

# The Impact of Characteristics of Executive Background on Corporate ESG Performance with Green Innovation as a Moderating Variable

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## Abstract

This study utilizes data from the Guotai Junan database. It applies the upper echelons and social identity theories to examine the impact of executive characteristics on corporate environmental, social, and governance (ESG) performance. The study finds that a larger executive team size significantly improves corporate ESG performance by enhancing resource integration, coordination, and strategy implementation. Older executives positively influence ESG performance through greater experience and long-term strategic insights. However, the average educational level of executives shows no significant impact, and a higher proportion of female executives appears to suppress ESG performance. Executive team size, age, and gender ratio also significantly affect corporate green innovation. Larger teams negatively impact green innovation, while older executives have a positive influence. However, a higher proportion of female executives seems to suppress green innovation. Finally, the scale has a significant positive effect on the dependent variable in state-owned enterprises, while this effect is not substantial in private enterprises. In private enterprises, the average age of the management team positively influences the dependent variable, but this is not the case in state-owned enterprises. The average education level has no significant impact on either type of enterprise, or the gender ratio negatively affects the dependent variable only in private enterprises.

**Keywords:** Executive Team Background, Corporate ESG Performance, Green Innovation, Social Identity Theory, Upper Echelons Theory

## Introduction

In today's rapidly evolving business landscape, corporate decision-making is heavily influenced by the cognitive frameworks and values of top executives. According to the upper echelons theory, the background characteristics of senior management teams play a pivotal role in shaping strategic choices, including innovation strategies. Managers' cognitive structures and values determine their ability to interpret relevant information, which directly affects the formulation and implementation of corporate strategies (Li & Yang, 2022). Furthermore, this theory highlights the profound influence of executive teams on

organizations. As the decision-making tier of the organization, the environmental awareness and values of executive teams significantly impact an organization's overall culture and direction (Phipps, 2012). As key navigators of corporate development, managers' decisions profoundly influence the trajectory and sustainability of enterprises, making the study of their background characteristics particularly crucial.

Recent scholarly attention has increasingly focused on the interplay between managerial characteristics and corporate governance. Chi, et al. (2023) introduced the concept of "professional competence in internal control" for boards of directors, categorizing it into three dimensions: professional knowledge, professional skills, and work experience. These competencies are intrinsically tied to the background attributes of management teams, underscoring the importance of executive profiles in shaping corporate governance outcomes.

Simultaneously, the growing emphasis on ESG (Environmental, Social, and Governance) performance has transformed how corporate sustainability and investment value are evaluated. ESG assesses companies across three critical dimensions—environmental protection, social responsibility, and corporate governance—prioritizing not only economic benefits but also social contributions. Huang, Yao, and Liu, (2023) argued that strong ESG performance enables companies to establish a positive social image, reduce resource consumption in the short term, and achieve long-term economic benefits. By disclosing ESG-related information, companies empower managers to make scientifically informed business decisions while promoting sustainable corporate practices (Xu & Yao, 2024). Moreover, ESG has emerged as a key factor in assessing corporate sustainability and investment value. It demonstrates a company's commitment to corporate social responsibility while also addressing environmental challenges (Gao, 2024). ESG evaluations further provide a critical framework for investors, helping them assess corporate sustainability and social responsibility commitments (Yang, Deng, & Hou, 2023).

The convergence of ESG performance and executive characteristics represents a crucial intersection for understanding corporate sustainability and strategic innovation. The upper echelons theory emphasizes that observable executive traits—such as the scale of senior management, average educational level, age, and gender diversity—profoundly influence decision-making processes. These traits shape managers' environmental awareness and strategic choices, particularly in driving green innovation initiatives. Green innovation encompasses a wide spectrum, including green technological, organizational, and cultural innovations that integrate sustainable development principles into corporate practices (Yang, Zeng, Ge, & Hao, 2022).

By aligning upper echelons theory with ESG frameworks, this study addresses the critical need to understand how executive characteristics influence corporate strategies for sustainable development. The environmental consciousness of executive teams not only shapes organizational culture but also sets a behavioral precedent for employees, encouraging active participation in green innovation and enhancing ESG performance (Wu & Tham, 2023). These dynamics underscore the broader significance of studying executive characteristics, as their influence extends beyond internal governance to societal and environmental impacts.

The study of executive characteristics and their influence on ESG performance is essential for understanding the mechanisms driving sustainable corporate practices. By elucidating the links between managerial profiles, corporate governance, and green innovation, this research provides actionable insights for stakeholders, including policymakers, investors, and corporate leaders. The findings can inform strategies to foster stronger ESG performance, ultimately contributing to sustainable development and corporate success in a complex and interconnected global economy.

## **Review of Literature**

### *Theoretical Background*

As the group that exercises actual control over enterprises, management's behavioral choices have a decisive impact on an organization's future development. According to upper echelons theory, the thoughtful construction of a management team is essential. The cognitive abilities and values of managers with diverse background characteristics inevitably shape the formulation and implementation of key decisions. Based on this theoretical framework, this study analyzes the effects of background characteristics—Scale, Av\_Age, Av\_Edu, and Av\_Gender—on ESG performance, with green innovation serving as a moderating variable. Furthermore, this study explores how these relationships differ between private enterprises and state-owned enterprises.

