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Executive AI Capability and Strategic ESG Decision-Making: Evidence from Chinese Listed Firms

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ABSTRACT

This study investigates the influence of executives' artificial intelligence (AI) capability on firm-level Environmental, So-cial, and Governance (ESG) outcomes within developing economies, recognising that such dynamics may diverge from those observed in advanced markets. Focusing on China as a representative context, the analysis explores the underlying pathways linking executives' AI capability with ESG per-formance, while also examining the contingent effects of political dependence dimensions, including resource redun-dancy and ownership structure. Grounded in a strategic deci-sion-making perspective, the study posits that executives' AI capability primarily informs ESG-oriented managerial judgements and investment allocations, rather than directly determining ESG outcomes. Utilising panel data spanning 2011 to 2023, the findings reveal three key insights. First, executives' AI capability exerts a positive effect on ESG performance. Second, the presence of redundant resources weakens this relationship, whereas private ownership en-hances it. Third, additional examination shows that execu-tives' AI capability is positively associated with symbolic environmental performance, but demonstrates no statistically significant linkage with substantive environmental perfor-mance, thereby indicating a strategic trade-off between sym-bolic and substantive ESG engagement. Collectively, these findings contribute to a more nuanced understanding of how managerial competencies at the individual level shape ESG outcomes in developing-country settings, while also offering practical implications for both corporate leaders and policy-makers.

1. Introduction

Recently, ESG considerations have increasingly attracted scholarly interest. Earlier investigations have identified multiple determinants of ESG at both organisational and institutional levels, including slack resources [20], governance arrangements [9], governmental intervention [38], and peer influence [16]. More recent work has shifted towards individual-level antecedents, with particular emphasis on executive-related factors. This stream of research highlights executives' demographic attributes, such as age, gender, education, and professional background [6; 8; 32],

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alongside psychological traits including hubris, narcissism, and overconfidence [29; 35; 59]. These attributes shape how executives perceive and interpret environmental and social issues. More recent attention has been directed towards executive capability, given that ESG, as a long-term investment, depends not only on executive characteristics but also on their capacity to manage long-horizon investments effectively [17; 28; 64]. The rapid expansion and diffusion of AI technologies have transformed organisational operations and managerial decision environments, imposing heightened cognitive demands in information processing, risk evaluation, and strategic formulation. Within this setting, executives' AI capability, defined as the capacity to convert AI's technical potential into judgements that enhance organisational competitiveness, has emerged as a critical determinant of ESG strategic orientation and long-term outcomes [18; 48; 65].

Contextual conditions can reshape the influence of established ESG drivers and may also generate new ones. Although ESG has gained strong market endorsement in developed economies Chen et al. [11], existing evidence suggests that ESG investments in developing contexts often fail to yield substantial market returns [3; 25]. This is largely attributed to consumer behaviour in such markets, where price sensitivity is pronounced [7] and functional product attributes are prioritised over ESG-related features [4]. Consequently, executives in developing economies may assign comparatively lower importance to ESG than their counterparts in developed settings. As noted in Almarayeh [3], firms in these environments frequently incur considerable short-term compliance and implementation costs, while facing delays in achieving market recognition and resource-based returns. Accordingly, within developing-country contexts, it remains uncertain whether executives' AI capability can effectively enhance ESG outcomes or meaningfully reshape ESG investment strategies.

Furthermore, while ESG development in advanced economies is largely driven by market mechanisms, in developing contexts such as China it is predominantly government-led [12]. Under such conditions, ESG functions as a strategic instrument for regulatory compliance and the attainment of political legitimacy [5; 55], which is essential for securing access to markets, technology, and human capital [21; 33]. Given that governments exert substantial control over critical resources in these economies, thereby significantly influencing firm operations [45], executives' perceptions of ESG are likely shaped by the extent of firms' reliance on political structures. This dependence may, in turn, affect ESG-related investment decisions. Following prior studies [21; 41; 45], this study conceptualises firms' need for political legitimacy as political dependence. Examining this factor enables a more refined understanding of how executives' AI capability interacts with ESG performance within a strategic decision-making framework in developing economies. Building on the above discussion, this study addresses two central research questions within the context of developing economies:

1) Does executives' AI capability reshape firms' ESG investment decisions and improve ESG performance?
2) How does political dependence influence the relationship between executives' AI capability and ESG performance?

China is selected as the empirical context for this investigation. In response to mounting environmental and social challenges following decades of rapid economic expansion, the Chinese government has increasingly prioritised sustainable development [23; 39], introducing policies to encourage corporate engagement in ESG practices [30; 66]. Despite this institutional support, business practices in China do not fully reflect the extent of governmental endorsement [47], making it a suitable setting for examining ESG performance dynamics. Additionally, the rapid advancement of AI adoption in China, combined with substantial heterogeneity across firms in terms of digitalisation levels and managerial technological awareness, provides a robust empirical

basis for assessing the role of executives' AI capability. As the largest developing economy globally, China also shares structural similarities with other emerging and industrialising nations, enhancing the broader relevance of the findings [23].

