



# Research on the Mechanism of Digital Government Development's Impact on Corporate Green Transformation

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**Abstract:** Against the backdrop of digital-green integration, whether and how digital government drives corporate green transformation is key to advancing both “Digital China” and “dual carbon” goals. Using 2014–2023 panel data of A-share listed firms, this paper employs a DID model based on the 2018 National Comprehensive Pilot Program for Electronic Government to assess the impact of digital government on corporate green transformation. Results show that digital government significantly promotes such transformation, with robustness confirmed. Heterogeneity analysis reveals stronger effects in SOEs, eastern regions, and urban clusters. Mechanism tests identify three pathways: digital transformation, green technology innovation, and environmental regulation optimization. This study offers empirical insights for optimizing digital governance and green policies during the 15th Five-Year Plan period.

**Keywords:** digital government; corporate green transformation; digital transformation; green technology innovation; environmental regulation

## 1. Introduction

As China transitions from the 14th to the 15th Five-Year Plan, digital and green transformations have become central to national competitiveness. The Third Plenary Session of the 20th CPC Central Committee (2024) called for accelerating Digital China and improving green development policies. Against this backdrop, digital-green integration is a strategic path for high-quality growth.

Digital governance offers new opportunities for corporate green transformation. Key policies — including the 14th Five-Year Plan for Digital Economy (2021) and the State Council’s 2022 guidelines — have positioned digital government as foundational to building a cyber power and Digital China. Technologies like AI and big data are now key drivers of economic and governmental transformation.

Since the 2020 dual carbon goals, green transformation has become imperative. However, firms face rising costs and limited green tech capabilities. While policy pressure is a known driver, leveraging digital government to overcome these barriers is essential for advancing both Digital China and dual carbon goals.

This paper examines how digital government influences corporate green transformation. Contributions: (1) integrates public administration, environmental economics, and information science; (2) combines causal inference, text analysis, and mechanism testing via a quasi-natural experiment; (3) identifies three pathways — digital transformation, green innovation, and regulation optimization — offering insights for firms navigating digital government contexts.

## 2. Policy Context and Literature Review

### 2.1 Policy Background

In 2017, the 19th CPC National Report first positioned “Digital China” as a national strategy. The 14th Five-Year Plan (2020) outlined its implementation. Digital government represents the tech-enabled evolution of e-government, enhancing governance efficiency.

In December 2017, the Cyberspace Administration and NDRC launched the “National Comprehensive E-Government Pilot Program” in provinces like Beijing, Shanghai, and Zhejiang. The policy focuses on coordination, infrastructure, data management, services, and e-documents, aiming to modernize governance and accelerate digital transformation.

### 2.2 Literature Review

Digital economy growth has made digital government a key research area. Studies explore its role in social governance, common prosperity, sustainable development, business environment, and governance modernization. Macro-level findings show e-government reduces informality and boosts trade. Micro-level studies indicate digital governance enhances firm investment efficiency and innovation.

Under dual carbon goals, corporate green transformation is critical. Research highlights external factors, market incentives, digital finance, and technology. Policy uncertainty can hinder transformation, while new energy city pilots and digital transformation promote it. Digital tools improve information disclosure, resource allocation, and innovation.

Recent work links digital governance to green behavior. Digital governments improve transparency, reduce costs, and enable real-time environmental monitoring. They also offer incentives like tax breaks and financing for green firms. Institutional pathways — external environment and internal governance — are also explored.

However, most studies treat digital government and green transformation separately. Few examine them within a digital-green integration framework. This paper addresses that gap by using a DID model and mechanism testing to analyze how digital government drives corporate green transformation.

### **3. Theoretical Analysis and Research Hypotheses**

#### **3.1 Digital Government and Corporate Green Transformation**

Digital government uses big data, AI, and blockchain to modernize governance. It promotes green development by improving resource allocation and transparency. Studies show digital government boosts green innovation and urban green development. Public data openness enhances environmental transparency and green R&D. Thus, hypothesis H1: Digital government promotes corporate green transformation.

#### **3.2 Mechanisms of Influence**

##### **(1) Digital Transformation.**

Digital transformation helps firms overcome high energy use and inefficiency. Digital government platforms guide tech integration and open data access, reducing costs and boosting green innovation. Hypothesis H2: Digital government promotes green transformation via digital transformation.