Scale of senior management (Scale): the scale of management refers to the total number of senior personnel comprising the company's management team, including board members, supervisors, and executive managers (Zhang et al., 2021). As the size of the management team expands, the available information and talent resources grow correspondingly, creating favorable conditions for advancing ESG performance. A larger management team can effectively mitigate risks in the innovation process and facilitate the integration of multidisciplinary expertise, thereby promoting comprehensive research and development efforts. This scale effect enables companies to engage more deeply in fields such as environmental technology and renewable energy. By incorporating green innovation as a moderating variable, organizations can enhance their ESG performance, leveraging the diverse capabilities of a robust management team.

Average educational level (Av\_Edu): education level refers to the highest degree or qualification attained by an individual, particularly in the context of managers, executives, or employees within an organization. A background allows business elites to carry an inherent aura, as graduating from prestigious institutions bestows considerable prestige upon executives (Fang, & Dong, 2022). This recognition not only enhances their credibility and authority within the industry but also instills confidence among stakeholders such as investors, clients, and employees. Furthermore, management teams with higher educational levels are often able to access more comprehensive information. Under the moderating effect of green governance, they can leverage this information to improve ESG performance.

Average age of senior management (Av\_Age): average age refers to the mean age of individuals within a specific group, such as employees or management teams in an organization. From the perspective of the average age of management, a higher average age often indicates more extensive practical experience and a deeper understanding of the company, which facilitates more informed decision-making. This age advantage also grants

the management team greater authority, enabling relatively centralized decision-making within the firm. Under a centralized decision-making model, companies tend to adopt a more cautious and rational approach to innovation investment, ultimately achieving a higher volume of innovative outputs with a broader impact.

Average age of senior management (*Av\_Gender*): gender refers to the proportion of males to females within a specific group, such as a workforce, management team, or board of directors. Female executives are often risk-averse and competitive and face more work-family conflicts. They also encounter various forms of gender discrimination, which may lead to their relatively low efficiency in management and innovation. Furthermore, gender stereotypes make it difficult for female executives to make decisions that are recognized by their leaders and colleagues. Coupled with limited resource allocation, the innovation activities they lead are often less efficient (Pan, & Liu, 2021).

Based on the above analysis, this study proposes the following hypotheses: H1: Executive characteristics have a significant impact on corporate ESG performance; H2: The significant impact of executive characteristics on corporate ESG performance is partially mediated through the pathway of corporate green innovation capabilities; H3: Compared to state-owned enterprises, the influence of executive characteristics on ESG performance differs in private enterprises.

### *Hypothesis*

The social identity theory, proposed by Taffel and Turner in 1986, emphasizes that individuals tend to associate themselves with specific social groups and form their sense of identity through comparisons with other groups (Tafel, & Turner, 1986). This social identification helps to maintain personal self-esteem and strengthen group cohesion, motivating individuals to take actions that reinforce and protect their group's status. For corporate executives, the success and reputation of the company are often closely linked to their personal identity. A company's performance in ESG aspects reflects its social identity, representing the organization's values and sense of responsibility in these areas. Therefore, the attention and practices that managers place on ESG performance are crucial in shaping the company's identity within society. By prioritizing ESG efforts, corporate leaders not only enhance their organization's societal standing but also align their leadership with broader environmental and social responsibilities.

Based on the upper echelon's theory, the personal characteristics of top executives can significantly influence corporate strategic choices and performance. Jia et al. (2016) found that analyzing the characteristics of the entire executive team is more effective than focusing solely on individual executives. The demographic characteristics of executives serve as effective indicators for assessing their cognition and values. Wang et al. (2022) highlighted that a company's outstanding performance largely stems from the competencies of its core management team. Moreover, Adams et al. (2012) discovered that the competencies of executives directly influence the scientific and effective nature of their management and decision-making processes. Executive competencies have long been associated with factors such as gender. Xue et al. (2022) noted that differences in leadership styles between male and female executives are due to variations in stress tolerance, risk preferences, decision-making styles, and personal abilities when making risk-related decisions. Within this

framework, this paper investigates how executive characteristics such as Scale, Av\_Age, Av\_Edu, and Av\_Gender significantly influence ESG performance, with a particular focus on the role of green innovation. Furthermore, this study explores how these relationships differ between private enterprises and state-owned enterprises.