This study contributes to the literature on individual-level determinants of ESG in two primary ways. First, it incorporates executives' AI capability into the analysis of firm ESG performance, thereby extending existing research on ESG drivers and executive attributes. Second, it examines the moderating role of political dependence, a context-specific factor characteristic of developing economies. Drawing on prior work [41; 42; 50], political dependence is analysed through two dimensions, namely redundant resources and ownership structure. Furthermore, to clarify the mechanisms through which executives' AI capability influences ESG outcomes, the study distinguishes between symbolic and substantive environmental performance in subsequent analysis, highlighting a strategic trade-off between these two forms of ESG engagement. The findings offer deeper insights into the linkage between executives' AI capability and ESG performance in developing contexts, while also providing actionable implications for both corporate decision-makers and policymakers.

2. Literature Review and Hypothesis Development

2.1 Determinants of ESG Performance

ESG represents a long-term investment orientation aimed at addressing the expectations of diverse stakeholders [57]. Through mechanisms such as legitimacy construction Jiang et al. [27], product differentiation [53], and the strengthening of social reputation [10; 58], ESG engagement can enhance firms' market outcomes. Existing literature has extensively examined institutional and organisational drivers underpinning corporate participation in ESG, including regulatory pressures [37], societal and industry norms [16], governance frameworks [9], and the availability of slack resources [20].

Given that managerial actors hold discretion over organisational responses to institutional pressures and resource allocation decisions [19], more recent research has shifted towards individual-level determinants of ESG. This body of work emphasises the role of executive attributes, including gender, educational attainment, professional experience, as well as behavioural traits such as arrogance and narcissism, in shaping firm ESG engagement [6; 8; 29; 32; 35; 59]. Within the context of widespread AI integration in managerial processes, a critical dimension of executive capability concerns the extent to which AI technologies can be effectively understood and utilised. Executives' AI capability refers to the capacity to recognise the technological value of AI, comprehend its operational mechanisms, manage its adoption, and facilitate its alignment with business processes within an ethical framework [2; 65]. From a strategic decision-making perspective, executives possessing strong AI capability are more likely to identify the strategic relevance of ESG-related technologies and embed ESG considerations into organisational decision frameworks. Such executives are better positioned to leverage AI in environmental governance, social responsibility fulfilment, and governance enhancement, thereby aligning ESG objectives with technological applications at the strategic level.

However, the majority of prior studies examining individual-level ESG determinants are grounded in developed-country contexts, raising questions regarding their applicability to developing economies. The influence of ESG drivers may vary substantially across these contexts [3; 11; 25], as firm strategies and behaviours are shaped by their surrounding environments Scott [51], and institutional, market, and legal conditions differ markedly between developed and developing settings [69]. For instance, evidence suggests that market competition enhances ESG performance

in the United States [31], whereas in emerging economies it may exert a constraining effect [43]. This divergence is largely attributed to the comparatively lower returns associated with ESG investments in developing markets. Consequently, existing individual-level analyses require reassessment within developing-country contexts, particularly in relation to executives' AI capability. In environments where ESG is not strongly supported by market mechanisms, it remains unclear whether firms led by executives with high AI capability will pursue such long-term, lower-return investments, and how these executives shape ESG-related strategic choices.

Additionally, shifts in national context may introduce new determinants of ESG performance. Emerging evidence from developing economies indicates that governmental influence plays a more prominent role in ESG development compared to developed contexts [12]. In settings characterised by weaker market institutions, firms seeking access to critical resources often cultivate close relationships with government authorities, which control key assets such as market entry, land allocation, tax incentives, and ownership structures [40; 52]. Consequently, in developing countries such as China, heightened governmental emphasis on environmental and social issues has positioned ESG as a strategic mechanism for securing political legitimacy and accessing state-controlled resources [41; 52; 55]. Therefore, when examining this relationship in developing contexts, it is essential to further investigate how political dependence shapes the linkage between executives' AI capability and ESG performance by influencing ESG-related strategic decision-making processes.

