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CEO facial attractiveness and firms' environmental innovation: how does looking good lead to doing good?

Zhongju Liao¹, Ke Chen¹✉ & Xiaoyun Ren¹

Environmental innovation is an important way for firms to actively fulfill their social responsibilities, and it is also a popular choice for firms to move towards a green path. Based on upper-echelons theory, we examine the relationship between CEO facial attractiveness and firms' environmental innovation from the perspective of overt leadership traits. Selecting 381 heavily polluting firms in China from 2017 to 2022 as the research sample, multiple regression analysis was used to examine the impact of CEO facial attractiveness on environmental innovation, as well as the mediating effect of face awareness and the moderating effect of firm visibility. The results showed that CEO facial attractiveness promoted firms' environmental innovation, and face awareness played a mediating role. Firm visibility negatively moderated the relationship between CEO facial attractiveness and face awareness. The study reveals the positive impact of a CEO's positive image in promoting the process of corporate environmental innovation, especially in state-owned firms.

¹School of Economics and Management, Zhejiang Sci-Tech University, Hangzhou, China. ✉email: co07ke@163.com

Introduction

In the context of globalization, phenomena such as climate change and resource depletion are becoming increasingly serious, raising significant public concern about environmental issues. Industrial firms are the main contributors to environmental pollution and, therefore, must take responsibility for protecting the environment (Fang and Li, 2024; Luo et al. 2023). Firms need to facilitate environmental innovation to promote green development. However, engaging in environmental innovation poses challenges for firms regarding natural supply and the time-consuming and uncertain nature of the environmental innovation process (Sun et al. 2024). Previous research on firms' environmental innovation has mainly focused on external factors such as environmental regulations, public demand for green practices, and competitor pressure (Chen et al. 2024; Liao and Liu, 2022; Tatoglu et al. 2020; Teeter and Sandberg, 2017), plus internal factors focused on the values and resources of the executive team (Cainelli et al. 2015; Przychodzen and Przychodzen, 2015). There are also some studies that specifically target firms' chief executive officers (CEOs), taking into account their personal traits and conduct (Li et al. 2024; Ortiz-de-Mandojana et al. 2019).

Undoubtedly, firms' CEOs frequently receive attention from various sectors of society, with a focus on their personal characteristics and the impact they have on the outside world (Lu et al. 2022). In the current social context, the role that CEOs play in environmental innovation is crucial (Al-Shaer et al. 2023). For example, previous studies have validated the impact of CEO traits on firms' environmental innovation, including CEOs' religious beliefs (Liao et al. 2019), power (Gull et al. 2023), marketing experience (Huang et al. 2023), and overseas experience (Wang et al. 2022), but there are still some gaps. First, previous studies have overlooked the more observable personal characteristics of CEOs, such as facial attractiveness. According to the upper-echelons theory, the personal characteristics of corporate executives have a significant impact on a firm's decision-making and operations (Hambrick and Mason, 1984).

Facial attractiveness is the most innate characteristic of executives. Numerous studies have shown that attractive individuals tend to receive more positive evaluations compared to unattractive individuals (Eagly et al. 1991; Langlois et al. 2000). CEOs with high facial attractiveness receive more positive reviews from the public and preferential treatment in all aspects (Hamermesh and Abrevaya, 2013). This may encourage CEOs to take proactive action to uphold their personal image and organizational reputation—specifically, by leading the way in guiding their firms to assume greater social responsibility (Borghesi et al. 2014). Furthermore, external beauty is often associated with moral beauty, so beautiful people are seen as more likely to fulfill their social responsibilities (Wang et al. 2015). Firms' environmental innovation saves resources, reduces environmental pollution, and demonstrates corporate social responsibility, which strengthens public trust (Mrkajic et al. 2019; Yuan and Cao, 2022). Therefore, CEOs with higher facial attractiveness are more likely to promote firms' environmental innovation.

If a CEO has a high level of facial attractiveness, they often have a high degree of satisfaction with their personal image, and, therefore, are eager to showcase this advantage to the outside world in order to obtain the benefits of a good reputation, excellent image, and the trust of others (Chen et al. 2014; Dion et al. 1972; Ridgway and Clayton, 2016). This is also known as face-saving consciousness (Goffman, 1955). When CEOs have a high level of facial attractiveness, they are more likely to gain a good impression from the outside world. From the perspective of impression management theory, in order to maintain this initial impression and maintain face, CEOs are often more likely to take

actions to consolidate their reputation image, such as leading the firm in environmental innovation (Zhang et al. 2024). Because ethical and public welfare behaviors can enhance the images of CEOs, behaviors such as environmental innovation have prosocial characteristics (Galaskiewicz and Burt, 1991; Godfrey, 2005; Seifert et al. 2003; Suganthi, 2019). However, previous research on the relationship between CEO facial attractiveness, face awareness, and environmental innovation is scarce. Stakeholders' understanding of a firm often depends on its visibility (Bushee and Miller, 2012). Existing research mainly focuses on the impact of firm visibility on social responsibility, while neglecting the important role of the CEO, especially a visually attractive CEO. So, under the context of high visibility, the effect of CEOs with a beauty premium on face awareness is a topic worth paying attention to.

In this study, we explore how CEO facial attractiveness influences their firm's environmental innovation. We will consider face awareness as a mediating variable factor and firm visibility as a moderating variable. This study makes the following contributions to the literature. First, it enriches the research on the driving factors of firms' environmental innovation. Starting with the unique characteristic of the CEO, it elaborates on the impact of face attractiveness on environmental innovation, which adds to the upper-echelons theory by exploring the influence of CEO facial attractiveness on business operations. Second, we examine the mediating role of face awareness and how it influences the relationship between facial attractiveness and environmental innovation, especially the effect of CEO facial attractiveness on face awareness. Third, firm visibility as the moderating variable enhances the understanding of the relationship between facial attractiveness and face awareness, enriching the literature on facial attractiveness.