**H1: Executive characteristics have a significant impact on corporate ESG performance.**

Larger management teams improve collaboration and task specialization, enhancing ESG performance through resource diversity, but may face challenges from inefficiency and communication costs (Chen, 2022; Zhang et al., 2020). Higher education levels equip executives with better decision-making skills, fostering sustainability, social responsibility, and high-quality disclosures, but excessive compliance may hinder adaptability (Hussain et al., 2022; Zhang et al., 2020). Older executives leverage experience to promote responsibility and centralized decisions, benefiting ESG initiatives. However, their risk aversion could limit bold strategies (Qin, 2024; Chen & Tian, 2020). Gender diversity also shapes ESG outcomes. Female executives, known for risk-averse and socially sensitive decision-making, contribute positively to corporate responsibility (Wu & Hua, 2021; Galbreath, 2019). In conclusion, executive characteristics—team size, education level, age, and gender diversity—significantly influence ESG performance, each offering unique benefits and limitations.

**H2: The significant impact of executive characteristics on corporate ESG performance is partially mediated through the pathway of corporate green innovation capabilities.**

Green innovation serves as a bridge between executive characteristics and ESG performance by fostering sustainable practices, particularly when management adopts innovation-driven strategies (Huang et al., 2021; Gu & Zhang, 2021). While female executives and older managers may approach green innovation with caution, their emphasis on social responsibility aligns with the overarching objectives of ESG performance (Wu & Hua, 2021; Galbreath, 2019). Female executives, often characterized by risk aversion and environmental sensitivity, contribute positively to ESG outcomes. However, they may encounter challenges in resource allocation for green innovation (Wu & Hua, 2021; Galbreath, 2019). This hypothesis establishes a structured framework to test the relationship between management attributes and ESG performance, emphasizing the mediating role of green innovation.

**H3: Compared to state-owned enterprises, the influence of executive characteristics on ESG performance differs in private enterprises.**

Private enterprises demonstrate greater effectiveness in leveraging ESG development to mitigate corporate risks compared to SOEs. SOEs, often burdened with fulfilling national political and social objectives, frequently operate in high-energy-consumption and high-pollution industries, such as coal, electricity, and energy. To comply with stringent national environmental policies, SOEs are required to allocate substantial financial resources and time to meet regulatory standards. This focus on compliance often limits their capacity for innovation and adaptability, reducing the effectiveness of ESG practices in enhancing corporate performance (Zhao, 2024). In contrast, private enterprises typically face fewer regulatory pressures and financial constraints, allowing them to implement ESG practices with greater flexibility and efficiency. This proactive approach enables private firms to focus on

building corporate reputation, fostering innovation, and mitigating risks through ESG initiatives. Furthermore, private enterprises, driven by more entrepreneurial and adaptive leadership, exhibit stronger alignment between executive characteristics and ESG performance. The distinct objectives and operational frameworks of SOEs and private enterprises highlight differences in how executive traits influence ESG outcomes. While SOEs prioritize administrative mandates and policy compliance, private enterprises leverage executive characteristics to align ESG practices with corporate innovation and long-term goals, resulting in greater effectiveness and adaptability.

## **Research Methodology**

### *Population and Sample Selection*

This study focuses on Chinese A-share listed companies from 2011 to 2023, with data sourced from the Guotai Junan database. Companies in the financial sector, due to differing operational models, and ST/PT companies, due to financial instability, were excluded. Firms with a debt-to-asset ratio exceeding 1 were also removed to avoid distortions caused by severe financial stress. Additionally, observations with missing key variables and data from companies listed for less than two years were omitted to ensure the validity of statistical analyses. After applying these criteria, the final sample consists of 2,690 non-financial companies, totaling 34,971 observations, providing a more homogeneous dataset for examining ESG disclosures, financial characteristics, and corporate governance.

### *Research Philosophy*

This study adopts a positivist research philosophy, assuming reality is objective and measurable through systematic observation and empirical analysis. Positivism emphasizes observable data to establish generalizable patterns. The research examines how management team characteristics—such as team size, average age, educational level, and the proportion of female executives—impact corporate ESG performance, with green innovation as a moderating variable. Hypotheses include executive characteristics significantly influencing ESG performance (H1), green innovation mediates this relationship (H2), and the effects that differ between private and state-owned enterprises (H3). By leveraging measurable data, the positivist approach ensures findings are evidence-based and provide actionable insights.

### *Research Approach*

This study uses a quantitative research approach to analyze numerical data and explore the relationships between executive characteristics and corporate ESG performance, with green innovation as a moderating variable. Data will be collected from listed Chinese companies, focusing on management team characteristics such as team size, average age, educational level, tenure, and the proportion of female executives, alongside ESG performance indicators. The analysis aims to test hypotheses on how these characteristics influence ESG outcomes, particularly through green innovation, and to examine differences between private and state-owned enterprises. The findings are expected to enhance understanding of corporate sustainability and offer practical insights for improving ESG strategies through executive team attributes and innovation.



