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Does the CEO's Attention Affect How Well the Firm Performs Environmentally?

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ABSTRACT

This study explores whether CEOs' environmental attention (CEA) enhances firms' environmental performance. Drawing on attention-based and upper echelons theories, which emphasize that executives' cognitive focus shapes organizational outcomes, we argue that CEOs who devote greater attention to environmental issues are more likely to integrate environmental activities into corporate strategy. Using a panel dataset of non-financial firms listed in the FTSE 100, we measure CEOs' environmental attention from their annual letters to shareholders, employing four validated environmental wordlists. The results show that higher CEO environmental attention is positively associated with improved environmental performance, both concurrently and prospectively, with the strongest effect observed in emissions reduction. These findings highlight the pivotal cognitive role of CEOs in advancing corporate environmental sustainability and contribute to the growing literature on leadership and sustainability governance.

1 | Introduction

Managing local and global environmental changes is crucial for businesses and society today. These changes are degrading every aspect of life and risk worsening conditions for future generations (Aguilera et al. 2021, 1468). Environmental sustainability has become a crucial strategy for a firm's long-term success, enhancing its reputation, access to resources, stakeholders' relations, competitive advantage, and ultimately its financial performance (Clarkson et al. 2011; Dal Maso et al. 2024; Gull et al. 2022; Hart 1995; Islam et al. 2025; Lundgren and Zhou 2017; Orazalin et al. 2024; Russo and Fouts 1997).

Recent research emphasizes the significance of CEO characteristics in improving firms' environmental sustainability outcomes, including strategy, performance, and disclosure (Aguilera et al. 2021; Mahran and Elamer 2024). For instance, studies show that CEO characteristics are associated with green innovation (Galbreath 2019; Wang, Yang, et al. 2024), environmental performance (Glass et al. 2016), environmental strategy (Dahlmann and Brammer 2011), and environmental disclosures (Lewis et al. 2014; Zhu et al. 2023). However, despite this growing body of research, limited attention has been paid to the psychological characteristics (i.e., cognition) that underlie CEOs' environmental decision-making (Mahran and Elamer 2024).[1] Previous studies have focused mainly on CEOs' observable characteristics—what Aguilera et al. (2021) describe as "the visible part of the iceberg"—such as tenure, gender, and background (Aguilera et al. 2021; Aguirre-Pérez and García-Sánchez 2025). Although these characteristics are important, CEOs' psychological characteristics are likely to have a more direct influence on their strategic choices and actions (Wang, Devine, et al. 2024). This under-researched area highlights an important gap in understanding the role CEO cognition in shaping firms' environmental outcomes.

This study aims to examine whether CEO environmental attention (hereafter CEA) can contribute to improving firm

environmental performance. We draw on attention-based theory and upper-echelons theory, both of which emphasize that top executives—and what they focus on—shape firm outcomes. Executive attention is defined as the "allocation of controlled cognitive resources to a particular focus of attention, independent of other stimuli that might present in a context or while dealing with interruptions" (Ocasio 2011, 1287). In this study, environmental attention refers to the degree to which CEOs focus on protecting the natural environment. What the CEOs pay attention to tends to influence their decision-making and actions (Eggers and Kaplan 2009). Accordingly, CEOs who pay greater attention to environmental issues are expected to prioritize environmental goals (e.g., reducing emissions, increasing green revenues, and using resources as efficiently as possible) (Wang, Yang, et al. 2024; Zameer et al. 2021). This prioritization is expected to improve firm environmental performance.

To investigate the relationship between CEOs' environmental attention and firm environmental performance, we construct a panel dataset that comprises 75 non-financial FTSE 100 firms over nine consecutive years (2011–2019). These firms are becoming more involved in a variety of beneficial environmental initiatives, including reducing greenhouse gas emissions and developing eco-friendly products (Okereke 2007). This context provides a valuable setting to examine whether CEOs contribute to this trend. We measure CEOs' environmental attention—using their annual letter to shareholders—by reference to four environmental wordlists: Ahn (2020); Loughran et al. (2023); Moss et al. (2018); Vaupel et al. (2023).

Our findings consistently reveal that CEA contributes significantly to firm environmental performance, both contemporaneously and prospectively. While performance improvements emerge across all environmental dimensions—resource use, emissions reduction, and environmental innovation—the effect is particularly pronounced for emissions reduction. Firms led by CEOs with higher environmental attention demonstrate stronger commitments to and greater effectiveness in reducing emissions across production and operational processes. These findings align with global efforts to address climate change and advance net-zero business models and solutions (Carbon Disclosure project (CDP) et al. 2025; United Nations Global Compact and Accenture 2021).

Our study contributes to the existing literature by responding to calls to move beyond firm-level characteristics and CEOs' observable characteristics, instead underscoring the cognitive role of CEOs—specifically, their environmental attention—in enhancing firm environmental performance. Although firms may limit their environmental efforts to regulatory compliance and liability containment (Aragòn-Correa et al. 2020; Bansal and Roth 2000), a positive managerial attitude toward the natural environment can serve as a key driver of enhanced environmental performance that extends beyond mere compliance.

Prior research has examined how specific forms of managerial cognition and attention influence green innovation (Huang et al. 2024; Wang, Yang, et al. 2024), carbon emissions (Rehman et al. 2022; Wagner and Fischer-Kreer 2024; Zameer et al. 2021), and greenwashing practices (Hao et al. 2025). This literature emphasizes executives' distinct cognitive characteristics related to environmental performance, including attention breadth (i.e., attention to multiple issues simultaneously) (Ahn 2020), promotion and prevention focus (Wagner and Fischer-Kreer 2024), temporal focus (i.e., past-, present-, or future-oriented) (Zhao et al. 2025), and managerial awareness (Garel and Petit-Romec 2022; Zameer et al. 2021). We extend this literature by focusing on CEOs' attentional intensity, defined as the degree of attention devoted to a focal issue such as environmental concerns (Brielmaier and Friesl 2023; Joseph and Wilson 2018). This individual-level mechanism remains underexplored despite its direct link between CEOs' priorities and firms' environmental performance.

The remainder of this study is structured as follows. Section 2 presents the theoretical background underlying the study. Section 3 provides a comprehensive review of the relevant literature and develops the research hypothesis. Section 4 outlines the research methodology, including the sample selection, data sources, variable measurement, and empirical models. Section 5 reports the empirical results, while Section 6 discusses the findings and offers the concluding remarks.

2 | Theoretical Background

Upper echelons theory proposes that the personal characteristics (values, cognitions) of "powerful actors" (top executives and particularly the CEO) significantly influence organizational outcomes, including both strategic (e.g., product innovation) and performance (e.g., social, profitability, and growth) outcomes (Carpenter et al. 2004; Hambrick and Mason 1984). Similarly, Ocasio (1997, 203) suggests that what CEOs do "depends on how they selectively focus their attention on certain characteristics of the organization and its environment, and ignore others." Attention directs what CEOs notice, encode, interpret, and focus their time and effort in their environment, shaping their sensemaking and subsequent strategic choices and actions (Kaplan 2011). It varies across CEOs due to differences not only in information exposure but also in relatively stable, distinct cognitive characteristics (Desjardine and Shi 2020).

Research on CEO attention demonstrates that attention to a specific issue (e.g., attention to innovation) positively influences firm outcomes such as firm innovativeness (e.g., entry into new product markets or new product development) (Eggers and Kaplan 2009; Fu et al. 2020; Yadav et al. 2007), the firm's rate of exploration (Rhee 2024), and risk-taking propensity (Surroca et al. 2016). Similarly, Stevens et al. (2015) find that firms managed by CEOs who have a high degree of other-regarding values (e.g., helpful and loving) allocate more attention to social goals. These values further contribute to higher stakeholder-based performance (e.g., higher product and service quality, stronger fulfillment of the social mission, enhanced public reputation, and greater growth in the client base) (Jiao et al. 2017).