2.2 Executives AI Ability and ESG Performance

Prior evidence indicates that enhanced executive capability mitigates concerns related to career risk, thereby increasing the propensity to support long-term strategic initiatives, including ESG, which in turn improves ESG performance [17; 28; 64]. However, such conclusions are predominantly derived from developed-country samples. In these contexts, consumers are generally willing to pay a premium for products embodying ESG attributes, thereby strengthening the economic returns associated with ESG investment [61]. In contrast, emerging evidence suggests that ESG performance in developing economies does not necessarily translate into greater consumer willingness to pay [38]. Two primary factors explain this divergence. First, deficiencies in social statistics and information disclosure systems hinder consumers' ability to accurately and promptly identify products with ESG characteristics [46]. Second, high price sensitivity among consumers limits firms' capacity to recover the long-term costs of ESG investments through market mechanisms [7]. As a result, the uncertainty surrounding ESG as a long-term investment increase, weakening executives' incentives to adopt ESG as a means of enhancing market performance. Within this context, executives' AI capability assumes a pivotal role. Executives with strong AI capabilities are better equipped to process complex datasets, interpret market signals, and generate more precise forecasts regarding the risks and returns of long-term investments. When analytical insights and decision-support tools indicate that ESG investments are unlikely to yield substantial short- or medium-term market returns, the perceived strategic value of ESG diminishes, leading to reduced motivation to expand ESG engagement and consequently reshaping firms' ESG investment decisions.

Moreover, given resource constraints, ESG investment frequently competes with other long-term strategic initiatives. For instance, evidence suggests that heightened organisational focus on ESG may partially alleviate environmental sustainability pressures, thereby reducing incentives for further investment in environmental technologies [63]. Executives with advanced AI capability are more capable of identifying substitution effects among competing long-term strategies and reallocating scarce resources towards options with higher expected returns and clearer

implementation pathways within a strategic decision-making framework. Consequently, when such executives determine that ESG investments are unlikely to effectively attract customers or enhance market performance in developing contexts, firms may deliberately scale back ESG-related expenditures while increasing investment in alternative long-term strategies. This reflects a strategic trade-off in ESG allocation decisions. Based on this reasoning, the following hypothesis is proposed:

H1: Executives' AI ability is negatively associated with ESG performance.

2.3 The Moderating Role of Political Dependence

In developing countries contexts, firms' political dependence fundamentally arises from their reliance on government-controlled access to markets, talent, and technology [14; 15; 41]. The extent of this dependence is shaped by the firm's resource endowment and its political positioning. Drawing on prior research, this study focuses on two key dimensions—redundant resources [34] and ownership structure [39; 67]—to examine the moderating role of political dependence in the relationship between executives' AI capability and ESG performance. It is anticipated that higher levels of political dependence will prompt executives to place greater emphasis on ESG outcomes, thereby influencing firms' ESG investment decisions.

2.3.1 The Moderating Role of Redundant Resources

In developing-country settings, firms' redundant resources reflect not only their financial capacity but also the outcomes of their political dependence. Prior research indicates that financially robust firms are more likely to secure policy-related resources, such as subsidies, tax incentives, and credit support, by maintaining stable relations with government authorities [33; 50]. For instance, evidence demonstrates that slack resources enable firms to enhance social performance, including expanding charitable contributions [1; 56]. Resource accumulation stemming from political connections provides a buffer against environmental uncertainty, reducing reliance on returns from a single market channel. Consequently, redundant resources can be interpreted as a resource-based manifestation of political dependence, shaping how executives' AI capability influences their evaluation of ESG investment value and, in turn, firms' ESG investment decisions.

Firms with relatively limited redundant resources possess weaker internal financial buffers, making it more challenging to manage operational uncertainty via market mechanisms. As a result, these firms exhibit heightened political dependence, seeking to establish or strengthen governmental relationships to access critical resources, such as fiscal subsidies and policy support [15]. In this context, ESG activities serve as a strategic signal to demonstrate compliance, responsibility, and commitment to long-term development to governmental stakeholders. Compared with resource-abundant firms, those with fewer redundant resources are more incentivised to leverage ESG investments strategically to secure external institutional support, thereby alleviating internal resource constraints [34]. Executives with strong AI capability are better able to discern government policy directions and regulatory priorities, aligning ESG initiatives with policy objectives to enhance the likelihood of securing governmental recognition and resource allocation [49]. Therefore, in firms with low redundant resources, executives' AI capability is more readily translated into proactive ESG engagement, promoting ESG performance within a political-legitimacy-oriented strategic decision-making framework. Based on this reasoning, we hypothesize that:

H2: Redundant resources negatively moderate the relationship between executives' AI ability and ESG performance.

2.3.2 The Moderating Role of Ownership Structure

Prior studies indicate that government ownership constitutes a key source of political legitimacy and competitive advantage [13; 70]. In developing economies such as China, the state influences firms not only through regulatory oversight but also via direct or indirect equity holdings. Consequently, state-owned enterprises (SOEs) possess inherently high political legitimacy and typically benefit from government support and access to policy resources [21; 70]. By contrast, privately owned firms generally lack such institutional advantages, requiring additional legitimacy-building efforts to secure critical resources [41]. Hence, ownership structure significantly shapes firms' demand for political legitimacy and guides ESG-related strategic decision-making.