**Variables Measurement***Table 1 Variables Description and Source*

Variable Name	Variable Definition	Variable Symbol
Dependent variable:		
ESG Performance	ESG stands for Environmental, Social, and Governance.	ESG
Independent variable:		
Scale of senior management	The size of the executive team or top management in a company.	Scale
Average educational level	1 = Vocational or below (including secondary education or equivalent), 2 = associate's degree (College or Technical Education), 3 = Bachelor's Degree, 4 = Master's Degree, 5 = Doctoral Degree (PhD), 6 = Other (including honorary degrees, correspondence courses, or non-traditional forms of education), 7 = MBA/EMBA (Master of Business Administration or Executive MBA).	Av_Edu
Average age of senior management	The mean age of the individuals holding key managerial positions in a company.	Av_Age
Proportion of female senior management	The percentage of senior management positions occupied by women within an organization.	Av_gender
Adjustment variable:		
Green innovation	Total number of corporate green patent authorizations.	GI
Control variables:		
Size	Firm size = $\ln(\text{total assets})$ .	Size
Lev	Leverage (Lev)= $\frac{\text{Total Assets}}{\text{Total Debt}}$	Lev
Tobin	Ratio of company market capitalization to total assets.	Tobin
Dual	If the chairman of the company and the general manager is the same person then take the value of 1, otherwise 0.	Dual
Listage	Listage= $\text{Current Year}-\text{Year of Listing}$	Listage
Return on Assets	ROA= $\frac{\text{Net income}}{\text{Total assets}}$ .	Roa
dummy variables:		
Year fixed effects	Annual dummy variables.	Year
Company fixed effects	Company dummy variables.	Company

*Dependent Variables*

ESG performance (ESG): China securities ESG score is a comprehensive rating system developed by China Securities Index Co., Ltd. to evaluate the environmental, social, and governance (ESG) performance of listed companies in China.

*Independent Variables*

The background characteristics of managers are measured using four indicators: scale of senior management (Scale), average educational level (Av\_Edu), average age of senior management (Av\_Age), proportion of female senior management (Av\_gender),

*Adjustment Variable*

Green innovation (GI): This study uses the number of corporate green patent applications to measure the level of corporate green innovation (Li, Y., Gao, D., & Wei, P., 2021).

*Control Variables*

Based on relevant literature, the following variables are selected as control variables for this study: Size (Size), Lev (Lev), Tobinq (Tobinq), Dual (Dual), Listage (Listage), Return on Assets (Roa).

*Model Specification*

Based on the theoretical analysis and the proposed hypotheses, this study constructs Model (1) to examine the mechanism through which management background influences ESG performance and to test the hypotheses.

$$ESG = \alpha + \beta_1 \text{Manage}C_i + \beta_2 \text{Size}_2 + \beta_3 \text{Lev}_3 + \beta_4 \text{Tobinq}_4 + \beta_5 \text{Dual}_5 + \beta_6 \text{Listage}_6 + \beta_7 \text{Roa}_7 + \sum \text{Company} + \sum \text{Year} + \varepsilon$$

Manage $C_i$  includes scale of senior management (Scale), average educational level (Av\_Edu), average age of senior management (Av\_Age), proportion of female senior management (Av\_gender).

Conduct independent regression analyses for each management background characteristic variable, and then introduce all characteristic variables simultaneously into a multiple regression model. To verify the moderating effect of corporate green innovation, incorporate the green innovation variable into the model (1) and further include the interaction term between management background characteristics and green innovation to construct the regression model (2):

$$GREEN = \alpha + \beta_1 \text{Manage}C_i + \beta_2 \text{Size}_2 + \beta_3 \text{Lev}_3 + \beta_4 \text{Tobinq}_4 + \beta_5 \text{Dual}_5 + \beta_6 \text{Listage}_6 + \beta_7 \text{Roa}_7 + \sum \text{Company} + \sum \text{Year} + \varepsilon$$

$$ESG = \alpha + \beta_1 \text{Manage}C_i + \beta_2 \text{GREEN} + \beta_3 \text{Size}_3 + \beta_4 \text{Lev}_4 + \beta_5 \text{Tobinq}_5 + \beta_6 \text{Dual}_6 + \beta_7 \text{Listage}_7 + \beta_8 \text{Roa}_8 + \sum \text{Company} + \sum \text{Year} + \varepsilon$$

Where,  $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8$  are the characteristic parameters of each variable,  $\alpha$  is the constant term (intercept),  $\varepsilon$  is the random error term.



## Results and Discussion

### *Descriptive Statistics*

Table 2 presents the individual descriptive statistics for the years 2011 to 2023.

Table 2

### *Descriptive Statistics*

	count	mean	sd	min	max
Esg	34971	4.151	0.929	1.000	7.750
Scale	34971	7.052	3.480	1.000	45.000
Av_Age	34971	47.244	3.947	29.500	64.000
Av_Edu	34971	3.379	0.690	1.000	7.000
Av_Gender	34971	0.168	0.168	0.000	1.000
Green	34971	0.856	1.195	0.000	7.380
Size	34971	22.124	1.276	19.676	26.086
Lev	34971	0.412	0.204	0.052	0.894
Roa	34971	0.044	0.065	-0.221	0.216
Dual	34971	0.297	0.457	0.000	1.000
Tobinq	34971	2.046	1.250	0.855	7.780
Listage	34971	1.967	0.913	0.000	3.367