##### **(2) Green Technology Innovation.**

Green innovation is key to transformation but needs support. Digital government enhances access to subsidy info and transparency, encouraging genuine innovation and curbing greenwashing. Hypothesis H3: Digital government drives green transformation via green technology innovation.

##### **(3) Environmental Regulations.**

Formal regulations often hinder green transformation due to rigid enforcement. Digital government enables real-time monitoring and precise enforcement, improving efficiency and reducing compliance costs. Hypothesis H4: Digital government promotes green transformation via optimized environmental regulation.

### **4. Research Design**

#### **4.1 Data Sources**

Data from 2014–2023 on A-share listed firms. Excluded financial, ST, and firms with missing data. Winsorized at 1%. Final sample: 34,936 observations. Green patents from CNRDS, transformation data from annual reports, regulation data from NBS, controls and digital data from CSMAR.

#### **4.2 Variable Selection**

##### **(1) Dependent Variable.**

This study references He Xiaoping's compilation of 113 green keywords spanning six categories, including green supply chain management and green manufacturing. Python was employed to conduct text analysis on listed companies' annual reports, counting the total frequency of green transformation keywords in each report. To account for text length variations, the indicator measurement follows the methodology proposed by Kuang Chang'e et al. The total keyword frequency is divided by the total word count of the text content and then multiplied by 100. Given the right-skewed distribution of the data, the frequency of relevant keywords is increased by 1 and then taken to the natural logarithm to obtain the Enterprise Green Transformation (EGT) indicator.

##### **(2) Explanatory Variable.**

Digital government (Egov) is proxied by the National Comprehensive E-Government Pilot Program, following Wang Lei et al. The city dummy equals 1 for pilot provinces and 0 otherwise; the year dummy equals 1 for 2018 and later and 0 otherwise.

##### **(3) Control Variables.**

Firm Size, Firm Age, Leverage, ROA, Top1 and Tobin's Q

(4) Mechanism Variables.

(1) Digital Transformation Index (DTI): a standardized composite index from CSMAR, covering strategic, technological, organizational, environmental, and digital application dimensions.

(2) Green Technology Innovation (GTI): log of total green patent applications (invention + utility model) plus one, following Xu Jia et al.

(3) Formal Environmental Regulation (FER): ratio of industrial pollution control investment to industrial value-added, multiplied by 100, following Ren Guangqian et al.

### 4.3 Model Specification

The model is constructed as follows:

$$EGT = \beta_0 + \beta_1 Egov_{it} + \beta_2 X_{it} + \lambda_i + \mu_t + \varepsilon_{it} \quad (1)$$

Here,  $i$  and  $t$  index firm and year;  $EGT$  is the dependent variable;  $Egov$  denotes digital government;  $X_{it}$  is a vector of controls;  $\lambda_i$  and  $\mu_t$  are firm and year fixed effects;  $\varepsilon_{it}$  is the error term.

To test research hypotheses H2 through H4, this paper constructs mediation effect model (2):

$$MV_{it} = \alpha_0 + \alpha_1 Egov_{it} + \alpha_2 X_{it} + \lambda_i + \mu_t + \varepsilon_{it} \quad (2)$$

In Model (2),  $MV$  serves as the mediating variable.

## 5. Empirical Analysis

### 5.1 Descriptive Statistics

Table 1 reports descriptive statistics. Mean EGT is 0.0080 (SD=0.014). Mean Egov is 0.3042 (SD=0.460), indicating 30.42% of firms are in regions with developed digital government. Other variables are within normal ranges.

