

Do Environmentally Conscious Executives Truly Promote Corporate Green Technology Innovation?—From the Perspective of Governance Pressure and Signaling

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Abstract: Combining higher-order theory and signaling theory, this study selects A-share listed companies from 2012 to 2022 as research subjects to empirically examine the intrinsic relationship between top management teams' environmental backgrounds and corporate green technology innovation. From the perspectives of governance pressure and resource-based view, the boundary conditions of this relationship are further explored. The findings reveal: (1) Top management teams' environmental backgrounds have a significantly positive impact on corporate green technology innovation. (2) Public environmental concern, analyst attention, corporate social responsibility information quality, and corporate social status all positively moderate the relationship between top management teams' environmental backgrounds and corporate green technology innovation. (3) In state-owned enterprises, the enhancing effect of top management teams' environmental backgrounds on green technology innovation is more pronounced compared to non-state-owned enterprises.

Keywords: Executive Environmental Background; Green Technology Innovation; Governance Pressure; Signaling

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1.Introduction

In the report of the 20th National Congress of the Communist Party of China, the concept of “promoting green development and achieving harmonious coexistence between humans and nature” was emphasized. In a market economy system, enterprises, as core participants, play a crucial role in promoting overall green development through their green innovation practices. Specifically, green technology innovation refers to a series of corporate behaviors aimed at reducing environmental pollution and opening up emerging market opportunities through technological and product innovation methods^[1]. Green technology innovation at the enterprise level constitutes a key path for promoting sustainable economic and social development and high-quality progress^[2]. It can not only promote the leap of enterprise transformation and upgrading, but also have a significant promoting effect on the achievement of the national goals of “carbon peak and carbon neutrality”^[3]. And further became the core driving force behind the global trend of green development. Given this, it is particularly important to explore effective strategies to motivate enterprises to implement green innovation activities.

Currently, research on the preconditions for the effectiveness of green technology innovation in enterprises mostly focuses on external dimensions, including institutional environment, market dynamics, and pressure exerted by stakeholders. In fact, compared to traditional technological innovation, green technological innovation represents a deep innovation of existing

technologies, which is more complex, expensive, and covers a wider range of knowledge systems. Therefore, relying solely on external forces to drive the green innovation process of enterprises may limit their effectiveness and make it difficult to fully guarantee their sustainable development^[4]. More importantly, enterprises need to start from within, implement green concepts from top to bottom, attach importance to the allocation of green resources, and provide strong support for green technology innovation activities, especially in key decisions and action plans. According to high-order theory, as the leader and promoter of enterprise development, if the senior management team of a company has an “environmental background”, it is highly likely to have a profound and comprehensive promoting effect on green technology innovation activities^[5]. Based on this, we speculate that senior management teams with environmental backgrounds demonstrate stronger willingness for green technology innovation. They value the long-term development and green transformation issues of the enterprise, and will provide solid support for the enterprise to carry out green technology innovation activities from multiple dimensions such as strategic planning, supply chain optimization, research and development activities, and production processes through decision-making and resource allocation, which is conducive to improving the enterprise’s green technology innovation performance. Unfortunately, there have been few scholars in previous studies who have delved into the impact mechanism of the environmental preferences of senior management teams on the effectiveness of green technology innovation. This provides an opportunity for this study to further explore the above issues.