The direct influence of CEOs' attention on their choices and subsequent actions is referred to as "behavior channeling" (Chin et al. 2013). CEOs "weigh available alternatives, facts, probabilities, and eventualities, and select a course of action that aligns with their attention" (Chin et al. 2013). They are likely to take action to pursue goals compatible with their attention, resulting

in improved performance in that domain. An alternative mechanism that explains how CEO attention shapes their strategic decisions and actions is "perceptual screening." Managers face large amounts of complex and ambiguous information, and rely on their cognitive biases, values, and experiences to handle, filter out, and interpret this information (Finkelstein et al. 2009; Hambrick and Mason 1984). On that basis, CEOs' attention serves to filter out information inconsistent with their cognitive schemes and subsequently shapes their assessment of the potential efficacy of various corporate actions, including environmental initiatives (Chin et al. 2013; Cho and Hambrick 2006).

Empirical research further illustrates these mechanisms. Politically liberal CEOs are more inclined to support social and environmental initiatives than their conservative peers (Chin et al. 2013; Kim 2024). As another example, CEOs' awareness of climate change, as manifested through their personal experience of abnormally high temperatures, has been associated with reductions in corporate carbon emissions (Garel and Petit-Romec 2022). Likewise, CEOs with environmental backgrounds are more willing to disclose corporate environmental management information and tend to provide higher levels of disclosure (Zhu et al. 2023). Studies in leadership also show that socialized leaders are likely to take action 'for the betterment of people, society, or institutions regardless of personal consequence', while personalized leaders' actions tend to place more emphasis on enhancing their personal power (Ligon et al. 2008, 317).

Because CEO attention is not directly observable, strategic management research has widely recognized CEO letters to shareholders as a rich source of information about CEOs' mindsets (Abrahamson and Hambrick 1997; Cho and Hambrick 2006; Clapham and Schwenk 1991; Craig and Amernic 2021; D'Aveni and MacMillan 1990; Duriau et al. 2007; Engelen et al. 2016; Huff 1990; Huff and Schwenk 1990; Kaplan 2011; McKenny et al. 2018; Ocasio 2011; Short et al. 2010; Short and Palmer 2003, 2008). This framework is grounded in the Whorf–Sapir hypothesis, which proposes that "the cognitive categories through which individuals attend to the world are embedded in the words they use" (Abrahamson and Hambrick 1997, 516). Thus, the words CEOs use and their frequency reveal their cognitive centrality, attentional focus, and sensemaking strategies (D'Aveni and MacMillan 1990; Huff 1990; Muller and Whiteman 2016).

Nadkarni and Barr (2008) examine the trustworthiness of information disclosed in shareholder letters and report that analysts rated them as generally trustworthy (mean = 3.9 on a five-point scale). Likewise, Gamache et al. (2015) demonstrate that the contents of letters show consistency when they are signed by the same CEO, but vary substantially across different CEOs. They conclude that the content of the letter to shareholders is a valid measure that underlies differences in cognition and motives among CEOs.

However, it has been argued that the CEO letter to shareholders may be crafted by consultants or public relations staff or communication professionals, rather than by the CEOs themselves. As a public document, the letter may also constitute an attempt to manage the impression of stakeholders rather than represent a valid source of CEO cognition. Nevertheless, research shows that the CEO letter is likely the outcome of a collective effort by the top executive team, with the final draft approved by the CEO (Abrahamson and Hambrick 1997; Cho and Hambrick 2006). Fiol (1995) concludes that non-evaluative statements (e.g., causal attributions) in the letter to shareholders are more likely to reflect managerial cognition, while evaluative statements (e.g., positive orientations) may be driven by impression management motives.

3 | Literature Review and Hypothesis Development

Environmental performance is an outcome that reflects the extent to which a firm protects the natural environment (Paillé et al. 2014, 451). It is commonly assessed using a range of sustainability indicators, including emissions and resource reduction, waste minimization, promoting recycling, and the development of eco-designed products (Aguilera et al. 2021; Dragomir 2018). However, despite its importance to a firm's long-term success, evidence suggests that environmental performance can vary considerably among firms (Berrone et al. 2013). Achieving strong environmental performance often requires sufficient financial resources and a long-term strategic commitment (Berrone et al. 2013; Clarkson et al. 2011; Hart 1995; Russo and Fouts 1997). The role of CEO attention is particularly important in securing these resources and in shaping and sustaining this commitment. This influence operates through three key mechanisms: resource allocation, monitoring, and coordination (Rhee 2024; Walls et al. 2012).

First, the CEO holds overall responsibility for the conduct and performance of the entire firm (Hambrick 2015, 1). The power granted to CEOs by their position provides them with greater latitude in their strategic choices and actions, including resource allocation (Carpenter et al. 2004; Finkelstein et al. 2009; Hambrick and Quigley 2014). The CEO is recognized as the leader of the firm's environmental management (Bansal and Roth 2000). Research shows that firms tend to replace their CEO following a large environmental fine (Aragón-Correa et al. 2025). For example, Dennis et al. (2009) find that executives perceive themselves as giving individuals are more likely to support corporate giving, resulting in more substantial and consistent philanthropic contributions. Bansal and Roth (2000) find that managers' concern for the natural environment motivates a firm's environmental responsibility and legitimacy, which manifests in increased ecological responsibility initiatives. CEOs who focus more on specific issues are more inclined to make decisions that direct resources (i.e., physical, human, or financial) toward addressing those issues (Nadkarni and Chen 2014; Rhee 2024). We therefore expect that a CEO who pays greater attention to environmental issues may allocate more resources to support environmental initiatives.

Second, heightened CEO attention to specific issues and events can enhance firms' awareness, preparedness, and actions in addressing them (Nadkarni and Chen 2014). This monitoring role of CEO attention involves tracking the progress of these issues by overseeing and directing the focus and intensity of employees' activities at lower organizational levels (Rhee 2024). In this role, CEOs tend to allocate their attentional resources

to reviewing progress reports and providing timely feedback on the issues they prioritize (Gaba and Joseph 2013). Research shows that CEOs who prioritize environmental protection are likely to foster a culture of environmental awareness (Huang et al. 2024; Zameer et al. 2021) and commitment (Aragon-Correa et al. 2004; Mahran and Elamer 2025; Ren et al. 2022; Wei et al. 2023) throughout their firms, while also reducing greenwashing practices (Hao et al. 2025). CEA may also enable the firm to gain a "first-mover" advantage, as suggested by Hart (1995), leading to improvement in environmental performance.

Third, environmental issues influence all aspects of a firm's operations (e.g., human resource, product development, manufacturing, marketing, transportation) (Post 1991). Consequently, implementing environmental initiatives requires coordination across multiple levels, both within the organization and externally with the supply chain and a range of stakeholder groups (Berrone and Gomez-Mejia 2009; Walls et al. 2012). CEOs who show greater attention to environmental issues can play a significant role in driving and implementing environmental initiatives. They can accelerate coordination efforts, streamline processes, and build strategic relationships that enable access to talent, innovation, and sustainable technologies (Walls et al. 2011). Research shows that a CEO's environmental awareness and beliefs foster corporate environmental practices, including green human resource management, thereby enhancing new product development as well as the firm's environmental and financial performance (Ren et al. 2022; Tang et al. 2024). Recently, Aragón-Correa et al. (2025) find that firms subject to environmental sanctions tend to demonstrate significant improvement in both environmental awareness and performance following the appointment of a new CEO.

Recent research from an attention-based perspective, closely related to this study, is by Ahn (2020). She examines the relationship between attention breadth (i.e., the CEO attends to diverse environmental, social, and governance issues simultaneously) and corporate social performance for a sample of 100 companies from the Fortune 500 in 2012. Attention breadth is observed by analyzing quantitatively the content of the CEO's letter to shareholders. She finds that attention breadth relates positively to corporate social performance and mediates the relationship between career experience, social ties, and corporate social performance.

In China, Zameer et al. (2021) survey 381 managers to determine whether there is a relationship between managerial environmental awareness along with stakeholders' role (i.e., customer pressure and regulator control), and environmental performance. They find that management environmental awareness plays a crucial role in adopting green production and improving environmental performance. In Malaysia, Rehman et al. (2022) survey 377 managers and find that environmental sustainability orientation positively influences environmental performance.