In developing countries, ownership structure influences firms' motivation to acquire political legitimacy, thereby moderating the impact of executives' AI capability on ESG decision-making. Executives with strong AI capability are adept at anticipating market-based ESG returns. In SOEs, where political legitimacy is already high, executives face weaker institutional pressures to pursue ESG for legitimacy purposes. In these firms, elevated AI capability tends to support cautious ESG investment decisions driven by market considerations, reflecting a market-oriented strategic decision-making framework. Conversely, private firms typically lack political legitimacy, prompting executives to view ESG as a strategic instrument to satisfy institutional expectations and alleviate policy constraints [62]. Under these conditions, even when executives with high AI capability assess that ESG investments may yield limited market returns, they may maintain comparatively high ESG engagement to secure political recognition and institutional support, reflecting a legitimacy-oriented ESG trade-off. Based on this reasoning, we hypothesize that:

H3: Private ownership positively moderates the relationship between executives' AI ability and ESG performance.

3. Methodology

3.1 Sample Data

The sample comprises firms listed on China's A-share market from 2011 to 2023. The selection process proceeded as follows. First, ST and *ST firms, firms delisted during the sample period, and those in the financial sector were excluded. Second, observations with missing values for control variables were removed. Third, firms with substantial missing data were omitted. Following these steps, the final sample consists of 28,166 observations. Continuous variables are winsorized at the 1st and 99th percentiles to reduce the influence of outliers. ESG data were obtained from the Wind Financial Terminal, while other firm-level information was sourced from the China Stock Market and Accounting Research (CSMAR) database.

3.2 Variables

3.2.1 Independent Variable: Executives AI Ability

Executives' AI capability is proxied by the proportion of senior executives with an information technology (IT) background. Only executives directly involved in daily decision-making are included, while individuals serving solely on the board of directors or supervisory board are excluded. Observations with missing executive resume information are also removed. Using information from executives' educational and professional histories, a keyword-matching approach identifies those with IT-related expertise or experience. An executive is classified as having an IT background if their resume contains any of the following keywords: "computer," "information technology," "big data," "cloud computing," "internet," "CTO," or "CIO." Executives' AI capability is then calculated as the

ratio of executives with an IT background to the total number of senior executives in a given year [36]. This measure reflects the collective level of digital and IT awareness within the executive team, with a higher ratio indicating stronger AI capability.

3.2.2 Dependent Variable: ESG Performance

Firm ESG performance is assessed using the ESG ratings provided by Huatai Securities, chosen for its extensive temporal coverage and applicability across a wide range of firms. The rating system classifies firms into nine levels, assigning ESG scores from 1 to 9. Consistent with prior studies [22], ESG performance is operationalised as the natural logarithm of the annual average ESG score plus one.

3.2.3 Moderating Variables: Political Dependence

Political dependence is captured through two dimensions: redundant resources and ownership structure. Redundant resources represent a firm's ability to flexibly allocate financial assets and are measured using the quick ratio, following prior research [60], with higher values indicating greater discretionary financial capacity. Ownership structure is coded according to firm ownership, with private ownership assigned a value of 1 and state ownership a value of 0.

3.2.4 Control Variables

Consistent with previous research [22; 26], control variables are included across two dimensions: firm financial characteristics and corporate governance. All data are obtained from the CSMAR database. Table 1 provides a summary of the variables and their respective data sources.

Table 1
Measurements of All Variables

Variable	Measurements	Database
Dependent Variable		
ESG Performance (ESG)	Measured using the Huatai Securities ESG rating. The annual average rating score is increased by one and then transformed using the natural logarithm	Wind
Independent Variable		
Executives Artificial intelligence Ability (ED)	Executives with an information technology background / the total number of senior executives	CSMAR
Moderating Variables		
Redundant Resource (RR)	Quick ratio, quick assets / current liabilities	CSMAR
Private Ownership (Owner)	Coded as 1 for private ownership and 0 for state ownership	CSMAR
Control Variables		
Firm Size (Size)	Ln（total assets）	CSMAR
Financial Leverage (Lev)	Total liabilities / total assets	CSMAR
Book-to-Market Ratio (BM)	Book value / market value	CSMAR
Cash Flow (Cash)	Operating cash flow / beginning total assets	CSMAR
CEO Duality (Dual)	Coded as 1 for CEO-chair duality, and 0 otherwise	CSMAR
Board Size (Board)	Ln（total number of board members）	CSMAR
Independent Directors (Indep)	(the number of independent directors / board members)×100	CSMAR

3.3 Empirical Model

This study utilises fixed-effects models for regression analysis. To account for macroeconomic cycles and firm- and industry-level heterogeneity, year, firm, and industry fixed effects are incorporated. The baseline model is specified as follows:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \theta Control_{it} + \alpha_i + Z_t + \gamma_{industry} + \varepsilon_{it} \quad (1)$$

$$Y_{it} = \beta_0 + \beta_2 X_{it} + \beta_3 X_{it} \times Moderator_{it} + \theta Control_{it} + \alpha_i + Z_t + \gamma_{industry} + \varepsilon_{it} \quad (2)$$

In the model, i indexes firms and t indexes years. Y_{it} denotes the dependent variable, namely ESG performance. X_{it} represents the independent variable, executives AI ability. $Moderator_{it}$ refers to the moderating variables, including redundant resources and private ownership. β denotes the regression coefficients. θ represents the vector of coefficients associated with the control variables. $\text{Control}_{\text{it}}$ includes all control variables. α_i captures firm fixed effects, z_t captures year fixed effects, $\gamma_{industry}$ captures industry fixed effects, ε_{it} is the error term.