The variable ESG ranges from 1.00 to 7.75, with an average value (mean) of 4.151, indicating a moderate level of performance across the sample. The standard deviation (SD) is 0.929, reflecting some variability around the mean. The variable team size (Scale) has an average of 7.052, with values ranging from 1.00 to 45.00. The standard deviation (SD) of 3.480 shows considerable variation in team sizes. The average age of executives (Av\_Age) ranges from 29.50 to 64.00, with a mean value of 47.244 and a standard deviation (SD) of 3.947, indicating that most executive teams fall within a similar age range. The variable average education level (Av\_Edu) averages 3.379, with values spanning from 1.00 to 7.00 and a standard deviation (SD) of 0.690, showing relatively consistent education levels. The gender ratio (Av\_Gender) has a mean of 0.168 and ranges between 0.00 and 1.00, with a standard deviation (SD) of 0.168, reflecting the diversity in gender representation. The mediating variable green patents (Green) has an average value of 0.856, with a range from 0.00 to 7.38 and a standard deviation (SD) of 1.195, indicating variability in firms' green innovation efforts. The variable firm size (Size) averages 22.124, with values ranging from 19.676 to 26.086. The standard deviation (SD) of 1.276 suggests moderate differences in company size. The variable leverage (Lev) ranges from 0.052 to 0.894, with a mean of 0.412 and a standard deviation (SD) of 0.204, showing diverse financial structures among firms. The return on assets (Roa) has a mean of 0.044, with values ranging from -0.221 to 0.216 and a standard deviation (SD) of 0.065, indicating variable financial performance. The CEO duality (Dual) variable averages 0.297, with a range from 0.00 to 1.00 and a standard deviation (SD) of 0.457, illustrating varying corporate governance practices. The variable Tobin's Q (Tobinq) averages 2.046, ranging from 0.855 to 7.780, with a standard deviation (SD) of 1.250, reflecting significant differences in market valuations. Finally, the variable listing age (Listage) has a mean of 1.967, spanning from 0.000 to 3.367, with a standard deviation (SD) of 0.913, demonstrating diversity in the listing history of firms.

*Correlation Analyses*

Table 3 presents the correlation matrix for the years 2011 to 2023.

Table 3  
*Correlation Matrix*

	Esg	Scale	Av_Age	Av_Edu	Av_Gender	Green	Size	Lev	Roa	Dual	Tobinq	Listage
Esg	1											
Scale	0.160 ***	1										
Av_Age	0.066 ***	- 0.015 ***	1									
Av_Edu	0.033 ***	- 0.023 ***	0.017 ***	1								
Av_Gender	- 0.020 ***	- 0.089 ***	- 0.151 ***	- 0.027 ***	1							
Green	0.151 ***	0.081 ***	0.133 ***	0.155 ***	0.094* **	1						
Size	0.187 ***	0.084 ***	0.292 ***	0.203 ***	0.129* **	0.445 ***	1					
Lev	- 0.099 ***	- 0.032 ***	0.124 ***	0.072 ***	0.104* **	0.208 ***	0.498 ***	1				
Roa	0.228 ***	0.159 ***	- 0.022 ***	- 0.034 ***	0.008	0.016 ***	0.024 ***	0.388 ***	1			
Dual	0.005	0.042 ***	- 0.033 ***	- 0.011 **	0.072* **	0.032 ***	0.177 ***	0.154 ***	0.058 ***	1		
Tobinq	- 0.099 ***	- 0.119 ***	- 0.085 ***	0.011 **	0.073* **	0.126 ***	0.356 ***	0.249 ***	0.179 ***	0.064 ***	1	
Listage	- 0.131 ***	- 0.354 ***	0.243 ***	0.119 ***	0.055* **	0.125 ***	0.419 ***	0.392 ***	- 0.275 ***	- 0.240 ***	0.005	1

The correlation matrix reveals that the correlation coefficients between corporate ESG performance and size of management, average age, and educational level are 0.16, 0.066, and 0.033, respectively, all significant at the 1% level. Over the study period, corporate ESG performance exhibited a significant positive trend with size of management, average age, and educational level. Additionally, ESG performance showed significant positive correlations with the adjustment variable (logarithm of green patents) and control variables such as firm size and return on assets, indicating consistent upward trends. Conversely, ESG performance was negatively correlated with the proportion of female executives, debt-to-asset ratio, Tobin's Q, and firm listing age. Most correlations among the control variables were below 0.3, suggesting no severe multicollinearity issues.

*Panel Regression Analysis Results and Discussion*

Table 4 presents the baseline regression for the years 2011 to 2023.