More recently, Wang, Yang, et al. (2024) analyze the relationship between TMT's environmental attention and the firm's green innovation over a 9-year period from 2012 to 2020. They use a sample of 635 listed Chinese companies, representing 18,514 observations. Their firm's TMT's environmental attention is measured by applying content analysis to their management discussion and analysis to extract environmental-related words. The results show that TMT's environmental attention is associated with a higher firm's green innovation. Likewise, Huang et al. (2024) find that managerial attention to environmental protection enhanced green innovation performance in 956 firms listed on China's A-share market from 2008 to 2018. Moreover, they find that firms achieved better results when managerial attention focused on specific environmental issues/problems rather than broad ones.

Similarly, in the US context, Wagner and Fischer-Kreer (2024) investigate the potential effect of CEO regulatory attention—specifically, promotion- and prevention-focused attention—on corporate carbon emissions. Using a sample of 512 firms listed in the Standard & Poor's (S&P) 500 index over an 11-year period from 2007 to 2018, they measure their firms' CEOs' regulatory focus based on the content of their letters to shareholders. Their analysis shows that CEOs with a high promotion (prevention) attention are positively (negatively) associated with corporate carbon emissions.

Collectively, the preceding discussions suggest that CEO environmental attention matters for a firm's environmental performance. We, therefore, suggest that CEOs who prioritize environmental issues are more likely to improve their firms' environmental performance. Accordingly, we propose the following hypothesis:

Hypothesis (H). : CEO attention to environmental issues is positively related to environmental performance.

4 | Method

4.1 | Data and Sample Selection

The study sample consists of 77 non-financial firms that are indexed in the FTSE 100 for 2019. Financial firms often have distinct governance structures and may be more heavily regulated, which can affect CEO communications in unique ways (Financial Conduct Authority 2019). This index includes the 100 largest firms listed on the London Stock Exchange (LSE) in terms of market capitalization, approximating £2 trillion (LSE 2019). The identified firms (77 firms) are observed repeatedly over a 9-year period from 2011 to 2019, resulting in 693 observations. Starting in 2011 and ending in 2019 ensures that the sample period covers a relatively stable economic period, excluding the worst effects of the Global Financial Crisis (2008–2009) and the COVID-19 pandemic (2020–2021). Firms with no CEO letter to shareholders (22 observations) and firms with missing values of the relevant variables or negative book values (44 observations) are excluded.

The final sample comprises 75 firms with 627 observations. These firms represent nine major sectors, including basic materials (14%), consumer discretionary goods and services (27%), consumer staples (14%), energy (3%), health care (6%), industrials (23%), technology (3%), telecommunications (2%), and utilities

(7%). The sectoral representation of the sample is virtually identical with the proportions present among the 77 non-financial firms in the LSE. For each firm-year in the final sample, financial and non-financial data are collected from Refinitiv Eikon datasets. The CEO's letter to shareholders is extracted manually from each firm's annual report.

4.2 | Measurement of Variables

4.2.1 | Dependent Variable

We use the environmental score from LSEG Workspace (formerly Thomson Reuters Eikon) to measure firms' annual environmental performance. LSEG Workspace was acquired by the London Stock Exchange Group (LSEG) in 2021. The score is a composite measure based on three weighted categories. First, the emissions reduction score measures "a company's commitment and effectiveness towards reducing environmental emissions in production and operational processes" (22 performance indicators). Second, the innovation score reflects "a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through environmental technologies, processes, or eco-designed products" (20 performance indicators). Third, the resource use score reflects "a company's performance and capacity to reduce the use of materials, energy, or water, and to develop more eco-efficient solutions through improved supply chain management" (19 performance indicators) (LSEG 2024).

4.2.2 | Explanatory Variables

We use the CEA as our main explanatory variable. CEA is measured annually for each CEO by counting environment-related keywords in their letter to shareholders, scaled by the total word count. We use four different environmental word lists: Ahn (2020 (henceforth A)); Loughran et al. (2023 (henceforth L)); Moss et al. (2018 (henceforth M)); Vaupel et al. (2023 (henceforth V)). These lists include 38, 64, 41, and 100 environmental words, respectively.[2] Our use of multiple lists arises from the lack of consensus on the most appropriate dictionary for addressing our research question. Employing multiple measures further enhances robustness considering this uncertainty.

CEO letters to shareholders, which serve as the primary texts for analysis, are downloaded from firms' annual reports and converted to plain text (.txt) files to ensure optimal processing (see Appendix A for detailed procedures). A total of 627 CEO letters are successfully uploaded to the CAT Scanner software (McKenny et al. 2012).[3]

Further, we apply the principal component analysis to the four individual measures of the CEA to construct an overall composite measure of the CEA (CEA_C).[4] The four measures of the CEA are loaded positively to the first principal component, which has an eigenvalue of 3.3 and accounts for substantial variance (81%) in the four underlying CEA's measures. We view this composite measure as more indicative of CEA, compared with the four individual measures, although our results are substantially similar under all five measures of CEA.

4.2.3 | Control Variables

We include a set of control variables that might be associated with environmental performance. We include firm size, firm age, and capital intensity. Larger firms with higher capital intensity are likely to have more resources, be more visible, and consequently be exposed to higher litigation risk (Brammer and Millington 2006; Udayasankar 2008). Therefore, they are likely to invest more in environmentally friendly technologies and newer equipment (Clarkson et al. 2011). We measure firm size as the natural logarithm of total assets. Firm age is measured as the natural logarithm of the number of years since the firm was incorporated. Capital intensity is measured as capital expenditures divided by total assets.

We control a firm's financial resources, using profitability, liquidity, and leverage. Prior studies show that firms with higher financial resources are more likely to engage in environmental activities (Clarkson et al. 2011; McWilliams and Siegel 2000; Seifert et al. 2004; Waddock and Graves 1997). We measure profitability as the firm's return on assets. Liquidity is measured as the square root of cash and short-term investments divided by total assets. Leverage is measured as the debt-to-capital ratio.

We control factors that capture management's unobservable capabilities, using three variables: sales growth, market-to-book value, and research and development expenditures (R&D) (Walls et al. 2012). Higher values of these variables reflect greater talent and stronger growth potential. We measure sales growth as the natural logarithm of current sales divided by the previous year's sales. The market-to-book ratio is measured as the natural logarithm of the market value of a firm divided by its book value. R&D is measured as a binary variable that takes the value of 1 if a firm reports R&D and 0 otherwise.

We also control a firm's corporate governance. Firms committed to good governance practices tend to have a higher likelihood of engaging in environmental activities (Aguilera et al. 2021; Johnson and Greening 1999; Walls et al. 2012). We measure corporate governance using the Management score provided by Thomson Reuters Eikon. This score reflects a company's commitment and effectiveness towards following best practice corporate governance principles, including board structure (e.g., independence, duality, and diversity) and compensation policy. The score ranges between 0 and 100, with a higher score reflecting a higher commitment to following the best governance practices.

In addition, we included a nine-point scale to reflect the classifications of GICS codes at the two-digit level. This controls the degree to which heterogeneity between sectors (e.g., economies of scale and competitive intensity) may affect the extent of spending on CSR\environmental activities (McWilliams and Siegel 2000; Waddock and Graves 1997). We also include a dummy variable to control year effects. Appendix B contains definitions for the study's variables.

4.3 | Empirical Model

We use a random-effects regression to examine the relationship between CEA and environmental performance, as the result of the Hausman test shows that using a random-effects is more efficient than a fixed-effects model (Chi-square = 26.34, $p > 0.10$). The following model explains the estimated relationship between CEA and environmental performance:

$$\text{Env\_P}_{it} = \beta_0 + \beta_1 \cdot CEA\_X_{it} + X'_{it}\beta + \sum_j \lambda_i \cdot Industry_{ij} + \sum_t \delta_t \cdot Year_t + \gamma_i + \epsilon_{it}$$

where Env_P_{it} refers to environmental performance for firm i at time t, β_0 is the constant, CEA_X_{it} represents five alternative measures of the CEO environmental attention (CEA_A, CEA_L, CEA_M, CEA_V, and CEA_C), X'_{it} is a vector of control variables described above, λ_i and δ_t denote industry and year fixed effects, respectively, γ_i refers to firm level random effect, and ϵ_{it} is the errors term. All standard errors and test statistics (e.g., the random-effects parameters) are estimated using a robust standard errors clustered at the firm level.