Table 1. Descriptive Statistics

Var	Obs	Mean	Std	Min	Max
EGT	34936	0.0080	0.014	0.0000	0.0826
Egov	34936	0.3042	0.460	0.0000	1.0000
Size	34936	22.2930	1.302	20.0151	26.3686
Age	34936	2.6159	0.614	1.0986	3.4965
Lev	34936	0.4162	0.206	0.0572	0.9072
ROA	34936	0.0324	0.066	-0.2791	0.1927
Top1	34936	33.1503	14.584	8.6300	72.8000
TobinQ	34936	2.0499	1.298	0.8239	8.8070
DTI	34162	36.7603	10.960	7.3625	68.3545
GTI	34936	1.3786	1.443	0.0000	5.8805
FER	34731	0.9529	0.233	0.0000	1.9056

### 5.2 Benchmark Regression

Using model (1), Table 2 shows Egov is positively significant at 1% across all specifications, validating H1. The coefficient remains stable after adding controls. Columns (2), (3), and (4) present estimation results incorporating control variables. The results show that the coefficient for Egov remains positively correlated with corporate green transformation indicators at the 1% significance level.

Table 2. Benchmark Regression Results

	(1)	(4)
	EGT	EGT
Egov	0.00436*** (12.17)	0.00292*** (8.38)
Size		0.00387***

	(1)	(4)
	EGT	EGT
		(19.17)
Age		-0.00718***
		(-4.87)
Lev		0.00200**
		(2.19)
ROA		-0.00621***
		(-3.69)
Top1		-0.0000472***
		(-3.61)
TobinQ		0.0000886
		(0.98)
_cons	0.00663***	-0.0597***
	(60.86)	(-10.18)
individual	YES	YES
year	YES	YES
N	34932	34932
r <sup>2</sup>	0.316	0.357

Note: (1) \*\*\*, \*\*, and \* denote significance levels of 1%, 5%, and 10%, respectively; (2) Values in parentheses represent t-values adjusted for cluster-wise robust standard errors. The same applies to subsequent sections.

### 5.3 Parallel Trends Test

To satisfy the parallel trends assumption, this study follows Beck (2010) using the pre-policy period as baseline. Figure 1 shows pre-policy coefficients are near zero and insignificant. Post-2018 coefficients are significantly positive (with a lag), indicating the policy has a positive and persistent impact on corporate green transformation.

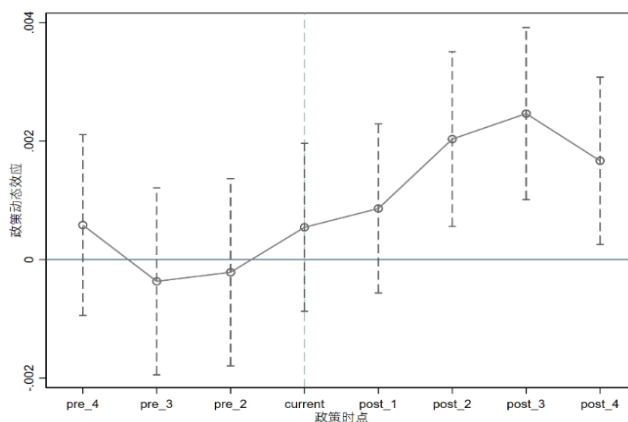


Figure 1. Parallel Trend Analysis

### 5.4 Robustness Tests

#### (1) Placebo Test.

To rule out unobservable factors, this study conducts a placebo test by randomly assigning policy years 500 times. The resulting coefficients center around zero and follow a normal distribution, confirming the robustness of the benchmark estimates.

#### (2) PSM-DID Test.

To mitigate selection bias, this study applies annual 1:1 nearest neighbor PSM using control variables as covariates. Regression on the matched sample (Table 3 Col 1) confirms the robustness of the findings.

#### (3) Replacing Key Variables.

Given that EGT based on keyword frequency may be influenced by greenwashing, this study follows Li Wenjing and Zheng Manni (2016) by using the logged value of green patent applications plus one as a substantive green transition indicator

(RGT). Replacing the dependent variable with RGT in model (1) yields consistent results (Table 3 Col 2), confirming robustness.

(4) Eliminating Interference from Related Policies.

To exclude interference from concurrent policies, this study controls for the “Information for the People Pilot Policy” and the “Big Data Comprehensive Pilot Zone Policy” by including their year dummies in model (1). The regression coefficient for Egov remains significantly positive at the 1% level (Table 3 Col 3), confirming the robustness of the core findings.