Table 4  
*Baseline Regression*

	(1) Esg	(2) Esg
Scale	0.023*** [0.002]	0.004** [0.002]
Av_Age	0.011*** [0.002]	0.011*** [0.002]
Av_Edu	-0.008 [0.011]	-0.021* [0.011]
Av_Gender	-0.144*** [0.042]	-0.109*** [0.041]
Size		0.216*** [0.012]
Lev		-0.738*** [0.045]
Roa		0.401*** [0.094]
Dual		-0.035** [0.014]
Tobinq		-0.007 [0.005]
Listage		-0.203*** [0.017]
_cons	3.505*** [0.101]	-0.373 [0.259]
comany	YES	YES
year	YES	YES
r2	0.555	0.57
N	34971	34971

Standard errors in brackets, \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

To examine the robustness of the executive characteristics' influence on corporate ESG performance, this study utilized two regression models. Model 1 includes only the core explanatory variable, executive characteristics, with both individual firm and year fixed effects. Model 2 builds upon Model 1 by adding control variables for firm characteristics. Through these two models, we observe the effects of executive characteristics on corporate ESG performance.

In both models, the regression coefficient for team size is 0.023 in Model 1 and 0.004 in Model 2, with statistical significance at the 1% and 5% levels, respectively. This suggests that, all else being equal, an increase in team size significantly promotes the growth of corporate ESG performance. Larger teams benefit from the advantages of resources and talent, enabling them to more effectively share responsibilities and focus on various ESG domains, such as environmental protection, social responsibility, and corporate governance. These teams often

possess stronger execution and cross-departmental coordination capabilities, allowing them to implement more comprehensive ESG strategies that yield greater social and environmental benefits. Additionally, larger teams tend to have higher market visibility, attracting greater attention from investors and the public, thus fostering partnerships and accelerating ESG progress.

The regression coefficient for executive team age is 0.011 and statistically significant at the 1% level. This indicates that older executives significantly contribute to increased corporate ESG performance. Experienced executives, having accumulated industry knowledge and personal wisdom, are typically more insightful in long-term strategic planning and are inclined to adopt stable ESG measures. They place greater emphasis on managing reputational risks and ensuring compliance, recognizing the importance of sustainability for the long-term survival of the company. As such, they display heightened responsibility and urgency on ESG issues.

The average educational level of executives, however, does not show a significant impact on corporate ESG performance at the 5% level. Although education is important, it does not necessarily equate to the ability to implement ESG strategies. In practice, leadership, communication skills, and industry experience are often the key factors in determining ESG effectiveness. In rapidly evolving ESG standards and technological requirements, hands-on experience may outweigh theoretical knowledge.

The coefficient for female executives is -0.109 and is significant at the 1% level. This suggests that an increased proportion of female executives tends to suppress ESG growth. The limitations imposed by corporate culture and traditional attitudes may lead female leaders to face significant challenges in advancing the ESG agenda, including overcoming biases and securing resource support. In the early stages of increasing the proportion of female executives, they may experience "minority group pressure," needing to prove their value while managing the complexity of a diverse culture. This can slow down the implementation of ESG projects in the short term.

Among the control variables, the growth of asset size and return on assets significantly promotes ESG growth. Large enterprises, with their capital and resource advantages, can invest more in R&D innovations and social responsibility initiatives, thereby enhancing their ESG ratings. Additionally, these firms leverage their brand influence to effectively lead industry ESG standards and attract greater attention from the media and consumers. Their strong risk resistance also enables them to remain stable in the face of external shocks, promoting long-term sustainable development and indirectly improving ESG performance. Higher asset return rates reflect efficient resource allocation and operational effectiveness, helping to reduce waste and energy consumption in line with environmental protection goals, while also attracting responsible investors who support firms adhering to ESG principles.

Conversely, variables such as debt-to-asset ratio, dual roles in CEO and board chairmanship, and listing age significantly inhibit ESG growth. High leverage and debt levels can negatively affect ESG performance, as the company may face substantial debt and interest burdens, limiting funds available for environmental upgrades and social responsibility activities. High debt also raises concerns about financial instability, potentially damaging the company's

reputation and weakening the governance aspects of ESG, particularly in transparency and risk management. The dual role of CEO and board chair can lead to excessive power concentration and lack of oversight, increasing the risk of abuse of power and undermining shareholder and stakeholder interests, thus reducing the transparency and effectiveness of corporate governance, including in ESG investments and commitments. Older firms, with extended listing ages, may experience a decline in innovation capacity and struggle to adapt to new trends and ESG-related regulations. These firms face difficulties in adjusting strategies to meet changing ESG standards, particularly with the increasing importance placed on corporate social responsibility by younger consumers. Additionally, the accumulation of legacy issues and outdated business models makes it harder for older firms to undergo swift transformations, possibly impeding ESG progress.

Table 4 presents the mediation effect for the years 2011 to 2023.