Theoretical background and hypotheses development

Face attractiveness and firms' environmental innovation. Facial attractiveness refers to the degree to which the appearance of a face brings pleasure to others (Sigall and Landy, 1973). As the most direct external characteristic of an individual, the appearance of the face is often used as the basis for judging others (Todorov et al. 2005). For example, a person's levels of empathy, intelligence, and personal prestige can be expressed in their facial appearance (Zebrowitz et al. 2002). Previous studies have shown that facial attractiveness carries an implicit advantage in the job market and can enhance employees' confidence and performance (Scholz and Sicinski, 2015; Halford and Hsu, 2020). Furthermore, the impact of facial attractiveness applies not only to ordinary employees but also to corporate executives. For example, executives with an outstandingly good appearance may have an advantage in terms of total compensation compared to those with an average appearance (Ahmed et al. 2023), and the salaries of the CEO and top executives of a firm may also vary based on their appearance. Typically, CEOs with high facial attractiveness receive higher salaries (Li et al. 2021).

Will CEOs with high facial attractiveness not only have an impact on individuals, but also on the firm? According to the upper-echelons theory, as senior managers in a firm, their personal traits can influence their own behavior and decision-making, and further shape the firm's strategic choices and specific actions (Hambrick and Mason, 1984). Among the various dimensions of individual characteristics, external features are usually easier to observe and quantify than internal features, which prompts existing research to use CEO demographic background characteristics as a starting point to examine their impact on firm decision-making and performance (Elsheikh et al.

2025), and CEO facial attractiveness belongs to this category of background features (Guo et al. 2022). For example, in the context of upper-echelons theory, Mills and Hogan's (2020) study has confirmed that the attractiveness of a CEO's face directly affects their financial decisions. In addition, the attractiveness of the CEO's face can also affect their negotiation and merger and acquisition behavior, thereby affecting the firm's profits and performance, especially for publicly traded firms (Rosenblat, 2008). A CEO with an extraordinary appearance can attract more financing (Halford and Hsu, 2020; Rule and Ambady, 2008).

It is worth noting that in addition to objective firm performance, the CEO's appearance can also have a significant impact on a firm's pro-social behavior. Studies have found that the appearance of a CEO is closely related to a firm's philanthropic behavior, and CEOs with different levels of appearance have different attitudes towards philanthropy as a pro-social behavior (Ling et al. 2022). Analyzing the underlying mechanisms of this phenomenon, individuals with a superior appearance often exhibit more kindness, sympathy, and altruism (Dion et al. 1972), and Wang et al. (2017) showed that individuals with an outstandingly attractive appearance are more likely to engage in moral actions. Furthermore, individuals with higher facial attractiveness often exhibit pro-social behavior as a response to preferential treatment from the outside world, which serves as feedback to society (Konrath and Handy, 2021; Wilson and Eckel, 2006). However, attractive individuals create a positive first impression with their appearance and also tend to appear more confident in their behavior and performance, which enhances the overall positive perception others have of them (Pfann et al. 2000). This confidence causes others to believe they have superior abilities (Mobius and Rosenblat, 2006). Therefore, society has high expectations of individuals who are attractive, including expectations of positive qualities and behaviors, which may encourage the individuals to participate more in social activities (Li et al. 2021). This idea can be applied to CEOs and corporate managers. CEOs with a beauty premium are more inclined to lead firms to actively fulfill voluntary social responsibilities (Wang et al. 2025). Moreover, environmental innovation by firms is a manifestation of fulfilling social responsibility (Arena et al. 2018), as well as moral and pro-social behavior (Suganthi, 2019).

Environmental innovation is defined as new or improved processes, practices, systems, and products that are beneficial to the environment and have a positive impact on sustainable development (Oltra and Jean, 2009). Environmental innovation is a way to create commercial value for firms, is beneficial for enhancing competitiveness (Dah et al. 2024), and also helps firms make rational use of resources (Sun and Sun, 2021). In other words, environmental innovation improves production efficiency and reduces operating costs for firms. Environmental innovation also means firms complying with environmental regulations, allowing them to avoid risks and enjoy various preferential policies (Leenders and Chandra, 2013; Shui et al. 2025). Moreover, environmental innovation can reduce resource consumption and pollution, which is conducive to promoting green environmental protection, which can be seen as the contribution of firms to human society (Ge et al. 2018; Song and Yu, 2018). Therefore, environmental innovation by firms can improve people's quality of life and facilitate firms' active social responsibility (Jiménez-Parra et al. 2018).

Therefore, a highly attractive CEO not only presents a beautiful appearance but also contains moral beauty. Their behavior better reflects their pro-social nature; in response to external expectations, the attractive CEO is likely to encourage the firm to assume social responsibility. Environmental innovation is a pro-social behavior and a manifestation of the firm actively fulfilling social

responsibility. That is to say, CEOs with high facial attractiveness have sufficient conditions to lead the firm towards an eco-friendly direction. Therefore, we propose the following hypothesis:

H1: The attractiveness of CEO's faces has a positive impact on firms' environmental innovation.

The mediating role of face awareness. The concept of saving face comes from the need to be respected, and individuals need to maintain their public image, reputation, and positive evaluation from the outside world (Hwang, 1987; Lim and Bowers, 1991). The willingness to face and be afraid of losing face is the awareness of face (Bao et al. 2003), which can also be understood as the desire of individuals to improve their social status and reputation within the social group (Zhang et al. 2011). If an individual values power, status, and image, and enjoys showcasing their identity, it indicates they have a high sense of face (Belk et al. 1982; French and Raven, 1959), and abstract concepts such as power, status, and image can be expressed in concrete forms such as wealth, knowledge, and beauty. Therefore, individuals who are noticeably attractive tend to value the advantages bestowed by their external image, which leads them to pay special attention to their self-esteem (Wade, 2000). This high level of self-esteem is a manifestation of high face awareness. Moreover, people with a superior appearance often exhibit a strong desire for a noble status and good reputation because an attractive appearance requires a high-quality status and reputation to match. After reaching a higher social status, they will work more actively and hard to stabilize it in order to avoid losing that status (He et al. 2019), which also confirms the importance of face-saving for people who are attractive.