4. Results

4.1 Descriptive Statistics

Table 2 presents the descriptive statistics. ESG performance ranges from 0.69 to 2.17, with a mean of 1.63. The average executives' AI capability is 0.17, reaching a maximum of 1, indicating that executives with an information technology background are relatively rare among Chinese listed firms and represent a small share of executive teams. The remaining variables exhibit acceptable descriptive statistics.

Table 2
Descriptive Statistics

Variable	N	Mean	S. D	Min	Max
ESG	28,166	1.63	0.17	0.69	2.17
ED	28,166	0.07	0.18	0.00	1.00
Size	28,166	22.41	1.28	19.95	26.30
Lev	28,166	0.43	0.20	0.06	0.90
BM	28,166	0.34	0.16	0.05	0.82
Cash	28,166	0.06	0.08	-0.17	0.29
Dual	28,166	0.27	0.44	0.00	1.00
Board	28,166	2.13	0.20	1.39	2.89
Indep	28,166	37.59	5.29	33.33	57.14

Table 3 reports the correlations among the key variables. Executives' AI capability shows a positive correlation with ESG performance, which only partially aligns with our baseline expectation. Overall, the correlations are relatively weak, with most coefficients below 0.3, indicating that multicollinearity is unlikely to substantially influence the estimation results [68].

Table 3
Correlation Matrix

	ESG	ED	Size	Lev	BM	Cash	Dual	Board	Indep
ESG	1								
ED	0.100***	1							
Size	0.215***	-0.094***	1						
Lev	-0.098***	-0.103***	0.483***	1					
BM	0.108***	-0.037***	0.052***	-0.458***	1				
Cash	0.098***	-0.037***	0.071***	-0.180***	0.006	1			
Dual	0.019***	0.101**	-0.159***	-0.118***	-0.023***	0.015**	1		
Board	0.005	-0.094***	0.254***	0.146***	0.027***	0.020***	-0.195***	1	
Indep	0.091***	0.052***	0.006	-0.010	-0.032***	0.009	0.118***	-0.539***	1

Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

4.2 Regression Analysis

Table 4 presents the baseline regression results examining the relationship between executives'

AI capability and ESG performance. Following prior studies [54], industry-year and firm-year fixed effects are included to strengthen the robustness of the results. The coefficient on executives' AI capability is positive and statistically significant, indicating a positive association with firm ESG performance. This finding contradicts the negative prediction of Hypothesis 1, and thus Hypothesis 1 is not supported. Several factors may explain this outcome. First, governments increasingly promote ESG through top-down regulations and policy guidance, making ESG an important institutional signal that influences firm legitimacy and access to resources. This process may heighten both market attention and executive focus on ESG performance [5; 55], thereby shaping ESG-related strategic decision-making.

Second, in China, strong governmental emphasis on green transformation and high-quality development enables executives with advanced AI capability to leverage enhanced information-processing skills to capture policy benefits, such as green credits and subsidies, which can improve ESG performance and increase the expected returns of ESG investments [34]. Third, digital technology advancement and green development often progress in tandem, with executives possessing AI expertise frequently driving firms' digital transformation. Improved resource allocation efficiency and reduced pollutant emissions enabled by digital technologies may indirectly enhance ESG outcomes. Nevertheless, it is important to note that ESG improvements linked to executives' AI capability may not always reflect substantive change, but rather symbolic actions [24]. To address this, further analyses distinguish between symbolic environmental performance and substantive environmental performance, clarifying the mechanisms through which executives' AI capability influences ESG outcomes and highlighting the strategic trade-off between symbolic and substantive ESG engagement.

Table 4
Baseline Regression

Variables	**(1)**	**(2)**	**(3)**	**(4)**
ED	0.062***	0.056***	0.055***	0.061***
	(7.85)	(7.10)	(9.47)	(7.82)
Size		0.021***	0.054***	0.047***
		(12.56)	(53.03)	(20.93)
Lev		-0.066***	-0.249***	-0.113***
		(-6.70)	(-33.84)	(-10.89)
BM		0.065***	-0.030***	0.031***
		(7.63)	(-3.77)	(3.24)
Cash		-0.042***	0.117***	-0.037***
		(-3.30)	(8.89)	(-2.93)
Dual		-0.000	0.007***	-0.001
		(-0.07)	(3.12)	(-0.37)
Board		0.030***	0.028***	0.006
		(3.26)	(4.60)	(0.62)
Indep		0.002***	0.003***	0.002***
		(6.87)	(13.12)	(6.26)
Constant	1.621***	1.017***	0.368***	0.532***
	(1,758.91)	(22.82)	(15.29)	(10.03)
Firm FE	Yes	Yes	No	Yes
Industry	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	28,166	28,166	28,166	28,166
Adjusted R2	0.485	0.486	0.196	0.499

Note: Significance levels are defined in Table 3.