5 | Results

5.1 | Descriptive Statistics and Correlations

Tables 1 and 2 present the descriptive statistics and the Pearson correlation coefficients for the variables used in the sample. Table 2 shows the CEO environmental attention measures (i.e., CEA_A, CEA_L, CEA_M, CEA_V, and CEA_C) are positively and significantly correlated with Env_P. The correlations between the CEO attention measures are strong, positive, and statistically significant, suggesting that these indicators effectively capture the underlying construct. Furthermore, the correlation coefficients in Table 2 reveal no concerns regarding multicollinearity between the independent variables, as the highest observed correlation is 0.59. This finding is supported by the Variance Inflation Factor values, which range from 1.14 to 3.01—well below the commonly accepted threshold.

5.2 | Regressions

Models 1–5 in Table 3 present the results of the random-effects regressions examining the relationship between the current values of CEA measures and environmental performance (Env_P). Across all five models, the coefficients of the CEA measures are positive and statistically significant: CEA_A ($\beta = 31.395$, $p < 0.05$), CEA_L ($\beta = 41.185$, $p < 0.05$), CEA_M ($\beta = 38.069$, $p < 0.05$), CEA_V ($\beta = 39.116$, $p < 0.05$), and CEA_C ($\beta = 0.814$, $p < 0.01$). These results support our hypothesis and suggest that firms led by CEOs with greater environmental attention tend to exhibit higher levels of environmental performance.

To further examine the influence of CEA on Env_P, we conduct a more stringent analysis by regressing the current level of CEA on future values of Env_P. This approach recognizes that the effects of managerial attention on organizational outcomes may not be immediate but may take time to materialize (Eklund and Mannor 2021; Kaplan 2011; Nadkarni and Chen 2014; Ocasio and Joseph 2018). Accordingly, we incorporate the forward values of Env_P 1 year ahead (Model 1) and

TABLE 1 | Descriptive statistics.

	Mean	Median	SD	Min	Max
Env_P	62.484	66.640	21.523	4.530	93.670
CEA_A	0.061	0.059	0.034	0.000	0.171
CEA_L	0.053	0.052	0.031	0.000	0.152
CEA_M	0.066	0.061	0.035	0.000	0.177
CEA_V	0.027	0.028	0.027	0.000	0.117
CEA_C	0.000	−0.121	1.796	−3.228	5.807
Size	15.971	15.870	1.430	12.473	19.584
Age	3.449	3.497	1.050	0.693	4.890
Capital intensity	0.188	0.191	0.087	0.000	0.547
Profitability	0.109	0.097	0.072	−0.080	0.558
Liquidity	0.508	0.499	0.179	0.037	0.981
Leverage	39.809	39.030	21.742	0.000	98.670
Growth	0.055	0.054	0.182	−1.679	1.410
MTB ratio	1.125	1.065	0.801	−1.238	4.249
R&D	0.478	0.000	0.500	0.000	1.000
Governance	64.210	67.860	26.447	0.150	99.880

Note: This sample consists of 75 firms (627 observations) over the period 2011 to 2019. *Env_P* refers to environmental performance. CEO environmental attention (CEA) is measured using four distinct environmental word lists developed by Ahn (2020), Loughran et al. (2023), Moss et al. (2018), and Vaupel et al. (2023). The composite measure, *CEA_C*, combines these four individual indicators into a single index. All variables are defined in Appendix B.

TABLE 2 | Pearson correlation matrix.

No.	Variable	1	2	3	4	5	6	7	8
1	Env_P	1.000							
2	CEA_A	0.214*	1.000						
3	CEA_L	0.313*	0.673*	1.000					
4	CEA_M	0.280*	0.849*	0.760*	1.000				
5	CEA_V	0.192*	0.677*	0.730*	0.758*	1.000			
6	CEA_C	0.278*	0.892*	0.879*	0.940*	0.879*	1.000		
7	Size	0.606*	0.199*	0.214*	0.226*	0.099*	0.206*	1.000	
8	Age	0.067	−0.027	−0.032	−0.026	0.005	−0.022	0.004	1.000
9	Capital intensity	0.257*	0.181*	0.211*	0.255*	0.243*	0.248*	0.099*	−0.251*
10	Profitability	−0.056	−0.087*	−0.033	−0.096*	−0.065	−0.079*	−0.363*	0.081*
11	Liquidity	0.048	−0.024	−0.039	−0.010	−0.069	−0.039	0.153*	−0.228*
12	Leverage	0.125*	0.138*	0.058	0.142*	0.047	0.108*	0.230*	−0.129*
13	Growth	−0.186*	−0.131*	−0.096*	−0.135*	−0.076	−0.122*	−0.160*	−0.091*
14	MTB ratio	−0.121*	−0.127*	−0.137*	−0.155*	−0.159*	−0.161*	−0.346*	0.056
15	R&D	0.051	0.210*	0.200*	0.231*	0.197*	0.234*	0.178*	0.093*
16	Governance	0.317*	0.008	0.131*	0.057	0.049	0.068	0.393*	−0.009
No.	Variable	9	10	11	12	13	14	15	16
9	Capital intensity	1.000							
10	Profitability	0.006	1.000						
11	Liquidity	0.294*	−0.173*	1.000					
12	Leverage	0.107*	0.013	−0.048	1.000				
13	Growth	−0.070	0.075	−0.123*	−0.141*	1.000			
14	MTB ratio	−0.052	0.589*	−0.098*	0.445*	0.027	1.000		
15	R&D	0.042	−0.029	0.077	−0.006	−0.052	0.002	1.000	
16	Governance	0.146*	−0.076	0.024	0.123*	−0.132*	−0.061	0.134*	1.000

Note: This sample consists of 75 firms (627 observations) over the period 2011 to 2019. *Env_P* refers to environmental performance. CEO environmental attention (CEA) is measured using four distinct environmental word lists developed by Ahn (2020), Loughran et al. (2023), Moss et al. (2018), and Vaupel et al. (2023). The composite measure, *CEA_C*, combines these four individual indicators into a single index. All variables are defined in Appendix B.
*Significant at $p < 0.05$.

2 years ahead (Model 2), as reported in Table 4. The results indicate that CEA_C is positively and significantly associated with Env_P at $_{t+1}$ ($\beta = 1.084$, $p < 0.01$) and at $_{t+2}$ ($\beta = 1.053$, $p < 0.01$).

Overall, the results reported in Table 4 are consistent with the earlier findings presented in Table 3 and provide further support for our hypothesis that CEO environmental attention plays an important role in improving firms' environmental performance after controlling for firm characteristics as well as year and industry effects. The results for the control variables also reveal a significant positive relationship ($p < 0.01$) between firm size and Env_P across all models, suggesting that larger firms tend to exhibit higher levels of environmental performance. This finding is consistent with the slack resources theory.

Models 1–9 in Table 5 offer a more fine-grained analysis of the specific categories of environmental performance—resources use, emissions reduction, and innovation—that CEOs who are attentive to environmental issues are more likely to prioritize, leading to an improvement in this category. As shown in Table 5, CEA_C contributes positively to reducing resources use and emissions, and to the adoption of environmentally friendly technologies. However, the most pronounced influence is observed in relation to emissions reduction. Specifically, CEA_C is positively and significantly associated with the emissions reduction scores both concurrently ($\beta = 0.892$, $p < 0.05$) and prospectively, 1 year ($\beta = 0.891$, $p < 0.05$) and 2 years ahead ($\beta = 0.984$, $p < 0.05$). Resources use and Innovation also show a positive association with CEA_C; however, these associations are either marginally significant or not statistically significant.

TABLE 3 | Random-effects regression of CEO environmental attention on environmental performance.