For the group of corporate CEOs, upper-echelons theory suggests that facial features are both observable demographic background characteristics of executives and the most intuitive outward identification (Datta and Rajagopalan, 1998). This visual trait can significantly shape society's evaluation of executives and form initial impressions. For example, CEOs with outstanding appearance are often perceived as more capable, credible, and leadership, leading to positive stereotypes (Halford and Hsu, 2020). It is worth noting that this initial impression formed based on facial advantages is not a static existence. In the long-term process of social interaction, CEOs with high facial attractiveness will continue to receive positive feedback from the outside world, which makes them highly sensitive to their own image and social evaluation (Hamermesh and Abrevaya, 2013). In other words, such CEOs are more likely to receive positive feedback and a positive image from others, and are more concerned about maintaining these advantages, which in turn fosters a strong sense of face and motivates impression management. According to the classic interpretation of impression management theory, in order to effectively maintain and enhance others' positive evaluations of oneself, individuals will actively adopt various behaviors and strategies to shape their self-image (Baumeister and Leary, 1995). That is to say, CEOs with prominent physical appearance, driven by a strong sense of face, will actively manage their own impressions and take practical actions. Celebrity CEOs often have a strong sense of face to maintain their celebrity status and image, and within the framework of impression management, this sense of face drives them to take specific actions (Lee et al. 2020). CEOs typically have a higher sense of face management motivated by impression management, which ultimately drives them to maintain impression advantages (Lin et al. 2024; Zhou et al. 2023).

Face is not a unilateral existence, but an interdependent social resource that also requires the participation and recognition of others (Wan et al. 2016). Because if a person's performance falls

below the expectations of the outside world or there is a gap between their behavior and the standards required by their social status, they will lose face (Ho, 1976), while people with high face awareness will focus on their image and social status. If people's behavior can earn them respect from others, they will save face (Zhao et al. 2019). Therefore, individuals often leverage pro-social qualities to seek a good word-of-mouth reputation to improve their self-image, social status, and gain respect from others and gain face. People with a strong sense of face will pay special attention to their personal image and social status, and crave positive evaluation and respect from others. In order to achieve these goals, they are more likely to exhibit pro-social behavior.

Research has found that people with a strong sense of face tend to focus on ecological issues (Shin et al. 2007) and are also more inclined to express their ecological and environmental vision through pro-social green behaviors, in order to enhance their social status and reputation (Griskevicius et al. 2010), thus gaining face. Compared to ordinary-looking CEOs, CEOs with a beauty premium tend to receive more attention, and their social status and image often receive high praise and expectations from the outside world. So, for CEOs with a beauty premium, losing face can have a negative impact on their personal image and social status, and engaging in pro-environmental actions can help them improve their status and gain face (Griskevicius et al. 2010). Therefore, they are more willing to promote environmental innovation in their firms. In other words, highly attractive CEOs are more inclined to lead firms in implementing environmental innovation because they have a stronger sense of face, so they are more likely to adopt pro-social behavior, and having a wider range of practices in environmental innovation is a manifestation of social responsibility and altruism. In summary, we propose the following hypothesis:

H2: Face awareness plays a positive mediating role between the facial attractiveness of CEOs and their firms' environmental innovation.

The moderating role of firms' visibility. Firm visibility reflects the firm's public awareness (Campbell and Slack, 2006), which is one of the important characteristics of a firm and can be measured by the firm's media exposure (Brammer and Pavelin, 2006). Based on stakeholder theory, visibility is a reflection of the information that a firm transmits to the outside world, and which attracts attention (Baker et al. 1999). This is facilitated by providing multiple channels for external stakeholders to understand the information of the firm, thereby alleviating the problems caused by information asymmetry. However, visibility can also increase the exposure of executives, who frequently appear in the public eye and have a high level of attention (Deng et al. 2024).

When the visibility of the firm is high, the CEO, as the highest executive officer of the firm, will inevitably attract public attention, thereby gaining more popularity. At this point, the positive image of a CEO with a high facial attractiveness will be repeatedly reinforced through media and other channels, and

they may become a celebrity CEO themselves, which will significantly enhance the goodwill and recognition of the outside world towards them (Agnihotri and Bhattacharya, 2021; Li et al. 2019). The strong psychological security gained from this makes them inclined to believe that the public is more likely to accept and love them, even if they have done something wrong (Ling et al. 2022). Therefore, such CEOs are less sensitive to negative evaluations or image damage events, and do not need to be overly anxious about maintaining face. In other words, high firms' visibility amplifies the strengthening effect of physical advantages on the positive impression of CEOs, thereby reducing their level of concern for adverse events and weakening their sense of face.

On the other hand, CEOs with high facial attractiveness, as their appearance itself is a symbol of a superior image, do not need to invest excessive effort in shaping their external image, which allows them to act with less concern and reduces their worries about potential face damage from conflicts (Chen et al. 2021; Shtudiner and Klein, 2020). In addition, in high-visibility environments, CEOs with outstanding appearances will receive more positive feedback from the media, which not only enhances their confidence but also makes them more likely to attribute certain successes to their own abilities (Chen et al. 2025; Fu et al. 2025). This inherent attributional tendency diminishes individuals' reliance on others' evaluations, thereby further reducing their sensitivity to face. It is worth noting that in low-visibility environments, CEOs with high facial attractiveness may need to actively showcase their physical advantages to gain benefits and shape their image (Wang et al. 2025). However, under high visibility, its image advantage has been established, allowing more energy to be invested in substantive operations and strategic decision-making of the firm (Klein and Shtudiner, 2021; Wang et al. 2019). Compared to actual business performance, the importance of face has significantly decreased, which has also contributed to the weakening of their sense of face. In summary, we propose the following hypothesis:

H3: Firm visibility plays a negative moderating role between CEO facial attractiveness and face awareness.