At present, there is still a lack of exploration in the field of green technology innovation for enterprises. From the perspective of driving factors, the promotion of green technology innovation in enterprises is not only closely related to the characteristics of managers themselves, but also inseparable from the pressure exerted by external stakeholders and the resource capabilities of the enterprise itself^[6]. According to higher-order theory, the diversity of personality traits among senior management not only shapes their management style, but also guides the determination of corporate strategic direction and the selection of management measures, thereby profoundly affecting the performance of the enterprise^[7]. However, to fully leverage this influence, it also relies on the synergistic effect of external supervision and governance mechanisms. In this context, the public and analysts, as important components of informal supervision mechanisms, can exert significant influence on multiple dimensions such as business operations, implementation of environmental protection measures, and performance improvement. In addition, based on the resource-based theory, enterprises have different tangible and intangible resources that can be transformed into unique capabilities. Resources are non transferable and difficult to replicate between enterprises, and these unique resources and capabilities are the source of sustained competitive advantage for enterprises. From the perspective of signal transmission, organizations with higher status have a stronger ability to acquire opportunities and intangible or tangible resources than those with lower status^[8]. At the same time, good corporate social responsibility performance strengthens the connection between the company and stakeholders, not only optimizing the company’s public image, but also promoting the improvement of employee skills and labor input, which is conducive to winning the recognition and support of stakeholders and laying a solid foundation for obtaining various resources needed for green innovation.

In summary, the willingness, resources, and opportunities of executives with environmental backgrounds to carry out green technology innovation play an important role in promoting the green transformation of enterprises. This article takes Chinese A-share listed companies from 2012 to 2022 as the research object, and empirically tests the relationship between the background of environmental executives and corporate green technology innovation. The contribution of this article is: (1) This study enriches the scope of exploration on the influencing factors at the managerial level in corporate green innovation. (2) In depth exploration of the boundary conditions under which executive characteristics affect corporate green technology innovation activities in the context of environmental protection aims to provide theoretical insights and inspirations for effectively utilizing managers’ environmental tendencies and reducing potential obstacles to corporate green innovation.

2.Literature review and research hypotheses

2.1 Environmental background and green technology innovation of the executive team

Based on high-order theory, multiple factors such as age, gender composition, professional experience, length of service, and educational background of senior management personnel in enterprises have a shaping effect on their personal value orientation, management skills, and management background characteristics^[7]. These characteristics further affect the

leadership style of managers, the choice of corporate strategic direction, and the final management decision-making process, thereby deeply influencing the overall performance of the enterprise. In other words, the diversity of personal characteristics of executives not only shapes their management style, but also determines the strategic positioning and management actions of the enterprise, ultimately having a profound impact on enterprise performance. Therefore, this article believes that the environmental background of the executive team is beneficial for improving the performance of green technology innovation in enterprises.

The environmental background of the executive team brings abundant green resources to the enterprise, formulates and maintains policies and systems conducive to green technology innovation, tilts towards green innovation in internal management, and effectively predicts and controls the uncertainty of green innovation. Executives with environmental experience can obtain scarce green resources in social organizations through their social status, providing more abundant social resource guarantees for green technology innovation in enterprises and improving their green technology innovation performance^[9]. Corporate executives with environmental experience have a higher level of attention to sustainability activities within the company^[10]. Having a higher understanding and awareness of green innovation can better promote corporate green technology innovation strategies; Executives with environmental experience will also assist core members of the company in recognizing the necessity of legality and ethical standards for business operations, promoting the company to actively optimize energy technology and implement green management strategies from a long-term perspective^[11]; Zhong Jiayi^[12] It is believed that executives with environmental experience are more likely to trigger personal social responsibility and care more about the interests of the general public. Compared to executives without environmental backgrounds, they have a greater moral responsibility to protect the environment and are more likely to firmly implement the company's environmental policies. In terms of internal management, we will increase investment in green technology innovation. Business leaders with environmental experience not only focus on the immediate benefits of the enterprise, but also on long-term sustainable development, actively promoting the adoption of environmental protection technologies and investing in green projects to ensure that the enterprise occupies a favorable position in future competition, while also having a positive impact on society and the environment^[13]. Executives with environmental experience can effectively anticipate and handle various uncertain factors in the process of corporate green innovation^[14]. In order to enhance the success probability of green innovation projects, especially in the rapidly changing market environment, enterprises need to respond quickly and timely launch services and products that meet environmental standards^[15]. At this point, executives with environmental experience can fully utilize their experience and knowledge to assist companies in more accurately grasping market opportunities and further promoting green innovation.