	Env_P				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
CEA_A	31.395**				
	(2.01)				
CEA_L		41.185**			
		(2.39)			
CEA_M			38.069**		
			(2.38)		
CEA_V				39.116**	
				(2.25)	
CEA_C					0.814***
					(2.70)
Size	7.175***	7.043***	7.131***	7.194***	7.259***
	(3.99)	(4.07)	(4.12)	(3.91)	(4.13)
Age	1.781	1.713	1.667	1.600	1.590
	(0.85)	(0.83)	(0.82)	(0.76)	(0.78)
Capital intensity	14.006	12.300	13.442	12.895	13.485
	(1.17)	(1.08)	(1.16)	(1.09)	(1.17)
Profitability	34.562***	35.793***	34.252***	36.039***	35.099***
	(2.87)	(2.97)	(2.91)	(2.96)	(2.95)
Liquidity	8.950**	8.628*	8.685*	9.396**	8.877**
	(1.97)	(1.94)	(1.93)	(2.03)	(1.97)
Leverage	−0.004	−0.004	−0.009	−0.002	−0.003
	(−0.07)	(−0.07)	(−0.16)	(−0.04)	(−0.06)
Growth	0.021	−0.225	−0.133	−0.131	−0.126
	(0.01)	(−0.09)	(−0.05)	(−0.05)	(−0.05)
MTB ratio	1.021	0.894	1.092	1.072	1.048
	(0.91)	(0.81)	(0.98)	(0.98)	(0.95)
R&D	−2.612	−2.712	−2.346	−2.425	−2.484
	(−1.25)	(−1.31)	(−1.12)	(−1.23)	(−1.19)
Governance	0.051**	0.050**	0.048*	0.047*	0.049*
	(1.99)	(2.00)	(1.93)	(1.87)	(1.96)
Constant	−79.239**	−75.198**	−78.621***	−77.725**	−78.511***
	(−2.52)	(−2.53)	(−2.61)	(−2.43)	(−2.58)
Year fixed	Included	Included	Included	Included	Included
Industry fixed	Included	Included	Included	Included	Included
Observations	627	627	627	627	627
No. of firms	76	76	76	76	76
R^2 (Overall)	0.492	0.497	0.499	0.491	0.501
Wald chi2	294.50***	297.02***	307.65***	290.86***	305.06***

Note: Env_P refers to environmental performance. CEO environmental attention (CEA) is measured using four distinct environmental word lists developed by Ahn (2020), Loughran et al. (2023), Moss et al. (2018), and Vaupel et al. (2023). The composite measure, *CEA_C*, combines these four individual indicators into a single index. Standard errors are robust and clustered at the firm level. Estimates for industry and year fixed effects are omitted for clarity. z-Statistics are reported in parentheses. All variables are defined in Appendix B. The positive and significant coefficients on CEA indicate that higher CEO environmental attention is associated with improved environmental performance.

***Significant at $p < 0.001$.

**Significant at $p < 0.05$.

*Significant at $p < 0.10$.

TABLE 4 | Random-effects regression of CEO environmental attention on subsequent environmental performance.

	Env_P_{t+1}	Env_P_{t+2}
	Model 1	**Model 2**
CEA_C	1.084***	1.053***
	(3.50)	(3.69)
Size	7.867***	7.403***
	(4.68)	(5.22)
Age	0.174	0.379
	(0.10)	(0.23)
Capital intensity	14.134	9.047
	(1.08)	(0.87)
Profitability	32.568**	10.105
	(2.56)	(0.83)
Liquidity	2.225	−4.741
	(0.49)	(−0.97)
Leverage	−0.006	−0.011
	(−0.11)	(−0.20)
Growth	−4.037*	−3.159
	(−1.90)	(−1.32)
MTB ratio	2.240**	3.221***
	(2.01)	(2.69)
R&D	−3.777**	−3.752*
	(−2.24)	(−1.91)
Governance	0.011	0.006
	(0.52)	(0.26)
Constant	−77.313***	−61.707**
	(−2.64)	(−2.46)
Year fixed	Included	Included
Industry fixed	Included	Included
Observations	627	609
No. of firms	75	75
R^2 (Overall)	0.494	0.487
Wald chi2	267.09***	367.83***

Note: Env_P refers to environmental performance. CEO environmental attention (CEA) is measured using four distinct environmental word lists developed by Ahn (2020), Loughran et al. (2023), Moss et al. (2018), and Vaupel et al. (2023). The composite measure, *CEA_C*, combines these four individual indicators into a single index. Standard errors are robust and clustered at the firm level. Estimates for industry and year fixed effects are omitted for clarity. z-Statistics are reported in parentheses. All variables are defined in Appendix B. The positive and significant coefficients on CEA_C indicate that higher CEO environmental attention is associated with improvements in firms' environmental performance in subsequent years ($t+1$ and $t+2$).
***Significant at $p<0.001$.
**Significant at $p<0.05$.
*Significant at $p<0.10$.

5.3 | Additional Test-Controlling for CEO Characteristics

Although we document a significant positive relationship between CEA and environmental performance, as reported in Table 3, this association may be influenced by CEO demographic and structural characteristics that shape their strategic orientation toward environmental challenges. Previous literature argues that differences in CEO characteristics lead to varying levels of engagement in environmental initiatives (Arena et al. 2018; Lewis et al. 2014).

To address this concern, we re-estimate Model 5 in Table 3 by including several CEO characteristics that may influence environmental engagement. CEO age and gender capture demographic qualities influencing ethical sensitivity and strategic conservatism (Byron and Post 2016; Gull et al. 2024). CEO tenure and duality reflect the concentration of power that may weaken oversight (Davidson et al. 2005), while CEO background indicates cognitive orientation toward sustainability (Lewis et al. 2014). Finally, CEO network size represents social capital and exposure to environmental norms that can facilitate best-practice diffusion (Bouchet et al. 2022; He 2022). Data on these CEO characteristics are obtained from the BoardEx database, and detailed definitions of these variables are provided in Appendix B.

The results of our additional test are reported in Table 6, indicating that CEA continues to exhibit a positive and significant association with environmental performance in the current year (Model 1), 1-year-ahead (Model 2), and 2-year-ahead (Model 3) periods, even after controlling for CEO demographic and structural characteristics.

5.4 | Robustness Tests

To assess the robustness of the results, we re-estimate Model 5 in Table 3 using the two-step system generalized method of moments (GMM) estimator (Arellano and Bond 1991; Blundell and Bond 1998). This estimation is likely to provide consistent and efficient parameter estimates that are robust to biases and inconsistencies arising from omitted variables, simultaneity, and dynamic endogeneity (Abdallah et al. 2015, 801). Table 7 presents the results of estimating Model 1. The Arellano–Bond test for autocorrelation indicates the presence of first-order serial correlation (AR(1), $p=0.000$), whereas the AR(2) test shows no evidence of second-order autocorrelation, supporting the validity of the moment conditions. Moreover, Model 1 shows that the Hansen J test for over-identifying restrictions is insignificant ($p=0.562$), indicating that the instruments used are valid and uncorrelated with the error term.[5] The lagged dependent variable, Env_P_{t-1}, has a positive and significant relationship with Env_P_t ($\beta=0.642$, $p<0.01$). More importantly, CEA_C shows a positive and statistically significant relationship with Env_P_t ($\beta=2.334$, $p<0.05$). This result is consistent with the main findings reported in Table 3, suggesting that greater environmental attention is associated with improved environmental performance, beyond the effect of the previous year's Env_P.

TABLE 5 | Random-effects regression of CEO environmental attention on current and subsequent environmental performance categories.