4.3 Moderating Effect Analysis

Table 5 reports the results of the moderate analyses. Columns (1) and (2) examine the moderating role of redundant resources, with the interaction term showing a negative and significant effect. This indicates that executives with higher AI capability are better able to assess ESG investment risks and adopt more cautious ESG-related decisions. Consequently, when redundant resources are limited, ESG investment tends to decline further, reflecting a resource-constrained strategic decision trade-off. Hypothesis 2 is therefore supported. Columns (3) and (4) assess the moderating effect of private ownership, where the interaction term is positive and significant. This suggests that the positive impact of executives' AI capability on ESG performance is stronger in privately owned firms compared with SOEs, supporting Hypothesis 3. This result likely reflects the greater need for political legitimacy in private firms. In such contexts, executives with AI expertise can more effectively leverage technological capabilities to meet ESG-related expectations and secure associated resource support, thereby influencing ESG-related strategic decision-making.

Table 5
Moderating Effect

Variables	**(1)**	**(2)**	**(3)**	**(4)**
ED	0.061***	0.079***	0.061***	0.031*
	(7.80)	(7.16)	(7.82)	(1.81)
RR	0.004	0.006**		
	(1.52)	(2.08)		
ED×RR		-0.028**		
		(-2.30)		
Owner			0.001	-0.001
			(0.18)	(-0.21)
ED×Owner				0.038**
				(2.04)
Size	0.047***	0.047***	0.047***	0.047***
	(20.89)	(20.93)	(20.91)	(20.85)
Lev	-0.106***	-0.106***	-0.113***	-0.113***
	(-9.46)	(-9.46)	(-10.87)	(-10.86)
BM	0.031***	0.031***	0.031***	0.031***
	(3.27)	(3.25)	(3.24)	(3.26)
Cash	-0.037***	-0.038***	-0.037***	-0.037***
	(-2.93)	(-2.94)	(-2.93)	(-2.92)
Dual	-0.001	-0.001	-0.001	-0.001
	(-0.38)	(-0.38)	(-0.38)	(-0.39)
Board	0.006	0.006	0.006	0.006
	(0.61)	(0.61)	(0.63)	(0.63)
Indep	0.002***	0.002***	0.002***	0.002***
	(6.25)	(6.24)	(6.25)	(6.25)
Constant	0.529***	0.526***	0.532***	0.536***
	(9.96)	(9.91)	(10.00)	(10.07)
Firm & Industry & Year FE	Yes	Yes	Yes	Yes
Observations	28,166	28,166	28,166	28,166
Adjusted R2	0.499	0.499	0.499	0.499

Note: Significance levels are defined in Table 3.

4.4 Endogeneity Analysis

To address potential endogeneity arising from omitted variables, we follow prior studies [44] and employ an instrumental variable (IV) approach. Consistent with existing research Ji et al. [26], the industry-level average of executives' AI capability is used as the instrument, and the model is

estimated using two-stage least squares (2SLS). As reported in Columns (1) and (2) of Table 6, the main results remain robust, confirming that our findings are not driven by omitted-variable bias.

Table 6
Endogeneity Analysis

Variables	**(1)**	**(2)**
	ED	**ESG**
ED_instrumented		0.071***
		(5.35)
ED_PeerRatio	0.752***	
	(112.91)	
Size	0.003**	0.047***
	(2.35)	(20.90)
Lev	0.013*	-0.113***
	(1.94)	(-10.90)
BM	0.012*	0.031***
	(1.89)	(3.23)
Cash	0.000	-0.037***
	(0.02)	(-2.93)
Dual	0.003	-0.001
	(1.64)	(-0.39)
Board	0.003	0.006
	(0.56)	(0.62)
Indep	-0.000***	0.002***
	(-2.65)	(6.28)
Constant	-0.045	
	(-1.29)	
Firm & Industry & Year FE	Yes	Yes
Anderson Canon. Corr. LM statistic	9633.857***	
Cragg-Donald Wald F statistic)	1300	
Observations	28,166	28,166
Adjusted R^2	0.799	0.028

Note: Significance levels are defined in Table 3.

