Li, H., 2023a. CO2 emission spillover effects in the digital transformation of China's manufacturing industry and its inter-industry differences. *Energy Rep.* 10, 520–534.
- Zhang, Z., Dai, X., Ding, Y., 2023b. Government environmental governance and firms' green innovation: evidence from listed firms in heavy pollution industries of China. *Financ. Res. Lett.* 55, 103848.
- Zhao, X., Cai, L., 2023. Digital transformation and corporate ESG: evidence from China. *Financ. Res. Lett.* 58, 104310.
- Zhao, X., Zhao, L., Sun, X., Xing, Y., 2023. The incentive effect of government subsidies on the digital transformation of manufacturing enterprises. *Int. J. Emerg. Mark.* <https://doi.org/10.1108/IJOEM-05-2022-0766>.
- Zhou, X.G., 1993. Unorganized interests and collective action in communist-China. *Am. Sociol. Rev.* 58 (1), 54–73.

- Zhou, X.G., Zhao, W., Li, Q., Cai, H., 2003. Embeddedness and contractual relationships in China's transitional economy. *Am. Sociol. Rev.* 68 (1), 75–102.
- Zhuo, C., Chen, J., 2023. Can digital transformation overcome the enterprise innovation dilemma: effect, mechanism and effective boundary. *Technol. Forecast. Soc. Chang.* 190, 122378.
- Ziaie, A., ShamiZanjani, M., Manian, A., 2021. Systematic review of digital value propositions in the retail sector: new approach for digital experience study. *Electron. Commer. Res. Appl.* 47, 101053.
- Zucker, L.G., 1977. The role of institutionalization in cultural persistence. *Am. Sociol. Rev.* 726–743.

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