Figure 1 depicts the theoretical model of this study.

Method

Data sources. This study selected heavily polluting A-share listed firms in China from 2017 to 2022 as a sample. The firms' financial data were sourced from CSMAR, the annual reports of the firms came from Juchao Information, and the environmental innovation data of the firms, and the online news reporting data of the firms, all came from CNRDS. The green patent research database in CNRDS is a combination of Chinese patent data and the green patent classification number standards published by the World Intellectual Property Office. Considering the reliability and completeness of the data, this study excluded firms with ST and * ST, firms with missing data, and firms with CEO photos that did not meet the testing software requirements. Ultimately, balanced panel data were obtained for 381 heavily polluting firms and 636

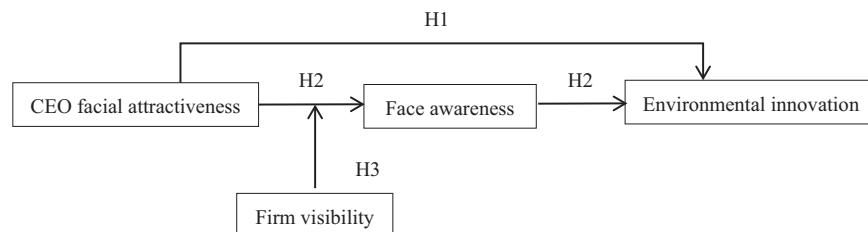


Fig. 1 Theoretical model.

CEOs. In order to reduce the impact of extreme values, this study applied winsorization at the 1% and 99% levels to all continuous variables.

Variable measurement

CEO facial attractiveness (CFA). Using software to measure the attractiveness of a CEO's face is an efficient way to obtain objective evaluation results, helping us to accurately capture and analyze facial features. The aim of software measurement is to accurately compare the facial ratio of the subject with the golden ratio to obtain an attractiveness score. This includes calculating the ratio of facial width to height, the ratio of nose to ear length, and nose width to face width, facial symmetry, and other indicators (Blankespoor et al. 2017; Kim et al. 2021; Schmid et al. 2008). This technology has been applied in the research of CEO facial attractiveness assessment by Halford and Hsu (2020), Liu et al. (2022), Yang et al. (2024), and Zhang et al. (2024), and has become one of the most popular methods for appearance assessment due to its scientific and objective advantages. This study obtained clear and complete frontal photos of CEOs from websites such as Sogou, Baidu, and the firm's official websites based on the firm name and CEO's name. The inclusion criteria were that the CEO's facial expression should be neutral, the photo should have no editing marks, and the resolution should be high enough. Drawing on the method of Chiu et al. (2024), Baidu AI facial recognition technology was used to recognize and score the CEO's face for 150 key points, producing a score of 0–10, which was ultimately used as the CEO's facial attractiveness score.

Environmental innovation (EI). Based on the research by Brunnermeier and Cohen (2003) and Chang and Sam (2015) this study used the number of environmental innovation patents to measure the level of corporate environmental innovation. We considered that green invention patents can better reflect the level of corporate environmental innovation (Fu et al. 2023; Li, 2022), and so this study uses the number of authorized green invention patents to measure the level of environmental innovation of firms as detailed by Liao et al. (2024). Because some firms have no patent numbers, 1 was added to the number of patents before logarithmizing the values.

Face awareness (FW). The Sapir–Whorf hypothesis posits that language reflects an individual's values and cognition, and the words appearing in text can reflect an individual's thoughts (Short et al. 2010). The annual report of a firm is the channel for communication between the CEO and the outside world. The CEO usually uses the annual report to convey the firm's strategy, achievements, and plans to the outside world (Wagner and Fischer-Kreer, 2024). In addition, the annual report of a firm is carefully edited and confirmed by the CEO, and previous research has confirmed that the CEO's involvement in the annual report is extremely high (Gamache et al. 2015). Meanwhile, Nadkarni and Chen's (2014) study revealed that the words used by CEOs in corporate annual reports are closely related to the words used in press releases and public speeches. Therefore, the annual report of a firm can reflect the personal preferences and awareness of the CEO (Eggers and Kaplan, 2009; Marcel et al. 2011; Nadkarni and Barr, 2008). For example, Gamache et al. (2020) and Liang et al. (2024) have used corporate annual reports to measure CEOs' regulatory focus, while Liao et al. (2025) have also used corporate annual reports to measure CEOs' dependency-based self-construction awareness. Based on the method of Yadav et al. (2007), we conducted text analysis on the firms' annual reports, using the frequency of keywords to measure the CEO's face awareness. First, starting from the definition of face awareness,

"achievement," "reputation," "external image," "status," and "influence" were selected as seed words. Second, after studying a large number of annual reports of firms, we established eight keywords: "enormous value," "first place," and "international advanced level." Finally, we used Python software to calculate the frequency of each keyword in the annual reports of sample firms, and added 1 to take the logarithm for processing, in order to measure the CEO's face awareness.

Firm visibility (FV). Using Wang's (2016) method, we measured the firms' visibility by multiplying the number of times their name appeared in online news and then taking the logarithm of this count to determine the news coverage rate.

Control variables. Referring to the research of Liao et al. (2024) and Zhu et al. (2023), CEO's gender, tenure, and dual role integration were selected as control variables. Firm age, size, return on assets (Roa), gross profit margin (GP), board size (Board), and total number of shares held by the largest shareholder (Top1) were selected as control variables at the firm level, and firm age and size were logarithmically processed.