Table 4  
*Mediation Effect*

	(1) Esg	(2) Green	(3) Esg
Green			0.061 <sup>***</sup> [0.006]
Scale	0.004 <sup>**</sup> [0.002]	-0.008 <sup>***</sup> [0.002]	0.005 <sup>***</sup> [0.002]
Av_Age	0.011 <sup>***</sup> [0.002]	0.006 <sup>***</sup> [0.002]	0.011 <sup>***</sup> [0.002]
Av_Edu	-0.021 <sup>*</sup> [0.011]	-0.001 [0.011]	-0.021 <sup>*</sup> [0.011]
Av_Gender	-0.109 <sup>***</sup> [0.041]	-0.102 <sup>***</sup> [0.038]	-0.103 <sup>**</sup> [0.041]
Size	0.216 <sup>***</sup> [0.012]	0.405 <sup>***</sup> [0.012]	0.191 <sup>***</sup> [0.012]
Lev	-0.738 <sup>***</sup> [0.045]	-0.066 [0.043]	-0.734 <sup>***</sup> [0.044]
Roa	0.401 <sup>***</sup> [0.094]	-0.074 [0.084]	0.406 <sup>***</sup> [0.094]
Dual	-0.035 <sup>**</sup> [0.014]	-0.001 [0.013]	-0.035 <sup>**</sup> [0.014]
Tobinq	-0.007 [0.005]	0.020 <sup>***</sup> [0.005]	-0.008 <sup>*</sup> [0.005]
Listage	-0.203 <sup>***</sup> [0.017]	-0.120 <sup>***</sup> [0.016]	-0.196 <sup>***</sup> [0.017]
_cons	-0.373 [0.259]	-8.065 <sup>***</sup> [0.273]	0.122 [0.263]
comany	YES	YES	YES
year	YES	YES	YES
r2	0.57	0.751	0.572
N	34971	34971	34971

Standard errors in brackets, \* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01

Regression analysis 2 reveals that executive team size, age, and the proportion of female executives significantly impact corporate green innovation levels. Specifically, the executive team size negatively affects green innovation, while executive age has a significant positive influence on green innovation. The proportion of female executives is also significantly inhibiting green innovation. Regression analysis 3 further shows that when introducing mediating variables, the coefficients of executive characteristics change to varying extents and remain statistically significant. This indicates that the influence of executive characteristics on corporate ESG performance is partly mediated by their significant effect on green innovation. This suggests that even if certain traits of the executive team directly affect green innovation, their impact is magnified or diminished through these mediating channels, ultimately influencing the company's ESG performance.

Additionally, regression analysis 2 provides an important insight: the rapid growth of the digital economy not only directly drives the improvement of corporate ESG productivity (TFP) but also acts as a powerful catalyst for corporate R&D investments. This finding strongly supports the notion that the digital economy plays a critical role in boosting TFP. Further, regression model 3 delves into the transmission mechanisms behind the digital economy's impact on TFP enhancement. The coefficient for digital economy levels has decreased compared to the initial model but remains statistically significant at the 1% level. This indicates that part of the digital economy's contribution to TFP growth occurs through increased R&D investments by firms. The thriving digital economy significantly enhances corporate TFP and plays an essential role in driving corporate R&D investments. Through digital transformation, firms can efficiently collect and utilize information, improve decision-making, and optimize resource allocation, thus driving TFP growth. The research also reveals that the digital economy mitigates financing constraints and reduces information asymmetry, enhancing corporate innovation capabilities. Moreover, the digital economy promotes economies of scale and scope, expanding the firm's product sales and further increasing productivity. In conclusion, the digital economy's contribution to TFP growth is primarily realized through enhanced R&D investment, technological innovation, and market integration.



Table 5 presents the heterogeneity analysis for the years 2011 to 2023.

Table 5

*Heterogeneity Analysis*

	(1) Private	(2) State-owned
Scale	0.003 [0.002]	0.011 <sup>***</sup> [0.003]
Av_Age	0.014 <sup>***</sup> [0.002]	0.001 [0.003]
Av_Edu	-0.011 [0.013]	-0.03 [0.021]
Av_Gender	-0.117 <sup>**</sup> [0.049]	-0.055 [0.075]
Size	0.257 <sup>***</sup> [0.015]	0.179 <sup>***</sup> [0.020]
Lev	-0.734 <sup>***</sup> [0.054]	-0.576 <sup>***</sup> [0.080]
Roa	0.414 <sup>***</sup> [0.108]	-0.251 [0.194]
Dual	-0.036 <sup>**</sup> [0.016]	-0.060 <sup>**</sup> [0.029]
Tobinq	0.002 [0.006]	-0.013 [0.009]
Listage	-0.257 <sup>***</sup> [0.021]	0.209 <sup>***</sup> [0.036]
_cons	-1.426 <sup>***</sup> [0.324]	-0.076 [0.467]
comany	YES	YES
year	YES	YES
r2	0.578	0.604
N	24017	10954

Standard errors in brackets, \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

In state-owned enterprises, scale has a significant positive effect on the dependent variable, whereas its impact is not significant in private enterprises. In private enterprises, a higher average age of the management team positively influences the dependent variable, but this effect is not significant in state-owned enterprises. The average education level of the management team has no significant impact on the dependent variable in both state-owned and private enterprises. In private enterprises, the gender ratio has a negative effect on the dependent variable, whereas it is not significant in state-owned enterprises.

*Robustness Test*

Table 6 presents the robustness analysis for the years 2011 to 2023.