Based on the above analysis, this article proposes the following hypotheses:

The environmental background of the H1 executive team can promote the performance of green technology innovation in enterprises.

2.2 Impact from the perspective of external governance pressure

2.2.1 The regulatory effect of public environmental concern

With the continuous progress of Internet technology and information technology, the restriction effect of public supervision on the main activities in various fields of social economy is increasingly significant. The high level of public attention to environmental issues reflects their preference for environmental quality, which, as an informal means of environmental regulation, has a profound impact on stakeholders' corporate evaluations and behavioral choices. Based on this, the degree of public attention to environmental issues can be regarded as an indicator to measure the level of public participation in environmental governance.

According to reputation theory and stakeholder theory, in order to enhance their overall performance level, companies need to shape a positive corporate public image by implementing green technology innovation measures. In this process, enterprises also need to fully consider the high vigilance of the public, a key stakeholder group, towards environmental protection issues, in order to obtain their resource support in multiple dimensions such as commodity markets and capital markets^[16]. Therefore, the public's deep concern for corporate green behavior can effectively activate the reputation protection mechanism of

enterprises, thereby prompting them to take green actions and strengthen their product market competitiveness^[17], And ultimately promote the development of green technology innovation in enterprises.

Based on the above analysis, this article proposes the following hypotheses:

The positive regulation of H2 public environmental concerns is related to the relationship between the environmental background of executive teams and the performance of green technology innovation in enterprises.

2.2.2 Moderation effects of analysts' attention

The core responsibility of an analyst is to evaluate the current operational status of a company and predict its future development prospects based on this, with the aim of providing decision support and selection recommendations for investors^{[18][19]}. Through analyst reports, the company's green innovation achievements can convey positive information to various stakeholders, which helps to enhance the company's green brand image^[20], And alleviate the financial pressure it faces^[21]. Therefore, when the analyst's attention is high, the management's willingness to engage in green innovation activities will be significantly enhanced. From this perspective, the tracking activities of analysts can be seen as an efficient external supervision mechanism that can focus public attention on the green innovation practices of enterprises, thereby incentivizing enterprises from an external perspective to carry out more green innovation activities in order to maintain a good reputation and social image, thereby improving the effectiveness of green innovation.

Based on the above analysis, this article proposes the following hypotheses:

H3 analysts focus on positively regulating the relationship between the environmental background of executive teams and the performance of green technology innovation in enterprises.

2.3 Impact based on signal transmission perspective

2.3.1 The moderating effect of corporate social responsibility information quality

From an essential perspective, corporate social responsibility is not only a core concept that drives companies towards sustainable development goals, but also deeply rooted in their strategic planning and governance practices. Based on this, if enterprises can actively fulfill their social responsibilities, they will be able to effectively respond to the diverse social needs of stakeholders in operational management. In the initial stage of investors making investment decisions, the return on investment of a company becomes a key factor that they must carefully evaluate. According to the theory of signal transmission, a positive corporate image can release positive signals to stakeholders, thereby helping companies to more smoothly obtain various resources necessary for promoting green innovation from stakeholders^[22], Furthermore, to a certain extent, it can alleviate the funding pressure faced by enterprises when carrying out high-risk green innovation activities^[23]. Compared to other companies, those with higher quality of social responsibility information disclosure have established a more harmonious relationship with investors, and investors therefore prefer companies that actively undertake social responsibility and seek green technology innovation, hoping that they can achieve more breakthroughs in the field of green technology.

Based on the above analysis, this article proposes the following hypotheses:

The positive moderating effect of H4 corporate social responsibility information quality on the relationship between the environmental background of executive teams and the performance of green technology innovation in enterprises.

2.3.2 The regulatory role of corporate social status

Merton (1987)^[24] The study suggests that high status enterprises have better external performance and reputation in the social system, and also transmit signals of high-quality products or behaviors. This means that high status enterprises may have a potential guarantee and reputation mechanism, which makes them more likely to meet the expectations of green investors and relevant departments, thereby enhancing the confidence of these departments or investors in high status enterprises to carry out green technology innovation, and thus more likely to receive richer support^[25].