Results

Descriptive analysis. This study used Stata 18 for statistical analysis, and Table 1 shows the descriptive statistics and correlation analysis results for each variable.

Table 1 shows that the average CEO facial attractiveness is 4.1643, with a standard deviation of 1.2114, indicating that the sample data fluctuates greatly, and the collected data is comprehensive. The average value of firm visibility is 4.1001, with a standard deviation of 0.8339. The data range is relatively large, indicating that different firms have varying degrees of visibility. The correlation coefficient between CEO facial attractiveness and environmental innovation is 0.0527, which is significant at the 5% level; the correlation coefficient between CEO facial attractiveness and face awareness is 0.1132, which is significant at the 1% level. Overall, the coefficients did not exceed 0.5, indicating that there are no multicollinearity issues.

Hypothesis testing

Benchmark regression results. This study constructed a panel data model with dual fixed effects and conducted multiple regression analysis to explore the impact of CEO facial attractiveness on firms' environmental innovation. The results are presented in Table 2.

From Model 1a in Table 2, it can be seen that the control variable, integration of two roles, has a significant impact on the environmental innovation of the firm. Model 1b shows that the coefficient of influence of CEO facial attractiveness on firms' environmental innovation is 0.0177, which is significant at the 5% level. This indicates that CEO facial attractiveness has a positive promoting effect on firms' environmental innovation. Therefore, H1 is supported.

Mediation effect test. Table 3 shows the regression results of the mediating effect of face awareness between CEO facial attractiveness and firms' environmental innovation.

Model 2a in Table 3 indicates that gender and the number of shares held by the largest shareholder have a significant impact on face awareness. According to Model 2b in Table 3, the coefficient of influence of CEO facial attractiveness on face awareness is 0.0169, which is significant at the 10% level. This indicates that CEO facial attractiveness has a significant positive impact on face awareness, and CEOs with a beauty premium are more face-conscious. Model 2c shows that the coefficient of influence of face

Variables	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
El	0.0947	0.3131	1.0000												
CFA	4.1643	1.2114	0.0527**	1.0000											
FW	2.1283	0.4473	0.0359*	0.1132**	1.0000										
FV	4.1001	0.8339	0.1315***	0.0157	0.0676**	1.0000									
Gender	0.9418	0.2341	0.0383*	-0.0248	-0.0447**	0.0702**	1.0000								
Tenure	5.5949	4.1025	-0.0434**	0.0451**	0.0917***	0.0117	-0.0013	1.0000							
Dual	0.2760	0.4471	-0.0947***	0.0611**	0.0477**	-0.0095	-0.0137	0.1850***	1.0000						
Firm age	3.0364	0.2495	0.0216	-0.0507**	0.0005	0.0225	-0.0325	0.0885***	-0.0677***	1.0000					
Size	22.3666	1.2318	0.2015***	-0.0135	0.0587***	0.3215***	-0.0286	0.243	-0.1728***	0.2049***	1.0000				
Roa	0.0528	0.0587	0.0275	0.0275	0.0389*	-0.0264	0.1275***	0.0997***	0.0486***	-0.0598***	0.0361*	1.0000			
GP	0.2316	0.1176	-0.0568***	0.1248**	0.0026	0.0623***	-0.0312	0.0428**	0.1898***	0.4863***	0.0000	1.0000			
Board	2.1145	0.1787	0.0966***	-0.0448***	-0.0759***	0.0504**	0.0391*	0.0488**	0.1294***	0.2720***	0.0119	-0.0592***	1.0000		
Top1	31.9734	13.1407	0.0323	0.0381*	-0.0887***	-0.0143	0.0078	-0.111***	0.0876***	0.1142***	0.0849***	-0.0793***	-0.0338	1.0000	

***represents $p < 0.01$, **represents $p < 0.05$, and *represents $p < 0.1$.

Table 2 Regression results of direct effects.

Variables	EI	
	Model 1a	Model 1b
CFA		0.0177** (2.0485)
Gender	-0.0785 (-1.5653)	-0.0719 (-1.4320)
Tenure	-0.0012 (-0.4979)	-0.0007 (-0.3128)
Dual	-0.0371* (-1.7019)	-0.0400* (-1.8324)
Firm age	-0.2210 (-0.9833)	-0.2400 (-1.0680)
Size	0.0307 (1.4406)	0.0339 (1.5880)
Roa	-0.1739 (-1.0583)	-0.1693 (-1.0313)
GP	0.0904 (0.6563)	0.0705 (0.5109)
Board	-0.0630 (-0.9455)	-0.0661 (-0.9937)
Top1	-0.0023 (-1.4640)	-0.0021 (-1.3658)
_cons	0.3557 (0.4463)	0.2671 (0.3350)
Time effect	Yes	Yes
Individual effect	Yes	Yes
N	2286	2286
R ²	0.011	0.013
F	1.499	1.681

***represents $p < 0.01$, **represents $p < 0.05$, and *represents $p < 0.1$.

awareness on environmental innovation is 0.0383, which is significant at the 10% level. The coefficient of influence of CEO facial attractiveness on firms' environmental innovation is 0.0170, which is significant at the 5% level. This indicates that after adding face awareness, the relationship between CEO facial attractiveness and firms' environmental innovation remains unchanged. Therefore, it can be concluded that face awareness plays a mediating role between CEO facial attractiveness and firms' environmental innovation; that is, the higher the CEO facial attractiveness, the stronger their face awareness will be, ultimately promoting firms' environmental innovation. Therefore, hypothesis H2 is supported.

Moderating effect of firm visibility. Table 4 shows the moderating effect of firm visibility on the relationship between CEO facial attractiveness and face awareness.

