

CEO Characteristics and Green Innovation: A Systematic Literature Review

Nurul Fitriani^a, Selma Putri Safira^b, Putri Dwi Aprilia Nur Khasanah^c, and Yulianti Raharjo^{d,*}

^{a,b,c,d} *Program Studi Akuntansi, UPN Veteran Jawa Timur, Indonesia*

Abstract. This study employs a systematic literature analysis to identify research gaps and opportunities on the influence of CEO qualities on green innovation. By critically evaluating the shortcomings of current research and synthesizing pieces from reliable, Scopus-indexed journals, it adds to the body of knowledge on green innovation. The study's conclusions point out gaps in the literature, pointing out that prior studies have mainly concentrated on green innovation in industrialized countries—particularly China. Additional investigation is required to examine particular characteristics of CEOs, such as dualism, turnover, and other psychological attributes. Policymakers, practitioners, and academics can all profit from these insights.

Keywords: CEO, CEOs Characteristic, Green Innovation, Systematic Literature Review

*Corresponding author. E-mail: yulianti.raharjo.febis@upnjatim.ac.id

Introduction

Environmental deterioration and global climate change are critical challenges threatening human life (He et al., 2024). Green innovation represents a proactive business strategy aimed at reducing pollution emissions and minimizing energy consumption, while simultaneously balancing environmental responsibility with financial objectives. Green innovation is defined by Arena et al. (2018) as creating new goods or procedures that have minimal negative effects on the environment. Zhou et al. (2021) define green innovation as the application of novel or altered procedures, technologies, frameworks, and goods to minimize or prevent harm to the environment. These definitions highlight businesses' multifaceted approach to mitigating ecological harm through innovation.

Green innovation can help achieve sustainable growth and a competitive advantage by mitigating negative environmental effects (Hussain et al., 2023). Cutting waste and product costs improves social and financial efficiency and lessens environmental adverse effects (Weng et al., 2015). Scholars are concentrating on the elements that drive green innovation and how businesses may support it as the need for green innovation rises and its advantages become more apparent (Wang & Jiang, 2021). Several research papers (Chang & Chen, 2013; Cheng et al., 2023; Cui et al., 2022; Lv et al., 2021; Wang et al., 2023) examine organizational, cultural, and regulatory factors that affect green innovation. Despite their critical role in determining company strategy, empirical studies on CEOs' effects on green innovation in businesses still need to be available.

Previous empirical research has examined the relationship between CEO attributes and corporate green innovation from a number of perspectives, including CEO gender (Javed et al., 2023), political ties (Huang et al., 2021), international experience (Quan et al., 2023), time perspective (Hussain et al., 2023), hometown identity (Ren et al., 2020), green ecological experience (Wang et al., 2023), financial background (Guo & Zhao, 2024), background in information technology (Pan et al., 2024), and pollution experience (He et al., 2024). This study uses a different approach by conducting systematic literature review. This study fills in information gaps and provides insights into potential futures in CEO participation in green innovation through systematic literature review. The relationship between CEOs and green innovation will be studied through a review of

prior studies and current happenings. There are three main considerations that motivate this review. First, CEOs are increasingly prioritizing the implementation of green innovation, reflecting their recognition of its importance to the success of their companies. Second, the rising corporate focus on sustainability has the potential to foster sustainable development, boost investment, and enhance stakeholder engagement. Third, environmental studies scholars are realizing how important it is to comprehend how green innovation and CEO traits relate to one another. This analysis aims to address crucial gaps in understanding CEO engagement in green innovation by thoroughly reviewing the existing state of research and making recommendations for future advancement.

The result shows that traits such as CEO tenure, age, political connections, female gender, hometown identity, and experience in industry associations or environmental issues positively influence green innovation, while CEO narcissism and financial backgrounds may have negative effects. The study also highlights the overemphasis on developed countries, particularly China, and the limited exploration of other CEO characteristics.