Based on the above analysis, this article proposes the following hypotheses:

The positive adjustment of H5 corporate social status moderates the relationship between the environmental background of the executive team and the performance of corporate green technology innovation.

3. Research Design

3.1 Research Samples and Data Collection

This article selects all A-share listed companies in China from 2013 to 2022 as the research sample. To ensure the credibility and accuracy of research conclusions, we draw on the practices of existing literature^{[26][27]}. We have excluded the financial and real estate industries, ST and * ST companies with abnormal operations, and sample companies with severe data loss from this article. The data on the characteristics of corporate executives mainly comes from the Guotai An Financial Database (CSMAR), the variable data of corporate green technology innovation is obtained through the CNRDS (China Research Data Service Platform) database, the public environmental concern data comes from the search index disclosed on the Baidu website, and the social responsibility information data is obtained through the social responsibility research database in the Guotai An database and manually collected and organized. After matching the above data and filtering and processing the data, we finally obtained 28855 annual enterprise level observations. In order to ensure the accuracy of regression analysis and avoid extreme values interfering with the results, this study adopted tail truncation, which means truncating all continuous variables at the 1% and 99% quantiles. In the further moderation effect testing stage, in order to improve the stability and explanatory power of the model, we implemented decentralized processing on the explanatory and moderating variables to ensure the accuracy and reliability of the analysis results.

3.2 Model Design

This article establishes model (1) to test H1, and introduces moderating variable interaction terms based on equation (1) to test H2-H5.

$$GTI_{i,t} = \alpha_0 + \alpha_1 \text{Environ ratio}_{i,t} + \alpha_2 \text{Controls} + e_{i,t} \quad (1)$$

Among them, i and t represent the enterprise and year respectively, and ei and t are random interference terms.

3.3 Variable measurement

3.3.1 Explained variable: Green Technology Innovation (GTI).

Regarding the measurement of green technology innovation performance, draw inspiration from Zhao Shukuan et al^[28], This article uses the number of green patent applications to characterize the performance of green technology innovation. Patent data reflects the results of innovative activities and demonstrates the value of innovation. In addition, patent application data has high stability and reliability, which meets the needs of this study.

3.3.2 Core explanatory variable: Environmental background of the executive team.

Refer to Han Zhongxue and others^[29] And Kang Zhanjia and others^[30], If any of the following information is disclosed in the work experience column of the executive resume, it is considered an environmentally friendly executive: environmental protection, green, sustainable, low-carbon, energy-saving, new energy. The measurement standard for the environmental background of the executive team is the ratio of the number of executives with environmental backgrounds to the total number of executives in the executive team.

3.3.3 Adjusting Variables

(1) Public Environmental Attention: Based on Domestic and Foreign Literature Zheng et al^[31] Zheng Siqi and others^[32], This study used search data from residents in Baidu Index for specific environmental related keywords to construct an indicator system for measuring public environmental attention. The specific implementation steps are as follows: Firstly, using the Baidu search engine platform, targeting the keywords “environmental pollution” and “haze”, from 2012 to 2022, the average daily search frequency of various cities across the country will be captured through Python programming tools. Subsequently, these search frequencies were accumulated and their natural logarithm was taken by adding 1 to the total sum, as a substitute variable for measuring the level of public attention to environmental issues in each city.

(2) Analyst Focus: Measured by the natural logarithm of the number of analysts tracked plus one.

(3) Quality of Corporate Social Responsibility Information: Refer to Zou Ping^[33], In this study, we specifically selected the following twelve items from the “Basic Information Table of Social Responsibility Reports of Listed Companies” in the social responsibility research sub database of Guotai An Database as the core indicators for evaluating the quality of corporate social responsibility information: third-party institution verification, compliance with GRI’s “Sustainable Development

Reporting Guidelines”, disclosure of shareholder rights protection, disclosure of creditor rights protection, disclosure of employee rights protection information, disclosure of supplier rights protection, disclosure of customer and consumer rights protection, disclosure of environmental and sustainable development information, transparency of public relations and social welfare undertakings, disclosure of social responsibility system construction and improvement measures, disclosure of safety production information, and disclosure of existing problems of the company.