	Resources use			Emissions reduction			Innovation		
	Current year	1 year ahead	2 years ahead	Current year	1 year ahead	2 years ahead	Current year	1 year ahead	2 years ahead
	Model 1	Model2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
CEA_C	0.464	0.590	0.804**	0.892**	0.891**	0.984**	1.059	1.445*	0.884
	(1.10)	(1.45)	(2.22)	(2.03)	(2.48)	(2.45)	(1.45)	(1.78)	(1.14)
Size	8.942***	9.569***	9.190***	6.102***	6.369***	6.862***	5.481	6.084*	4.917
	(4.73)	(5.11)	(5.20)	(4.28)	(4.07)	(4.27)	(1.63)	(1.82)	(1.36)
Age	2.894	1.808	2.106	3.393	1.974	1.449	1.916	1.282	0.691
	(1.28)	(0.87)	(1.13)	(1.39)	(0.83)	(0.67)	(0.60)	(0.39)	(0.24)
Capital intensity	14.756	29.505	23.064	1.501	−3.509	1.700	16.855	2.512	−23.704
	(0.87)	(1.62)	(1.45)	(0.11)	(−0.27)	(0.13)	(0.66)	(0.09)	(−0.89)
Profitability	22.386	26.745	23.945	42.145***	37.712***	17.615	45.424*	24.658	−26.554
	(1.26)	(1.58)	(1.37)	(2.78)	(2.73)	(1.34)	(1.78)	(0.99)	(−0.98)
Liquidity	2.183	−2.538	−5.020	10.655**	2.494	−7.363	−0.925	−0.689	−4.528
	(0.36)	(−0.52)	(−0.85)	(2.10)	(0.46)	(−1.34)	(−0.10)	(−0.07)	(−0.44)
Leverage	−0.006	−0.017	0.081	0.067	0.101	0.099*	0.001	−0.067	−0.239**
	(−0.07)	(−0.20)	(1.03)	(1.07)	(1.63)	(1.74)	(0.02)	(−1.01)	(−2.39)
Growth	0.094	−3.500	−0.412	1.841	−0.161	−0.698	−3.425	−7.603	−6.284
	(0.03)	(−1.61)	(−0.14)	(0.89)	(−0.07)	(−0.21)	(−0.59)	(−1.48)	(−1.12)
MTB ratio	2.102	3.186*	2.998	−0.690	0.057	1.410	−0.963	0.812	4.201
	(1.17)	(1.85)	(1.64)	(−0.53)	(0.05)	(0.91)	(−0.34)	(0.25)	(1.21)
R&D	−4.064	−4.155	−2.361	−2.490	−4.835	−7.495**	−2.769	−2.508	−0.625
	(−1.26)	(−1.46)	(−0.73)	(−0.89)	(−1.64)	(−2.13)	(−0.48)	(−0.34)	(−0.10)
Governance	0.031	0.011	−0.007	0.037	−0.017	−0.022	0.056	0.063	0.071
	(0.95)	(0.34)	(−0.21)	(1.24)	(−0.68)	(−0.76)	(0.95)	(1.36)	(1.56)
Constant	−99.428***	−104.994***	−103.593***	−51.403*	−40.812	−39.726	−64.164	−65.937	−20.829
	(−2.96)	(−3.01)	(−3.20)	(−1.91)	(−1.35)	(−1.28)	(−1.07)	(−1.10)	(−0.34)

(Continues)

TABLE 5 | (Continued)

	Resources use			Emissions reduction			Innovation		
	Current year	1 year ahead	2 years ahead	Current year	1 year ahead	2 years ahead	Current year	1 year ahead	2 years ahead
	Model 1	**Model2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**	**Model 9**
Year fixed	Included	Included	Included	Included	Included	Included	Included	Included	Included
Industry fixed	Included	Included	Included	Included	Included	Included	Included	Included	Included
Observations	627	627	609	627	627	609	627	627	609
No. of firms	75	75	75	75	75	75	75	75	75
R^2 (Overall)	0.485	0.482	0.456	0.464	0.438	0.424	0.222	0.238	0.232
Wald chi2	302.69***	348.89***	421.24***	364.50***	927.30***	4279.28***	137.27***	193.32***	418.97***

Note: CEO environmental attention (CEA) is measured using four distinct environmental word lists developed by Ahn (2020), Loughran et al. (2023), Moss et al. (2018), and Vaupel et al. (2023). The composite measure, *CEA_C*, combines these four individual indicators into a single index. Standard errors are robust and clustered at the firm level. Estimates for industry and year fixed effects are omitted for clarity. z-Statistics are reported in parentheses. All variables are defined in Appendix B.
***Significant at $p < 0.001$.
**Significant at $p < 0.05$.
*Significant at $p < 0.10$.

Alternatively, we employ the propensity score matching (PSM) approach to address issues related to functional form misspecification, such as nonlinear relationships, interaction effects, and selection bias (Rosenbaum and Rubin 1983; Shipman et al. 2017). PSM has a key advantage of constructing treatment and control groups that are similar across relevant observable factors. This helps relax assumptions about the functional form of variable relationships and reduces bias arising from model misspecification (Abweny et al. 2026; Shipman et al. 2017).

To perform the PSM analysis, we first divide the sampled firms into treatment and control groups based on the median value of CEA_C. Firms with a CEA_C proportion above the sample median are placed in the treatment group, while those below the median are assigned to the control group. Observations from both groups are then matched based on the control variables used in the baseline regression. To ensure that the two groups are highly similar in observable characteristics, each treated firm is matched to one control firm without replacement, and a caliper of 1% (i.e., the maximum allowable difference in propensity scores between matched observations is limited to 0.01).

We estimate the propensity scores using a logit regression, with results reported in Table 6, Model 2. We then re-estimate the logit regression using the matched sample to verify that the treatment and matched control groups are indistinguishable in observable characteristics, with the results presented in Model 3. As shown in Model 3, the treatment and control groups are statistically comparable, as none of the coefficients are significant and their magnitudes are smaller than those in Model 2. This confirms that the matching process yields balanced samples and that the results are not influenced by the reduced sample size. Figure 1 illustrates the standardized percentage bias across covariates before and after matching. The plot shows that the standardized bias for all covariates is substantially reduced after matching, indicating that the propensity score matching procedure effectively improves covariate balance between the treatment and control groups.

We then re-estimate the relationship between CEA_C and Env_P using the matched sample. Model 4 reports the results of a random-effects regression examining this relationship. The results in Model 4 reveal a positive and statistically significant effect of CEA_C ($\beta = 1.053$, $p < 0.05$), consistent with the findings from the GMM analysis. Together, the GMM and PSM approaches reinforce the robustness of our results, consistently showing that CEA_C contributes to improvements in a firm's environmental performance.

6 | Discussion and Conclusion

Mitigating a firm's impact on the natural environment has become a major public and social concern, with long-term implications for a firm's liability exposure, corporate reputation, access to critical resources, and stakeholder relationships. The CEO plays a particularly crucial role in securing the necessary resources, and in monitoring and coordinating environmental activities. While much existing research on CEOs tends to focus on their demographic characteristics, less attention has been paid to their psychological characteristics (i.e., cognition), which may

TABLE 6 | Random-effects regression of CEO environmental attention on environmental performance (controlling for CEO characteristics).

	Env_P	Env_P_{t+1}	Env_P_{t+2}
	Mode 1	**Mode 2**	**Mode 3**
CEA_C	0.685**	1.054***	0.845***
	(2.04)	(3.35)	(2.79)
Size	7.263***	7.645***	5.659***
	(4.08)	(4.62)	(3.58)
Age	0.212	−1.214	0.202
	(0.11)	(−0.68)	(0.11)
Capital intensity	12.770	6.586	3.844
	(0.99)	(0.44)	(0.32)
Profitability	39.041**	42.587**	1.693
	(2.51)	(2.25)	(0.09)
Liquidity	10.206**	3.220	−1.845
	(2.24)	(0.66)	(−0.35)
Leverage	−0.016	0.007	−0.026
	(−0.24)	(0.12)	(−0.50)
Growth	0.763	−2.977	−1.544
	(0.34)	(−1.37)	(−0.59)
MTB ratio	1.478	1.960*	3.064***
	(1.21)	(1.77)	(2.80)
R&D	−0.810	−3.184*	−4.653***
	(−0.36)	(−1.73)	(−2.60)
Governance	0.049*	0.008	−0.003
	(1.70)	(0.34)	(−0.12)
CEO age	6.193	3.855	10.568
	(0.66)	(0.35)	(1.04)
CEO gender	0.297	−0.200	3.931
	(0.14)	(−0.05)	(1.18)
CEO tenure	0.616	0.855	0.395
	(0.81)	(1.04)	(0.50)
CEO duality	−1.522	−0.688	−0.919
	(−0.67)	(−0.39)	(−0.46)
CEO background	3.077*	2.869	−0.240
	(1.67)	(1.15)	(−0.07)
CEO network size	−0.081	−0.039	−0.003
	(−1.59)	(−0.87)	(−0.06)
Constant	−100.025**	−86.469*	−72.980*
	(−2.48)	(−1.91)	(−1.74)
Year fixed	Included	Included	Included
Industry fixed	Included	Included	Included
Observations	522	522	513
No. of firms	63	63	63
R^2 (Overall)	0.531	0.502	0.496
Wald chi2	0.539***	0.517***	0.514***