4.5 Robustness Analysis

Table 7 presents robustness checks using an adjusted sample and an alternative measure of executives' AI capability. First, as firms listed on the Small and Medium Enterprise (SME) Board and ChiNext Board generally exhibit greater innovation, growth potential, and technological reliance, Column (1) reports results for this subsample. The coefficient for executives' AI capability remains positive and significant, indicating that an AI-related executive background continues to drive ESG performance in the most innovative firm groups. Second, to control industry heterogeneity, Column (2) focuses on a subsample of manufacturing firms. The coefficient of 0.058 is significant, suggesting that even within the traditional manufacturing sector, executives with AI capability can effectively promote green transformation and social responsibility initiatives. Finally, the original ratio-based measure of executives' AI capability is replaced with a binary indicator (ED_Dummy), coded as one if at least one top management executive has an IT background and zero otherwise. In Column (3), the coefficient of ED_Dummy is 0.013 and significant. Collectively, these robustness checks consistently support the conclusion that executives' AI capability significantly enhances firm ESG performance.

Table 7
Robustness Test

Variables	(1)	(2)	(3)
ED	0.066***	0.058***	
	(7.22)	(5.70)	
ED_Dummy			0.013***
			(4.20)
Size	0.052***	0.051***	0.047***
	(15.08)	(17.40)	(20.89)
Lev	-0.134***	-0.108***	-0.113***
	(-8.61)	(-8.28)	(-10.84)
BM	0.030**	0.035***	0.031***
	(2.12)	(3.01)	(3.24)
Cash	-0.022	-0.025	-0.037***
	(-1.13)	(-1.51)	(-2.91)
Dual	-0.002	-0.003	-0.001
	(-0.62)	(-0.77)	(-0.29)
Board	-0.024*	0.015	0.006
	(-1.73)	(1.30)	(0.61)
Indep	0.002***	0.002***	0.002***
	(3.45)	(4.60)	(6.12)
Constant	0.519***	0.419***	0.536***
	(6.41)	(6.03)	(10.08)
Firm & Industry & Year FE	Yes	Yes	Yes
Observations	12,469	18,593	28,166
Adjusted R2	0.446	0.484	0.498

Note: Significance levels are defined in Table 3.

4.6 Further Analysis

To identify the mechanisms through which executives' AI capability influences firm ESG performance, we conduct further analyses following [24]. A text analysis approach is employed to extract and quantify keywords related to environmental planning and actions from firms' annual reports, capturing symbolic environmental performance and substantive environmental performance, respectively. Table 8 presents these results. Executives' AI capability is positively and significantly associated with symbolic environmental performance, whereas its relationship with substantive environmental performance is not statistically significant, highlighting a strategic trade-off between symbolic and substantive ESG engagement.

These findings indicate that executives with higher AI capability do not reduce ESG investment due to cost or expected-return considerations, contrary to the prediction of Hypothesis 1. Instead, their enhanced information-processing and risk-assessment skills enable them to leverage digital disclosure and strategic communication advantages. In developing-country contexts, where ESG legitimacy is increasingly valued, but substantive ESG returns remain uncertain, executives with stronger AI capability may strategically prioritise symbolic ESG actions as a more efficient managerial decision. By emphasising symbolic statements and planning-related disclosures, firms can satisfy the expectations of rating agencies and regulators. Such disclosure-oriented strategies provide legitimacy benefits and rating improvements at relatively low substantive costs, making them a rational ESG investment under resource constraints [24]. Therefore, the positive impact of executives' AI capability on ESG performance observed in the baseline regressions may be driven primarily by symbolic or disclosure-based mechanisms rather than substantive resource investments, suggesting that AI capability reshapes strategic ESG allocation towards symbolic channels.

Table 8
Further Analysis

Variables	**(1)** **Env_Strategy**	**(2)** **Env_Action**
ED	0.089**	0.002
	(2.13)	(0.03)
Size	0.016	0.053***
	(1.47)	(3.81)
Lev	-0.042	-0.147**
	(-0.87)	(-2.37)
BM	-0.023	-0.113**
	(-0.52)	(-1.97)
Cash	0.116**	0.092
	(2.00)	(1.22)
Dual	-0.015	-0.018
	(-1.13)	(-1.08)
Board	0.062	0.082
	(1.49)	(1.50)
Indep	0.001	0.003*
	(0.78)	(1.71)
Constant	0.094	-0.345
	(0.37)	(-1.06)
Firm & Industry & Year FE	Yes	Yes
Observations	21,088	21,088
Adjusted R2	0.426	0.698

Note: Significance levels are defined in Table 3.