To quantify these standards, we use binary assignment method, which assigns a value of 1 to each of the above indicators if the enterprise meets or has disclosed them, and a value of 0 if not. Subsequently, we calculated the total score of each company on the twelve indicators mentioned above, with a score range between 0 and 12 points. For the convenience of subsequent data analysis and research, we will divide the total score by 12 for standardization, and the result obtained is the quantitative indicator of Corporate Social Responsibility Information Quality (CSRQUA). The higher the value of this indicator, the better the quality of the company’s social responsibility information.

(4) Corporate Social Status: Reference to Jiang Fuxiu and Liu Zhibiao^[34], This article uses the Herfindahl index to measure the level of competition in the product market, which also reflects its relative market position at the enterprise level (referred to as Market-Position i, t). Specifically, the higher the value of Market-Position i, t , the lower the level of competition in the product market, reflecting the more significant the enterprise’s advantageous position in the market. The detailed calculation method is described as follows:

$$Market_Position_{it} = (X_{it}/X)$$

Where X_i is the annual total operating revenue of enterprise i , and X is the sum of the annual total operating revenue of all enterprises in the industry.

3.3.4 Control variables

Total asset turnover ratio (ATO): operating revenue/average total assets; Growth rate of operating revenue: (amount of operating revenue in the current period - amount of operating revenue in the same period last year)/(amount of operating revenue in the same period last year); Management Expense Rate (MR): Management expenses/total assets; Asset liability ratio (Lev): total liabilities/total assets; Return on Assets (ROA): Net profit divided by total asset balance

4. Empirical analysis

4.1 Descriptive statistics

The descriptive statistical results are shown in Table 1. The preliminary results indicate that the standard deviation of the main explanatory variable, Green Technology Innovation (GTI), is greater than the mean, indicating significant differences in the level of green innovation among enterprises and the need for improvement in the degree of green innovation. The mean, standard deviation, maximum, and minimum values of the explanatory variable for the environmental background of the executive team are 0.034, 0.069, 0.4, and 0, respectively, indicating that there are significant differences in the number of executives with environmental backgrounds in each company’s executive team, and the proportion of executives with environmental backgrounds in the company’s executive team is relatively low.

Table 1 Descriptive Statistics

variable	sample size	mean	Std. Dev	minimum	maximum
GTI	28855	0.364	0.774	0	3.664
ER	28855	0.034	0.069	0	0.4
MP	28855	0.285	1.418	0	11.878
BI	28855	249.206	227.196	9.817	1147.888
CSRQUA	28855	0.472	0.238	0	0.833
Analyst	28855	1.306	1.185	0	3.784
LEV	28855	0.406	0.203	0.054	0.915
ROA	28855	0.037	0.067	-0.286	0.206

variable	sample size	mean	Std. Dev	minimum	maximum
ATO	28855	0.651	0.433	0.079	2.639
Growth	28855	0.159	0.387	-0.558	2.378
MR	28855	0.089	0.072	0.008	0.449

4.2 Regression analysis

4.2.1 Environmental background and green technology innovation of the executive team

Table 2 Model 1 examines the impact of explanatory variables on green technology innovation. According to Model 1 in Table 3, it can be seen that the environmental background of the executive team has a positive impact on green technology innovation, with a coefficient of 1.551, which is significant at the 1% level. Hypothesis H1 has been validated.