Model 3a in Table 4 indicates a positive effect of CEO facial attractiveness on face awareness, with an impact coefficient of 0.0166, which is significant at the 10% level. Model 3b shows that after adding interactivity, the significance level remains unchanged, while the interaction term of CEO facial attractiveness and firm visibility has an impact coefficient of -0.0158 on face awareness, significant at the 5% level. This indicates that firm visibility plays a negative moderating role between CEO facial attractiveness and face awareness, and therefore, hypothesis H3 is supported. The negative moderating effect of firm visibility is shown in Fig. 2.

Robustness testing. To verify the robustness of the results, we included control variables at the CEO and corporate levels. We also selected regional-level control variables to address important factors that were omitted in the regression analysis. Following the methods of Zhang et al. (2022), Liu et al. (2020), and Luo et al. (2021), we included industrial structure (ISU), government intervention level (GOV), research and development intensity (R&D), industrialization level (Ind), technology market development level (TM), and informatization level (Inf) as control regional variables, as shown in Table 5. The results are consistent with the above research.

Heterogeneity testing. Chinese firms can be divided into state-owned firms and non-state-owned firms based on the nature of

Table 3 Regression results of the mediating effect of face awareness.

Variables	FW	EI	
	Model 2a	Model 2b	Model 2c
CFA		0.0169* (1.8324)	0.0170** (1.9730)
FW			0.0383* (1.7778)
Gender	-0.1590*** (-2.9665)	-0.1527*** (-2.8447)	-0.0661 (-1.3137)
Tenure	0.0034 (1.3624)	0.0038 (1.5219)	-0.0009 (-0.3750)
Dual	0.0061 (0.2608)	0.0033 (0.1418)	-0.0401* (-1.8392)
Firm age	-0.2031 (-0.8461)	-0.2213 (-0.9217)	-0.2316 (-1.0307)
Size	0.0030 (0.1322)	0.0061 (0.2661)	0.0336 (1.5780)
Roa	-0.1036 (-0.5904)	-0.0992 (-0.5658)	-0.1655 (-1.0086)
GP	0.1824 (1.2404)	0.1634 (1.1089)	0.0642 (0.4657)
Board	-0.0933 (-1.3123)	-0.0963 (-1.3554)	-0.0624 (-0.9384)
Top1	0.0033** (1.9816)	0.0034** (2.0681)	-0.0022 (-1.4495)
_cons	2.7124*** (3.1870)	2.6278*** (3.0850)	0.1666 (0.2085)
Time effect	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes
N	2286	2286	2286
R ²	0.168	0.170	0.015
F	27.319	25.754	1.776

***represents $p < 0.01$, **represents $p < 0.05$, and *represents $p < 0.1$.

Table 4 Regression results of the moderating effect of firm visibility.

Variables	FW	EI	
	Model 3a	Model 3b	Model 3c
CFA	0.0166* (1.8034)	0.0170* (1.8464)	0.0170* (1.9730)
FV	0.0070 (0.6604)	0.0073 (0.6902)	0.0383* (1.7778)
CEOFA*FV		-0.0158** (-2.2659)	
Gender	-0.1517*** (-2.8248)	-0.1407*** (-2.6125)	-0.0661 (-1.3137)
Tenure	0.0037 (1.4927)	0.0037 (1.4897)	-0.0009 (-0.3750)
Dual	0.0034 (0.1470)	0.0045 (0.1919)	-0.0401* (-1.8392)
Firm age	-0.2221 (-0.9251)	-0.2173 (-0.9059)	-0.2316 (-1.0307)
Size	0.0042 (0.1829)	0.0048 (0.2084)	0.0336 (1.5780)
Roa	-0.1071 (-0.6093)	-0.1301 (-0.7398)	-0.1655 (-1.0086)
GP	0.1578 (1.0687)	0.1737 (1.1763)	0.0642 (0.4657)
Board	-0.0933 (-1.3094)	-0.0954 (-1.3406)	-0.0624 (-0.9384)
Top1	0.0035** (2.0989)	0.0034** (2.0851)	-0.0022 (-1.4495)
_cons	2.6380*** (3.0960)	2.6004*** (3.0546)	0.1666 (0.2085)
Time effect	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes
N	2286	2286	2286
R ²	0.170	0.172	0.015
F	24.164	23.094	1.776

***represents $p < 0.01$, **represents $p < 0.05$, and *represents $p < 0.1$.

property rights. State-owned firms have significant advantages in resource acquisition, credit environment, financing conditions, and policy support and are more likely to engage in environmental innovation (Andrews et al. 2022). Therefore, we used Andrews et al.'s method and divided firms into state-owned and non-state-owned ones to explore the impact of CEO facial attractiveness on environmental innovation. The results are shown in Table 6.

From Model 5b in Table 6, it can be seen that the facial attractiveness of CEOs of state-owned firms has a significant promoting effect on environmental innovation, with a coefficient of 0.0352, which is significant at the 5% level, while the CEO facial attractiveness of non-state-owned firms does not have a significant effect on environmental innovation.

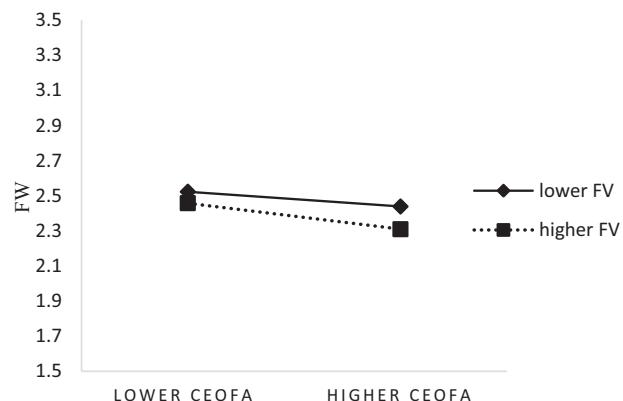


Fig. 2 The impact of CEO facial attractiveness on face awareness under different firm visibility.