**Table 3. Robustness Tests**

	(1)	(2)	(3)
	PSM-DID	Replace variable	Eliminate relevant policies
Egov	0.00250*** (4.88)	0.0336*** (2.80)	0.00199*** (4.57)
information			0.00227*** (5.79)
big_data			0.000785* (1.70)
_cons	-0.0650*** (-7.90)	1.064*** (6.25)	-0.0595*** (-10.16)
individual	YES	YES	YES
year	YES	YES	YES
N	14998	34932	34932
r2	0.471	0.763	0.359

## 6. Further Analysis

### 6.1 Heterogeneity Analysis

(1) State-Owned vs. Non-State-Owned Enterprises.

Digital government significantly promotes green transformation in both groups at the 1% level (Table 4 Col 1-2), but the effect is stronger in SOEs. Bootstrap tests confirm significant group differences, likely because SOEs leverage closer government ties to better utilize policy dividends.

(2) Eastern vs. Central-Western Regions.

The effect is significant in eastern regions but not in central-western regions (Table 4 Col 3-4). This disparity reflects the east’s advanced economy, higher marketization, and better digital infrastructure, which provide stronger institutional support for digital government empowerment.

(3) Urban Agglomerations vs. Non-Agglomerated Areas.

Digital government significantly promotes green transformation in both settings (Table 4 Col 5-6), but the effect is stronger in urban agglomerations (Beijing-Tianjin-Hebei, Yangtze River Delta, Pearl River Delta). This is attributed to higher economic concentration, stronger industrial synergy, and greater advantages in data sharing and policy coordination.

**Table 4. Test for Heterogeneity**

	(1)	(2)	(3)	(4)	(5)	(6)
	SOE	N-SOE	Eastern	Central-Western	Urban-Agg	Non_Agg
Egov	0.00491*** (6.60)	0.00222*** (5.68)	0.00333*** (8.46)	0.00178 (0.98)	0.00421*** (9.81)	0.00233** (2.20)
_cons	-0.0691*** (-7.23)	-0.0575*** (-7.47)	-0.0625*** (-8.49)	-0.0781*** (-4.19)	-0.0579*** (-6.73)	-0.0786*** (-6.27)
individual	YES	YES	YES	YES	YES	YES
year	YES	YES	YES	YES	YES	YES
N	10208	24724	25052	9880	20873	14059
r <sup>2</sup>	0.345	0.388	0.431	0.579	0.449	0.526

## 6.2 Mechanism Analysis

(1) Digital Transformation Empowers Corporate Green Transition.

The Egov coefficient is significantly positive at the 5% level (Table 5 Col 1), supporting H2. Digital government enhances corporate digitalization via infrastructure and service platforms, enabling firms to optimize processes and improve resource efficiency.

(2) Green Technology Innovation Drives Corporate Green Transformation.

The Egov coefficient is significantly positive at the 1% level (Table 5 Col 2), supporting H3. Digital government stimulates green innovation by improving the innovation environment, providing R&D subsidies, and fostering industry-academia-research collaboration.

(3) Environmental Regulation Optimization Boosts Corporate Green Transformation.

The Egov coefficient is significantly negative at the 1% level (Table 5 Col 3), supporting H4. Digital governance enables precise, intelligent environmental oversight, replacing rigid command-and-control regulations with efficient non-coercive tools like real-time monitoring, thereby reducing regulatory burden while promoting green transformation.

Table 5. Mechanism Testing

	(1)	(2)	(3)
	DTI	GTI	FER
Egov	0.239** (2.13)	0.0582*** (3.22)	-0.0298*** (-6.56)
_cons	37.51*** (24.10)	1.423*** (5.44)	0.957*** (13.23)
individual	YES	YES	YES
year	YES	YES	YES
N	34009	34932	34714
r <sup>2</sup>	0.865	0.765	0.343

## 7. Research Findings and Policy Recommendations

### 7.1 Conclusions

- (1) Digital government significantly promotes corporate green transformation.
- (2) Mechanisms include digital transformation, green innovation, and regulation optimization.
- (3) Effects stronger in SOEs, eastern regions, and urban clusters.

### 7.2 Policy Recommendations

- (1) Strengthen top-level digital government design with green goals embedded.
- (2) Leverage digital government's dual role to support green innovation and curb greenwashing.
- (3) Upgrade environmental regulations via smart monitoring and credit systems.

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