Table 2: Environmental Background and Green Technology Innovation of the Executive Team

GTI	
(1)	
ER	1.551***(23.703)
Growth	-0.033***(-2.735)
ATO	-0.058***(-4.878)
ROA	0.914***(11.597)
Lev	0.470***(18.522)
MR	-0.489***(-6.755)
_cons	0.172*** (9.825)
N	28855
R ²	0.040
F	202.026

***p<0.01, **p<0.05, *p<0.1

4.2.2 Public Environmental Concerns

The results in Table 3 show that the regression coefficients of the interaction term between the environmental background of the executive team and the public environmental concern are 1.592 and 0.002, respectively, with the same sign and significant at the 1% level. This indicates that public environmental concern has a moderating effect and positively moderates the relationship between the environmental background of the executive team and green technology innovation, and H2 has been validated.

4.2.3 Analyst Focus

The results of Model (2) in Table 3 indicate that analyst attention has a positive moderating effect on the relationship between the environmental background of the executive team and green technology innovation, supporting H3.

4.2.4 Disclosure of Social Responsibility Information

The results of Model (3) in Table 3 indicate that the higher the quality of corporate social responsibility information disclosure, the stronger the promotion effect of the environmental background of the executive team on green technology innovation, supporting H4.

4.2.5 Corporate Social Status

The results of Model (4) in Table 3 indicate that the regression coefficients of the interaction term between the environmental background of the executive team and the social status of the enterprise are significant at the 1% level. The higher the social status of the enterprise, the more favorable it is for executives with environmental backgrounds to promote green technology innovation. H5 has been validated.

Table 3 Adjustment Effect Test

	GTI			
	(1)	(2)	(3)	(4)
ER	1.592***(24.270)	1.568***(24.239)	1.507***(23.002)	1.581***(24.074)
BI	0.000***(6.915)			
ANALYST		0.103***(25.694)		
CSRQUA			0.257***(13.413)	
MP				0.023***(6.986)
ER*BI	0.002***(5.581)			
ER*ANALYST		0.308***(5.690)		
ER*CSRQUA			0.887***(3.214)	
ER*MP				0.197***(3.173)
Lev	0.464***(18.267)	0.398***(15.778)	0.459***(18.121)	0.455***(17.834)
ROA	0.889***(11.290)	0.233***(2.834)	0.879***(11.191)	0.892***(11.328)
ATO	-0.058***(-4.871)	-0.065***(-5.549)	-0.051***(-4.316)	-0.063***(-5.326)
Growth	-0.036***(-2.967)	-0.052***(-4.327)	-0.026***(-2.180)	-0.032***(-2.652)
MR	-0.551***(-7.522)	-0.519***(-7.254)	-0.323***(-4.408)	-0.489***(-6.761)
_cons	0.147***(8.256)	0.102***(5.824)	0.038*(1.869)	0.176***(10.028)
N	28855	28855	28855	28855
R ²	0.043	0.063	0.047	0.042
F	161.239	241.593	176.032	158.234

4.3 Robustness test

To ensure the reliability of the research results, this study conducted robustness tests by replacing the dependent variable. Learn from Qi Shaozhou and others^[35], This article uses the number of green invention patent applications as a substitute variable for the explained variable, and chooses patent applications instead of patent grants to measure it, because patent technology is likely to have an impact on business performance during the application process. Therefore, patent application data will be more stable, reliable, and timely than grant volume^[36]. Regression analysis is shown in Table 4. The results prove that the robustness test mentioned above is basically consistent with the previous text, further verifying the empirical results.

Table 4 Robustness Test

	GTI			
	(1)	(2)	(3)	(4)
ER	1.080*** (20.488)	1.061*** (20.425)	1.008*** (19.130)	1.074*** (20.340)
BI	0.000*** (9.433)			
Analyst		0.086*** (26.800)		
csrqua			0.213*** (13.867)	