Conclusion and discussion

This study takes heavily polluting A-share listed firms in China from 2017 to 2022 as its sample, and explores the impact of CEO facial attractiveness on environmental innovation from the perspective of the upper-echelons theory. The mediating role of face awareness was examined, and the moderating effect of firm visibility. The final research conclusions are as follows.

First, CEO facial attractiveness positively influenced firms' environmental innovation. Previous studies have mainly focused on the impact of CEO facial attractiveness on themselves, such as salary levels, career development, etc. (Colombo et al. 2022). This study extends the scope of research to the corporate level and is consistent with the findings of Wang et al. (2025), who found that the attractiveness of the CEO's face remains an important factor in driving corporate social responsibility. But what sets this study apart is that it profoundly reveals the important role of CEO facial attractiveness in driving firms' environmental innovation, further expanding the factors driving firms' environmental innovation and filling the gap in previous research. At the same time, extending the boundaries of upper-echelons theory, existing research has categorized CEO facial attractiveness into the personal traits of executives from the perspective of upper-echelons theory. Based on

Table 5 Regression results of robustness test.

Variables	EI	FW	EI	FW
	Model 4a	Model 4b	Model 4c	Model 4d
CFA	0.0182** (2.1034)	0.0178* (1.9374)	0.0174** (2.0182)	0.0179* (1.9417)
FW			0.0410* (1.8951)	
FV				0.0066 (0.6255)
FC*FV				-0.0140** (-2.0151)
Gender	-0.0700 (-1.3919)	-0.1501*** (-2.8041)	-0.0638 (-1.2678)	-0.1395*** (-2.5975)
Tenure	-0.0008 (-0.3543)	0.0041* (1.6651)	-0.0010 (-0.4269)	0.0040 (1.6190)
Dual	-0.0435** (-1.9860)	0.0059 (0.2511)	-0.0438** (-1.9983)	0.0068 (0.2907)
Firm age	-0.2568 (-1.1394)	-0.1834 (-0.7647)	-0.2492 (-1.1067)	-0.1816 (-0.7579)
Size	0.0339 (1.5832)	0.0075 (0.3308)	0.0336 (1.5698)	0.0061 (0.2667)
Roa	-0.1601 (-0.9715)	-0.1329 (-0.7580)	-0.1547 (-0.9390)	-0.1582 (-0.8992)
GP	0.0469 (0.3378)	0.2057 (1.3910)	0.0385 (0.2771)	0.2119 (1.4307)
Board	-0.0687 (-1.0288)	-0.0951 (-1.3392)	-0.0648 (-0.9706)	-0.0937 (-1.3174)
Top1	-0.0020 (-1.2688)	0.0034** (2.0380)	-0.0021 (-1.3572)	0.0034** (2.0532)
ISU	-0.0043 (-0.3261)	0.0328** (2.3438)	-0.0056 (-0.4280)	0.0313** (2.2356)
GOV	-0.1372 (-0.3356)	-0.2167 (-0.4981)	-0.1283 (-0.3141)	-0.1959 (-0.4504)
R&D	-1.1799 (-0.8768)	3.9412*** (2.7522)	-1.3415 (-0.9955)	3.9467*** (2.7579)
Ind	0.0572 (0.1609)	0.5805 (1.5329)	0.0334 (0.0940)	0.5266 (1.3879)
TM	1.4318* (1.7982)	0.0503 (0.0594)	1.4297* (1.7968)	0.0746 (0.0881)
Inf	-0.3430 (-1.2198)	-0.1666 (-0.5568)	-0.3362 (-1.1962)	-0.1733 (-0.5783)
_cons	0.3519 (0.4319)	2.1946** (2.5311)	0.2619 (0.3211)	2.1971** (2.5352)
Time effect	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes
N	2286	2286	2286	2286
R ²	0.016	0.178	0.018	0.180
F	1.480	19.490	1.578	18.010

Note: ***represents $p < 0.01$, **represents $p < 0.05$, and *represents $p < 0.1$.

Table 6 Heterogeneity regression results of different property rights.

Variables	State-owned		Non-state-owned	
	EI	EI	EI	EI
	Model 5a	Model 5b	Model 5c	Model 5d
CFA		0.0352** (1.9827)		0.0094 (0.8962)
Gender	-0.3277** (-2.1171)	-0.2700* (-1.7186)	-0.0319 (-0.6502)	-0.0318 (-0.6491)
Tenure	-0.0004 (-0.0753)	-0.0013 (-0.2505)	-0.0018 (-0.6872)	-0.0011 (-0.4196)
Dual	-0.0537 (-0.9401)	-0.0611 (-1.0696)	-0.0284 (-1.2593)	-0.0297 (-1.3177)
Firm age	-0.1366 (-0.1716)	-0.3063 (-0.3837)	-0.1182 (-0.5413)	-0.1190 (-0.5452)
Size	0.0515 (0.9550)	0.0705 (1.2900)	0.0346 (1.5585)	0.0356 (1.6011)
Roa	-0.0421 (-0.1035)	-0.0357 (-0.0879)	-0.2199 (-1.2995)	-0.2197 (-1.2985)
GP	0.0168 (0.0499)	-0.0397 (-0.1178)	0.1061 (0.7441)	0.1007 (0.7049)
Board	-0.2519 (-1.5951)	-0.2722* (-1.7250)	0.0193 (0.2649)	0.0196 (0.2696)
Top1	-0.0062* (-1.8170)	-0.0069** (-2.0019)	-0.0005 (-0.2993)	-0.0004 (-0.2214)
_cons	0.5107 (0.2027)	0.4727 (0.1881)	-0.3351 (-0.4174)	-0.3991 (-0.4952)
Time effect	Yes	Yes	Yes	Yes
Individual effect	Yes	Yes	Yes	Yes
N	660	660	1626	1626
R ²	0.034	0.042	0.012	0.012
F	1.345	1.525	1.138	1.116

Note: **represents $p < 0.05$, and *represents $p < 0.1$.

this, this study continues to provide insights for subsequent reasons. Facial attractiveness is undoubtedly the most prominent trait of individuals, and CEOs with high facial attractiveness often exhibit more enthusiasm and kindness, as well as a greater willingness to be responsible and contribute to society (Ling et al. 2022). Particularly amid the growing severity of environmental challenges, CEOs who prioritize physical appearance proactively drive the implementation of environmental innovation initiatives. Such efforts not only yield tangible environmental benefits for

contemporary society but also lay a solid foundation for safeguarding the well-being of future generations.