Note: Env_P refers to environmental performance. CEO environmental attention (CEA) is measured using four distinct environmental word lists developed by Ahn (2020), Loughran et al. (2023), Moss et al. (2018), and Vaupel et al. (2023). The composite measure, *CEA_C*, combines these four individual indicators into a single index. Standard errors are robust and clustered at the firm level. Estimates for industry and year fixed effects are omitted for clarity. z-Statistics are reported in parentheses. All variables are defined in Appendix B.
***Significant at $p < 0.001$.
**Significant at $p < 0.05$.
*Significant at $p < 0.10$.

have a more direct influence on how they shape strategies related to the natural environment (Aguilera et al. 2021; Mahran and Elamer 2024). In this study, we move beyond demography to investigate whether CEOs who direct greater attention to environmental issues can contribute to improving their firms' environmental performance.

Drawing on attention-based theory and upper echelons theory, we hypothesize that a greater level of CEO attention to environmental issues would lead to increased engagement in environmental activities, ultimately enhancing environmental performance. The empirical results support this hypothesis, indicating that firms led by CEOs with higher environmental attention scores tend to achieve better environmental performance. In particular, our findings consistently show that CEOs with greater environmental attention are associated with higher environmental performance, both currently and prospectively (i.e., 1–2 years ahead). These findings remain robust when using alternative measures of CEO attention, controlling for firm and CEO observable characteristics, and applying alternative model specifications (i.e., GMM and PSM).

A more detailed analysis reveals that CEO environmental attention tends to improve all dimensions of environmental performance (i.e., resource use, emissions reduction, and innovation). Among these, the most significant improvement is realized in emissions reduction. Cordano and Frieze (2000) find that environmental managers' attitudes toward the natural environment positively influence their preferences for pollution reduction activities. This emphasis on emissions reduction aligns with global trends in addressing climate change, with a growing number of firms' leaders setting carbon emissions targets (Carbon Disclosure project (CDP) et al. 2025). For instance, the United Nations Global Compact–Accenture CEO Study on Sustainability reports that 65% of 1230 CEOs across 113 countries and 21 industries have already begun advancing net-zero business models and solutions (United Nations Global

TABLE 7 | Results of GMM and PSM analyses.

	GMM	PSM		
	Env_P	Dummy of CEA_CP pre-matched	Dummy of CEA_CP post-matched	Env_P
	Model 1	Model 2	Model 3	Model 4
Env_P_{t-1}	0.642***			
	(4.60)			
CEA_C	2.334**			1.053**
	(2.29)			(2.45)
Size	5.936***	−0.168	−0.058	8.324***
	(2.89)	(−0.88)	(−0.26)	(5.35)
Age	−1.474	−0.178	0.024	2.181
	(−0.88)	(−0.97)	(0.13)	(1.21)
Capital intensity	0.880	1.757	−1.205	21.356*
	(0.04)	(0.72)	(−0.43)	(1.68)
Profitability	9.799	7.143**	−1.407	12.685
	(0.40)	(2.57)	(−0.42)	(0.74)
Liquidity	−7.423	−1.780**	0.914	6.160
	(−1.02)	(−2.10)	(0.82)	(0.96)
Leverage	−0.221**	0.001	0.000	0.003
	(−2.09)	(0.13)	(0.03)	(0.04)
Growth	−4.417	−0.235	0.834	−0.692
	(−0.73)	(−0.40)	(1.37)	(−0.34)
MTB ratio	1.865	−0.828***	0.054	2.429
	(0.64)	(−3.14)	(0.15)	(1.38)
R&D	−5.580	0.567	0.275	−0.430
	(−0.95)	(1.57)	(0.69)	(−0.12)
Governance	0.006	0.008	0.001	0.027
	(0.14)	(1.45)	(0.09)	(0.77)
Constant	−57.237*	8.451**	0.661	−100.833***
	(−1.85)	(2.42)	(0.16)	(−3.26)
Year fixed	Included	Included	Included	Included
Industry fixed	Included	Included	Included	Included
Observations	547	627	292	292
No. of firms	75	76	65	65
F_p	0.000	0.000	0.000	0.000
Pseudo R^2		0.283	0.014	
R^2 (Overall)				0.547
ar1p	0.000			
ar2p	0.257			
sarganp	0.504			
hansenp	0.562			

Note: GMM refers to the generalized method of moments, and PSM refers to propensity score matching. Env_P refers to environmental performance. CEO environmental attention (CEA) is measured using four distinct environmental word lists developed by Ahn (2020), Loughran et al. (2023), Moss et al. (2018), and Vaupel et al. (2023). The composite measure, CEA_C, combines these four individual indicators into a single index. Standard errors are robust and clustered at the firm level. Estimates for industry and year fixed effects are omitted for clarity. All variables are defined in Appendix B.

***Significant at $p < 0.001$.

**Significant at $p < 0.05$.

*Significant at $p < 0.10$.

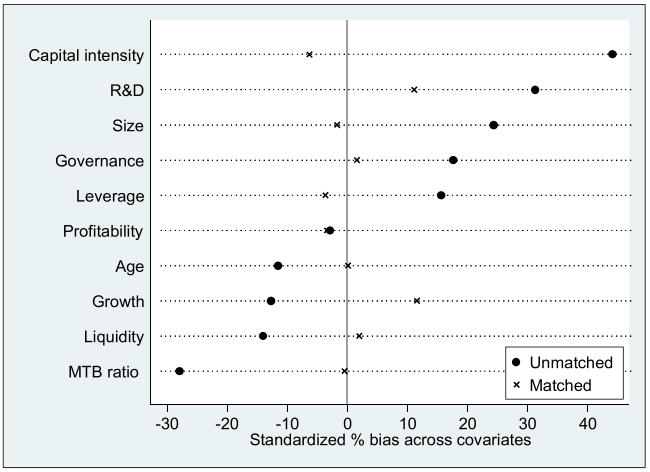

FIGURE 1 | Standardized % bias across covariates: unmatched vs. matched sample.

Compact and Accenture 2021). Moreover, emissions reduction is often more visible and measurable than other environmental issues (Qian and Schaltegger 2017; Vesty et al. 2015). As such, it is considered a central indicator that captures the overall direction and outcomes of changes in a firm's environmental strategy (Aragón-Correa et al. 2025; Vié et al. 2019). Consequently, CEOs are more inclined to focus their attention on emissions reduction and to translate that attention into action. As the adage goes, what gets measured gets managed.

The findings of this study have important theoretical and practical implications. In line with the attention-based and upper echelons perspectives, this study emphasizes the importance of the CEO attention in shaping a firm's actions and outcomes. The CEO is considered as a the firm's "chief cognizer" and decision maker (Calori et al. 1994), playing a critical role in regulating organizational attention (Ocasio 1997). In other words, environmental attention at the executive level is a key central driver of a firm's environmental performance. Moreover, this influence, as evidenced by the analysis, is not limited to the short-term but extends overtime, contributing to long-term environmental sustainability. From the perspective of upper echelons theory, prior research frames the natural environment as a strategic issue directed by the top executive team and one that drives change within the firm (Aragon-Correa et al. 2004; Subhabrata Bobby Banerjee 2001; Clarkson et al. 2011; Sharma 2000). Therefore, CEO attention to environmental issues may serve as a source of strategic continuity, positively not only influencing the firm's environmental performance but potentially the firm's overall success. These findings further underscore the importance of CEO climate leadership in addressing global climate challenges (United Nations Global Compact and Accenture 2021).