GTI				
	(1)	(2)	(3)	(4)
MP				0.023*** (8.621)
ER*BI	0.001*** (4.788)			
ER*Analyst		0.301*** (6.926)		
ER*CSRQUA			0.869*** (3.914)	
ER*MP				0.164*** (3.279)
Lev	0.347*** (16.989)	0.293*** (14.437)	0.344*** (16.872)	0.337*** (16.458)
ROA	0.692*** (10.933)	0.149** (2.262)	0.691*** (10.936)	0.698*** (11.028)
ATO	-0.032*** (-3.322)	-0.036*** (-3.850)	-0.025*** (-2.610)	-0.036*** (-3.782)
Growth	-0.031*** (-3.196)	-0.044*** (-4.591)	-0.023** (-2.330)	-0.027*** (-2.798)
MR	-0.311*** (-5.280)	-0.261*** (-4.533)	-0.099* (-1.674)	-0.237*** (-4.068)
_cons	0.060*** (4.219)	0.028** (1.988)	-0.025 (-1.531)	0.091*** (6.441)
N	28855	28855	28855	28855
R ²	0.034	0.055	0.037	0.033
F	126.342	211.161	138.991	122.393

4.4 Heterogeneity analysis

The environmental background of the executive team has a significant positive impact on green technology innovation. Does this impact vary depending on the nature of the enterprise? In the context of low-carbon and green social development, as the actual controller of state-owned enterprises, the Chinese government to some extent requires state-owned enterprises to assume social responsibility^[37], Enable executives with environmental backgrounds to participate more effectively in corporate green technology innovation under pressure. Compared to state-owned enterprises, non-state-owned enterprises usually face more intense market competition and greater obstacles to innovation^[38], So it may be more difficult to promote green technology innovation in enterprises.

Based on this, this article draws inspiration from Tang Kai et al^[39], The differential impact of environmental background executives on green technology innovation in enterprises with different ownership attributes was examined, and the regression results are shown in Table 5. The regression coefficients of environmental background executives in state-owned enterprises for green technology innovation are higher than those in non-state-owned enterprises. Compared to non-state-owned enterprises, state-owned enterprises have a more significant positive effect in promoting green technology innovation through the environmental orientation demonstrated by their executive teams.

Table 5 Heterogeneity test

	GTI	
	State owned enterprises (1)	Non state-owned enterprises (2)
ER	1.625*** (12.941)	1.457*** (18.541)
Lev	0.436*** (8.735)	0.462*** (13.849)
ROA	1.115*** (5.693)	0.865*** (9.793)
ATO	0.023 (1.194)	-0.126*** (-7.832)
Growth	-0.098*** (-4.133)	-0.011 (-0.752)
MR	-0.889*** (-5.796)	-0.424*** (-4.754)
_cons	0.165*** (4.424)	0.204*** (9.570)
N	9206	16980
R ²	0.040	0.041
F	63.906	120.217

5. Conclusion

5.1 Research Conclusion

This article is based on high-order echelon theory, signal theory, etc., and uses regression analysis to deeply study how the environmental background of the executive team affects the performance of green technology innovation in enterprises. It also explores the boundary conditions of the relationship between executive environmental background and enterprise green technology innovation from the perspectives of governance pressure and resource base. Based on data from A-share listed companies from 2012 to 2022, empirical research shows that: (1) the environmental background of the executive team has a significant positive impact on corporate green technology innovation. (2) The public attention to the environment, analyst attention, corporate social responsibility information quality, and corporate social status have all strengthened the promoting effect of the environmental background of the executive team on corporate green technology innovation. (3) Compared to non-state-owned enterprises, the environmental background of the executive team in state-owned enterprises plays a more prominent role in promoting green technology innovation. Specifically, in the context of state-owned enterprises, the environmental protection concept upheld by the executive team has shown a more significant catalytic effect on enhancing the efficiency and effectiveness of green technology innovation compared to non-state-owned enterprises.

5.2 Theoretical contributions

Firstly, this study systematically explores the impact of the environmental background of the executive team on corporate green technology innovation, enriching the research perspective on the antecedents of green technology innovation. Through empirical analysis, it has been clarified that the environmental background of the executive team is an important driving factor for corporate green technology innovation, providing a new perspective for understanding how the characteristics of the executive team shape corporate green strategies. In addition, the results of this study provide crucial strategic guidance for business leaders, effectively helping them deepen their understanding of the core role of the executive team in driving the green innovation process, thereby promoting a significant improvement in the competitiveness of the enterprise.