Second, face awareness plays a positive mediating role between CEO facial attractiveness and firms' environmental innovation. CEOs are not entirely rational; they also pursue social status, reputation, influence, and achievements. Furthermore, CEOs with a beauty premium often have a better image and higher status and are given more positive (Cipriani and Zago, 2011). CEOs who prioritize beauty often have the motivation to maintain or further

increase this privilege, which significantly enhances their sense of face. In order to maintain or win face, from the perspective of impression management, CEOs who prioritize beauty will achieve this goal through environmental innovation measures. Leading firm in environmental innovation often leads to positive evaluations, social status, and respect from the public, and can also continue to shape an excellent personal image (Liao et al. 2025), which is beneficial for enhancing the CEO's face among peers. In addition, this study applies impression management theory to the fields of facial attractiveness, face awareness, and environmental innovation, effectively linking the three and extending the application scope of impression management theory, providing a new perspective for subsequent research.

Third, firm visibility plays a negative moderating role between CEO facial attractiveness and face awareness. The results show that when firm visibility is high, CEOs with a beauty premium are less concerned about face. In the annual reports of high-visibility firms, they often use more cautious and conservative wording to reduce risks such as litigation and other factors (Thng, 2019), and this masks the CEO's strong sense of face. Moreover, when firm visibility is high, CEOs with a beauty premium will be more cautious in their words and actions, because positive evaluations can bring pressure on individuals to maintain an enhanced image, even resulting in more interpersonal competition. Therefore, CEOs may feel uncomfortable with these positive evaluations and even avoid them (Cook et al. 2022; Reichenberger et al. 2018; Weeks et al. 2019). In China, Eastern culture emphasizes the importance of humility and appearing low-key, so CEOs with a beauty premium often display behaviors that signal humility and pragmatism. In the public spotlight, CEOs need to approach positive evaluations rationally and pay attention to their public words and actions (Reichenberger et al. 2019; Weeks, 2015), which may lead to CEOs deliberately concealing their face-consciousness. However, in high-visibility firms, the CEO's achievements depend on their professional abilities. Therefore, even when an attractive CEO garners substantial attention, they will still prioritize practical actions and tangible achievements to secure recognition—rather than focusing on face-saving.

Fourth, in terms of the nature of firm property rights, the attractiveness of CEOs of state-owned firms had a promoting effect on environmental innovation, while this effect was not seen in non-state-owned firms. State-owned firms have a natural connection with the government, and CEO facial attractiveness is more likely to attract attention from the outside world, including government agencies. On the one hand, CEOs can strengthen the connection between their firms and the government through environmental innovation (Oliver and Holzinger, 2008), reduce policy uncertainty, and strive for political favoritism and benefits (Ovtchinnikov et al. 2020). On the other hand, firms' environmental innovation improves the prospects for future promotion of CEOs of state-owned firms (Chen et al. 2016), which is also a potential factor causing different results in the nature of firm property rights.

Managerial implications. The findings of this study enrich the upper-echelons theory and have implications for the development of firms. Firstly, the personal characteristics of the CEO will affect the operation and decision-making of the firm; therefore, the firm should guide the CEO's traits reasonably, so that they can move towards the direction that is conducive to firm operation and environmental innovation, and transform the traits into driving factors for fulfilling social responsibility. Secondly, the CEO is the “business card” of the firm, so it is necessary for CEOs to pay attention to their image, which is conducive to shaping the image of the firm and bringing it closer to meeting stakeholder

expectations. Firms should guide their employees' face awareness psychology correctly, and design a reasonable incentive system to transform face awareness into action, thereby improving their performance and contribution to the firm. Finally, using the firm's visibility to create a better personal image for the CEO to gain market recognition can promote products and improve the positive image and profitability of the firm by showcasing its social responsibility and environmental innovation achievements to the outside world.

Research limitations and future research directions. The findings of this study provide new insights into the impact of CEO facial attractiveness on firms' environmental innovation, but it has some limitations. First, this study selected firms from China's heavily polluting industries, which indicates that the value of generalizability still needs further testing. Therefore, future research can examine other industries in manufacturing and services. Second, this study only evaluates attractiveness based on the CEO's facial appearance, but physical attractiveness also includes aspects such as height, body shape, temperament, and personality. Future research can explore these aspects when considering the CEO's personal traits to add to our findings. Third, this study used annual reports for text analysis to measure CEO face awareness. Although it is a creative method, future research could use methods such as questionnaire surveys and interviews to measure CEO face awareness. Finally, the CEOs selected in this study are deeply influenced by Chinese culture, and future research could choose different cultural backgrounds. Based on this, we will continue to explore how the face consciousness of CEOs with a beauty premium will change according to firm visibility.

Data availability

No datasets were generated or analyzed during the current study.

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Author contributions

Conceptualization: Zhongju LIAO, Writing-original draft: Ke CHEN, Methodology: Xiaoyun REN.

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Additional information

Correspondence and requests for materials should be addressed to Ke Chen.

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