The results also have important practical implications for corporate governance, particularly for boards of directors and their committees. The evidence indicates that CEOs who demonstrate greater attention to environmental issues are more likely to enhance their firms' environmental performance. Therefore, firms aiming to enhance their environmental records should consider candidates who prioritize environmental sustainability when hiring new CEOs. These individuals are more likely to initiate environmental initiatives and serve as a major driving force behind internal environmental orientation (Subhabrata Bobby Banerjee 2002; Govindarajulu and Daily 2004; Paillé et al. 2014). Top management commitment is the most significant driver of corporate environmentalism (Subhabrata Bobby Banerjee et al. 2003; Dangelico 2016). Conversely, a lack of managerial attention to environmental issues may act as a significant barrier to environmental progress (Govindarajulu and Daily 2004; Paillé et al. 2014), increasing the risk of regulatory sanctions (Ahmed et al. 2024; Aragón-Correa et al. 2025) and a firm's risk profile (Orazalin et al. 2024).

For managers, the findings suggest that environmental performance can be improved by directing attention toward salient environmental issues, particularly emissions reduction. Emissions reduction attracts greater attention from firm constituents because it exhibits key attributes of issue salience, namely certainty, transparency, and emotivity (Bansal and Roth 2000). By prioritizing environmental issues that exhibit these attributes (i.e., are measurable, easily attributable to polluting firms, and emotionally engaging for the firm constituents (Bansal and Roth 2000, 729), managers can more effectively allocate attention and resources to improve environmental performance.

Although this study offers important insights, it is subject to certain limitations that provide opportunities for future research. Our sample is restricted to FTSE 100 firms publicly listed in the United Kingdom. These firms are typically large, highly visible, and subject to greater scrutiny from regulators, investors, and stakeholders. As a result, they may be more likely to adopt advanced sustainability practices and communicate environmental initiatives more actively. This characteristic may introduce potential visibility bias and may limit the generalizability of our findings to smaller firms or privately held organizations operating under different institutional pressures. Future research could examine whether the relationship between CEO environmental attention and environmental performance holds in smaller firms, private firms, or firms operating in other institutional contexts.

Furthermore, our exclusive focus on the CEO can also be considered a limitation. While the CEO and the top executive team are typically the most critical actors in attention regulation, other internal actors, including the board of directors, also play an important role in shaping organizational priorities (Hambrick and Mason 1984; Ocasio 1997). In particular, prior research shows that the board of directors plays a vital role in influencing firms' environmental performance (Aguilera et al. 2021; Walls et al. 2012). Future research could therefore examine whether board characteristics strengthen or weaken the relationship between CEO environmental attention and environmental performance. In addition, other organizational actors, including members of the top management team (TMT) and sustainability-oriented executives such as Chief Sustainability Officers (CSOs), may also shape firms' environmental priorities and strategic responses. Future studies could explore how the environmental attention of these actors interacts with CEO environmental attention to influence environmental performance.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data are available from the corresponding author upon reasonable request.

Endnotes

[1] Mahran and Elamer (2024) identify 18 published articles out of 139 that examine CEO psychological characteristics in relation to environmental sustainability.

[2] Although these word lists are intended to measure the same construct, they are developed using distinct methodological approaches. Ahn (2020) constructs and validates the word list using letters to shareholders from top 10 ESG-performing firms and the Global Reporting Initiative reporting guidelines. Loughran et al. (2023) develop their lists from S&P 500 firms' codes of business conduct and ethics, incorporating ESG ratings and Most Ethical Companies data. Moss et al. (2018) construct their list using venture funding proposals, and Vaupel et al. (2023) update this list using letters to shareholders of S&P 500 firms.

[3] CAT Scanner software is available at (www.catscanner.net).

[4] PCA is a variable-reduction technique that reduces the number of correlated variables by extracting common components from their correlation matrix. Highly correlated (i.e., conceptually overlapping) variables load onto the same principal component, which captures their shared variance (Allee et al. 2022).

[5] Specifically, we apply the xtabond2 command using two-step system GMM estimation with Windmeijer-corrected standard errors, small-sample adjustments, orthogonal deviations, and collapse the instrument matrix following (Roodman 2009). The lagged dependent variable and all control variables (except dummy variables for industry and year) are treated as endogenous and instrumented using lag structures from 1 to 3 years. Firm size and age are treated as predetermined variables, while year and industry dummies are considered exogenous.

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Appendix A

Text Preparation and Cleaning Procedures

We prepared CEO letters for textual analysis using a multi-step cleaning procedure. First, letters were downloaded from annual reports in PDF format and copied into Word files. We reviewed the texts to ensure they were free of repetition, spelling and grammatical errors, and typographical issues (e.g., missing spaces and extra spaces between words). We applied standard Word spelling and grammar checks and removed irrelevant material (e.g., headers, footers, page numbers, tables, and photographs). We verified text accuracy by comparing the copied content with the original PDFs.

Second, Word documents were converted into plain text (.txt) format to facilitate computational processing. Plain text files provide a more suitable format for analysis than PDF and word-processing formats because hidden characters (e.g., paragraph marks and formatting symbols) embedded in those formats may interfere with textual analysis.

Third, we used the CAT Scanner cleaning tool to remove extraneous characters introduced by optical character recognition (OCR), including non-standard symbols (e.g., ↑, ¤). This procedure ensured standardized, error-free texts suitable for analysis.

Appendix B

Variable Definition and Measurement

Variable	Definition
Env_P (environmental performance)	Measured by the annual environmental score assigned by Thomson Reuters Eikon to each firm. This score is a composite measure of three weighted categories related to: (1) resource use, (2) emissions, and (3) innovation.
Resource use	Reflects "a company's performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management" (19 performance indicators).
Emission reduction	Measures "a company's commitment and effectiveness towards reducing environmental emissions in the production and operational processes" (22 performance Indicators).
Innovation	Reflects "a company's capacity to reduce the environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes or eco-designed products" (20 performance indicators).
CEA_A	CEO environmental attention_A, measured as the square root of the proportion of environmental words in the CEO letter, using Ahn (2020) environmental word list.
CEA_L	CEO environmental attention_L, measured as the square root of the proportion of environmental words in the CEO letter, using Loughran et al. (2023) environmental word list.
CEA_M	CEO environmental attention_M, measured as the square root of the proportion of environmental words in the CEO letter, using Moss et al. (2018) environmental word list.
CEA_V	CEO environmental attention_V, measured as the square root of the proportion of environmental words in the CEO letter, using Vaupel et al. (2023) environmental word list.
CEA_C	A composite index based on the four individual measures of CEO's environmental attention.
Size (firm size)	Natural logarithm of total assets at the end of the fiscal year.
Age (firm age)	Natural logarithm of number of years since the firm was incorporated.
Capital intensity	The square root of capital expenditures divided by total assets at the end of the fiscal year.
Profitability	Earnings before extraordinary items divided by total assets at the end of the fiscal year.
Liquidity	The square root of cash and short-term investments divided by total assets at the end of the fiscal year.
Leverage (financial leverage)	Total debt divided by the sum of total debt and shareholders' equity at the end of the fiscal year.
Growth (sales growth)	Natural logarithm of sales at time t divided by sales at time $t-1$.
MTB ratio (market to book ratio)	Natural logarithm of the market value of a firm divided by its book value.
R&D (Research and development)	Research and development expenditures, measured as a binary variable that takes the value of 1 for a firm with R&D and 0 otherwise.
Governance	Measured by the Management score provided by Thomson Reuters Eikon. This score reflects a company's commitment and effectiveness towards following best practice corporate governance principles, including board structure (e.g., independence, duality and diversity) and compensation policy.
CEO age	Natural logarithm of the CEO's age (in years).
CEO gender	Dummy variable equal to 1 if the CEO is male and 0 if female.
CEO tenure	Natural logarithm of the number of years the CEO has served in the CEO position.
CEO duality	Dummy variable equal to 1 if the CEO also serves as the chairperson of the board, and 0 otherwise.
CEO background	Dummy variable equal to 1 if the CEO has an Anglo-Saxon background (e.g., British, American, or Australian), and 0 otherwise.
CEO network size	Natural logarithm of the number of the CEO's professional connections reported in the BoardEx database.