5. Conclusion

5.1 Conclusion

Using a sample of Chinese listed firms, this study examines the relationship between executives' AI capability and ESG performance. The results reveal a significant positive association between executives' AI capability and ESG performance. Further analysis shows that this effect is primarily reflected in symbolic environmental performance, while the impact on substantive environmental performance is not significant. These findings indicate that, in the developing-country context, executives with stronger AI capability tend to adopt strategic compliance behaviours, reflecting ESG-related decision-making under institutional pressure. Rather than engaging in high-cost substantive investments, they enhance ESG ratings through relatively low-cost optimisation of information disclosure, highlighting a strategic trade-off between symbolic and substantive ESG engagement. Additionally, considering the institutional environment and ESG determinants unique to developing countries, the study investigates how different forms of political dependence moderate the link between executives' AI capability and ESG performance. Redundant resources exhibit a significant negative moderating effect, suggesting that when firms have limited redundant resources, ESG is more likely to serve as a strategic tool to alleviate resource constraints and secure institutional support, thereby influencing ESG investment decisions. Private ownership positively moderates this relationship. Compared with SOEs, the positive association between executives' AI capability and ESG performance is stronger in privately owned firms. This indicates that private firms, lacking inherent political legitimacy, rely on ESG activities to obtain government recognition and institutional resources, prompting executives to prioritise legitimacy-oriented ESG decision-making.

5.2 Theoretical Contributions

First, this study extends the literature on individual-level determinants of firm ESG performance. Previous research at the individual level has mainly focused on executives' demographic characteristics, psychological traits, and general managerial abilities. Less attention has been given to new forms of managerial capabilities required in increasingly digitalized and intelligent decision-making environments. By incorporating executives' AI capability into the analysis of firm ESG performance, this study addresses the limitation of traditional executive-characteristic frameworks in explaining firms' sustainability behaviour amid deep AI integration. The findings indicate that executives' AI capability is positively associated with ESG performance. Further analysis shows that technology-enabled executives tend to prioritise symbolic disclosure over substantive change, highlighting a strategic trade-off between symbolic and substantive ESG engagement. This demonstrates that executive AI capability shapes not only ESG outcomes but also firms' ESG-related investment and disclosure decisions, providing a micro-level perspective on the interaction between digitalisation and green transition.

Second, this study illuminates how political dependence influences ESG behaviour in developing countries. Political dependence, a distinctive institutional factor in these contexts, is integrated into the analytical framework examining the relationship between executives' AI capability and ESG performance. Its different manifestations, captured through redundant resources and ownership structure, enrich the theoretical understanding of political connections and ESG. The findings reveal that political dependence moderates the relationship between executives' AI capability and ESG performance by influencing the relative appeal of symbolic versus substantive ESG strategies. This establishes an institution-contingent decision framework that explains why and under what conditions executive AI capability translates into different ESG strategic choices in developing-country settings.

5.3 Practical Implications

For firms, we should be alert to the technology-driven greenwashing risk and promote the The findings indicate that the transformation of ESG from strategic signalling to substantive action remains limited. Although executives' AI capability enhances ESG performance, the effect primarily manifests through strategic disclosure, reflecting a trade-off between symbolic and substantive ESG engagement. When selecting executives with digital expertise, boards and shareholders should consider not only their ability to improve external ratings but also implement assessment systems that include hard metrics, such as measurable carbon emission reductions and environmental protection investments, to guide executives' ESG-related managerial decision-making. Firms should encourage executives to leverage AI technology for optimising production processes, energy management, and other substantive operational areas, rather than solely as a tool for enhancing information disclosure. The study further shows that limited redundant resources constrain ESG investment, while private ownership increases reliance on ESG as a means of securing institutional support. This underscores that in developing countries, market mechanisms alone are insufficient to sustain ESG initiatives, and government intervention remains critical through institutional guidance and policy incentives. Policymakers can promote a shift from short-term compliance towards long-term strategic ESG engagement by enhancing information disclosure systems, incorporating ESG performance into resource allocation and policy support frameworks, and providing positive incentives for private firms. Consequently, with the rapid development of AI, firms can achieve coordinated advancement of technological progress and sustainable development, offering clearer decision guidance for both executives and policymakers.

5.4 Limitations and Future Research

First, our sample is limited to listed firms, whereas private start-ups may experience greater legitimacy pressures due to their early-stage characteristics. Future research could investigate the determinants of ESG performance specifically among start-ups in developing-country contexts. Second, this study focuses on China as a representative developing economy and highlights the moderating role of political dependence in the relationship between executives' AI ability and ESG performance. However, institutional environments, government roles, and market maturity vary widely across developing countries. Future studies could extend this framework to other emerging economies to assess the generalizability of political dependence and its influence on ESG outcomes across diverse institutional contexts.

Author Contributions

Conceptualization, C.L.; methodology, H.J. and R.Z.; software, R.Z.; validation, C.L., H.J. and R.Z.; formal analysis, C.L.; investigation, H.J. and C.L.; resources, R.Z.; data curation, R.Z.; writing—original draft preparation, C.L.; writing—review and editing, C.L., H.J. and R.Z.; visualization, R.Z.; supervision, H.J.; project administration, C.L.; funding acquisition, C.L. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement

The data presented in this paper are available on request from the corresponding author.

Conflicts of Interest

The authors declare no conflicts of interest.

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