Secondly, this study not only focuses on the internal characteristics of the executive team, but also deeply analyzes how external and internal factors such as public environmental concerns, analyst concerns, corporate social responsibility

information quality, and corporate social status strengthen the promoting effect of the executive team's environmental background on corporate green technology innovation. This discovery enriches the research framework on the influencing factors of green technology innovation in enterprises, providing a theoretical basis for understanding how external factors interact with internal factors and jointly promote green technology innovation.

Thirdly, this study compares and analyzes the impact of environmental backgrounds of executive teams in state-owned and non-state-owned enterprises on green technology innovation, revealing the unique advantages of state-owned enterprises in promoting green technology innovation. This discovery not only helps to understand the differences in green technology innovation among enterprises of different ownerships, but also provides targeted policy recommendations for policymakers to promote the balanced development of green technology innovation among various types of enterprises.

5.3 Practical Insights

5.3.1 Emphasize the environmental background construction of the executive team

Enterprises should actively select and cultivate executive team members with environmental backgrounds, as their professional knowledge and practical experience can significantly promote the development of green technology innovation in the enterprise. By enhancing the environmental awareness and capabilities of the executive team, companies can better respond to environmental challenges and achieve sustainable development.

5.3.2 Strengthen external supervision and information disclosure

Factors such as public environmental attention, analyst attention, quality of corporate social responsibility information, and corporate social status can strengthen the promotion of green technology innovation by the executive team's environmental background. Therefore, companies should actively respond to public concerns, strengthen communication with analysts, improve the transparency and quality of social responsibility information disclosure, and strive to enhance the company's social status and reputation. These measures help to establish an external supervision mechanism and encourage enterprises to pay more attention to green technology innovation and environmental protection practices.

5.3.3 Give full play to the leading role of state-owned enterprises in green technology innovation

The environmental background of the executive team in state-owned enterprises plays a more prominent role in promoting green technology innovation. This enlightens us that in the process of promoting green technology innovation, state-owned enterprises should play a demonstrative and leading role, and drive the entire industry towards green, low-carbon, and sustainable development through their own practical experience and resource advantages. At the same time, state-owned enterprises should actively learn from the innovation mechanisms and flexibility of non-state-owned enterprises, and continuously improve their own green technology innovation capabilities and levels.

5.3.4 Building a green technology innovation ecosystem

Enterprises should combine the environmental background of their executive team with external supervision, information disclosure, and state-owned enterprise leadership to jointly build an ecosystem of green technology innovation. In this ecosystem, various forces collaborate and promote each other, jointly promoting the development and application of green technology innovation. By strengthening industry university research cooperation and establishing green technology innovation alliances, enterprises can more effectively integrate internal and external resources, and improve the efficiency and effectiveness of green technology innovation.

5.4 Shortcomings and Prospects

Firstly, this article mainly examines the impact of the background traits of the executive team on green technology innovation. It cannot be denied that the cognitive traits of the executive team also have a significant impact on green innovation. Therefore, future research can study the influence of the executive team on psychological cognition and other aspects.

Secondly, although this study reveals the strengthening effect of factors such as public environmental concerns, analyst concerns, corporate social responsibility information quality, and corporate social status on the relationship between executive team environmental background and corporate green technology innovation, the research results may not fully reflect the actual situation of all industries, regions, and scale enterprises due to limitations in data availability and sample selection. Future research should expand the sample size to include enterprises from more industries and regions, in order to improve

the universality and applicability of research results.

Thirdly, the data for this study comes from sample companies in listed companies. Although this choice is based on sufficient consideration of the convenience of data acquisition, which facilitates the comparison and exchange of research results with peer research, its inherent limitations cannot be ignored. Specifically, this sample selection method may limit the generalizability of research results, as there may be differences in the situation of non listed companies.

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