Table 6

*Robustness Analysis*

	(1) Replacement of explanatory variables	(2) Excluding firms listed for less than 5 years
Scale	0.007*** [0.002]	0.006*** [0.002]
Av_Age	0.010*** [0.002]	0.011*** [0.002]
Av_Edu	-0.018 [0.012]	-0.017 [0.011]
Av_Gender	-0.098** [0.043]	-0.099** [0.040]
Size	0.207*** [0.012]	0.208*** [0.011]
Lev	-0.704*** [0.047]	-0.717*** [0.044]
Roa	0.447*** [0.099]	0.418*** [0.093]
Dual	-0.034** [0.015]	-0.042*** [0.014]
Tobinq	-0.010* [0.005]	-0.008* [0.005]
Listage	-0.174*** [0.018]	-0.194*** [0.017]
_cons	-0.227 [0.273]	-0.254 [0.253]
comany	YES	YES
year	YES	YES
r2	0.525	0.563
N	34971	32024

Standard errors in brackets, \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

To ensure the robustness of the preceding regression results, this study substitutes the annual mean ESG scores with the median scores from the Huazheng ESG database as the dependent variable. This approach aims to verify whether consistent results can be obtained from different evaluation perspectives, thereby mitigating potential methodological biases.

Second, the sample was adjusted by excluding firms listed for less than five years. This step is intended to eliminate the influence of data volatility associated with newly listed companies, as these firms often experience rapid growth periods, which can result in unstable ESG performance. During their initial development stages, ESG data may not accurately reflect long-term trends. By excluding such samples, the study focuses on firms with longer operational histories, enabling a more precise analysis of the ESG practices and intrinsic patterns of mature enterprises.

The revised regression results indicate that the coefficients' direction, magnitude, and significance of the key explanatory variables are consistent with the baseline regression findings. This consistency demonstrates that the empirical results are robust, and the conclusions drawn from the analysis are reliable and meaningful.

### **Conclusions**

This study, based on upper echelons theory and social identity theory, investigates the impact of executive characteristics on corporate ESG performance. Using data from the Guotai Junan database, various analyses were conducted, including descriptive analysis, correlation analysis, basic regression, heterogeneity analysis, and robustness checks. In hypothesis 1, the results indicate that the expansion of executive team size significantly improves corporate ESG performance. Larger executive teams are better able to integrate resources, coordinate across departments, and implement more comprehensive ESG strategies. Under similar conditions, executive age has a positive impact on ESG performance. Older executives often have more industry experience and wisdom, enabling them to gain deeper insights into long-term strategic planning and tend to adopt more stable ESG measures. However, the average educational level of executives did not have a significant impact on ESG performance. Additionally, a higher proportion of female executives tends to suppress ESG performance growth, which may be due to constraints imposed by corporate culture and traditional views. Female leaders often face challenges in advancing the ESG agenda, such as overcoming gender biases and securing necessary resources. In hypothesis 2, the study shows that executive team size, age, and gender ratio significantly affect corporate green innovation. Team size negatively impacts green innovation, while executive age positively influences it. In contrast, a higher proportion of female executives seems to suppress green innovation within the company. In Hypothesis 3, the study finds that scale has a significant positive effect on the dependent variable in state-owned enterprises, whereas its impact is not significant in private enterprises. Similarly, a higher average age of the management team positively influences the dependent variable in private enterprises but has no significant effect in state-owned enterprises. Moreover, the average education level of the management team does not have a significant impact on the dependent variable in either state-owned or private enterprises. Finally, in private enterprises, the gender ratio negatively affects the dependent variable, while it remains insignificant in state-owned enterprises.

This study, utilizing upper echelons theory and social identity theory, explores the impact of executive characteristics on corporate ESG performance, offering new insights into how executive traits influence sustainability outcomes. By integrating these two theoretical frameworks, the research underscores the importance of executive background, experience, and group identity in shaping corporate decision-making and sustainability performance, thereby deepening the understanding of corporate governance in the context of ESG (Hambrick & Mason, 1984; Tajfel & Turner, 1986). The study provides evidence that larger executive teams can effectively drive ESG initiatives, suggesting that firms consider expanding their leadership teams or creating specialized positions for ESG strategy. Additionally, the positive effect of executive age on ESG performance highlights the role of experience in driving long-term sustainable strategies. These findings can guide boards in forming leadership teams better equipped to address sustainability challenges.

However, this study also has some limitations. First, the reliance on data from the Guotai Junan database, which consists of 2,690 data points from Chinese listed companies, may lead to selection bias due to the scope and representativeness of the sample. These results may not be generalizable to a broader range of firms, especially those from different regions or industries. Furthermore, while the study employs rigorous quantitative analysis, it may overlook qualitative factors such as organizational culture, leadership styles, or specific management practices. These qualitative elements could provide deeper insights into how executive characteristics influence ESG performance. Lastly, although green innovation is considered as a moderating variable, its complex and multifaceted nature may make it difficult to capture all relevant dimensions and fully understand how it interacts with other factors. Different types of innovation (e.g., product versus process innovation) may have varying effects on ESG outcomes, adding complexity to the results.

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