This study intends to contribute to the body of knowledge in this field by combining and analyzing previous research in order to better understand the relationship between CEO qualities and green innovation. Second, the review provides valuable insights for researchers, helping them to refine theoretical frameworks and identify areas for further empirical investigation. Lastly, the research identifies significant gaps in the current literature and offers targeted recommendations for future studies, contributing to a more robust foundation for both academic and practical advancements in this field.

As a practical recommendation, companies should focus on leadership development programs that promote sustainability, especially for CEOs with financial backgrounds, to enhance their alignment with green innovation goals. Boards of directors should prioritize appointing CEOs with backgrounds in science, engineering, or sustainability, as these traits are associated with a stronger commitment to green practices. Policymakers and researchers are encouraged to expand research into developing economies, as these regions are underrepresented in the current literature. Additionally, governments can create tailored policies and incentives that support green innovation by promoting leadership characteristics that are conducive to sustainable business practices, such as experience in

environmental issues and the appointment of female CEOs.

Literature Review

Upper Echelons Theory

According to the upper echelons theory (Hambrick & Mason, 1984), executives shape their decisions based on highly subjective perceptions of their circumstances and options. That is to say, the behaviour of executives is influenced by their values, age, gender, and demography, as well as their personality and experience. A company's senior leadership can be reflected in its strategies and activities when this degree of personalization is used (Hambrick, 2007; Hambrick & Mason, 1984). According to Horbach and Jacob (2018), these traits contribute to the company's cognitive constitution and influence its efforts in green innovation. The upper echelons theory thus holds that factors including personality, experience, and gender can significantly affect a CEO's decision-making concerning the adoption of green innovation.

Imprinting Theory

Organizational behaviour was the first field in which imprinting theory was applied. Many analysts think that even when the external environment changes, previous "imprints" continue to impact a business. The process of imprint theory has lately been extended to the individual level by researchers. According to Zhou et al. (2021), for instance, CEOs who study or work abroad create distinct "imprints" that affect their skills and thinking and ultimately affect the bottom line of their companies.

According to imprinting theory, CEOs may form psychological imprints during significant times when they are learning, growing, and working. These imprints, encompassing abilities and cognition, may impact their decision-making ability. Therefore, it makes sense to apply imprinting theory to individual-level research, such as CEO studies (Zhou et al., 2021). This hypothesis holds that CEOs' work experiences leave "imprints" on their minds that affect their cognition and, in turn, the green innovation practices of their companies (Guo & Zhao, 2024).

Gender Socialization Theory

The impact of gender on environmental behaviour is frequently explained by the gender socialization

theory (Eagly & Crowley, 1986; Fine, 1992; Greenhalgh & Miller, 1993). According to the hypothesis, people's socialization within particular cultures and situations is shaped by gender-specific expectations, which then impact gender-specific behaviours. These societal norms establish socialization patterns that mould an individual's values, directing their attitudes and actions (Stern et al., 1993; Lane, 1976). In this situation, women tend to have greater values than males when it comes to attending to the needs of others.

Ecocentrism is a fundamental nature-centred value that is linked to feminine socialization, according to gender socialization theory. Studies have found that women have a better bond with nature and are more likely to be socialized to take on caregiving tasks (Beutel & Marini, 1995; Zelezny et al., 2000). Many cultures have seen the consequences of gender socialization (Williams & Best, 1990). Research indicates that some genders are predisposed to environmental concerns from an early age (Hamilton, 1985). According to Zelezny et al. (2000), women typically exhibit superior ecological attitudes and practices than men. Consequently, female CEOs are thought to be more inclined to emphasize environmental challenges especially the use of green innovation according to gender socialization theory.

Social Network Theory

Social network theory illustrates how a CEO's political connections affect green innovation within a company. These relationships have a big impact on how businesses act, make decisions, and respond to their surroundings (Lin et al., 2016). For getting the support of the government and minimizing political uncertainty, connections to politics are crucial (Xin & Pearce, 1996). Based on four aspects of social capital supplied by social networks—knowledge, risk tolerance, social credentials, and identity recognition—Huang et al. (2021) establish five processes by which a CEO's political connections support green innovation. CEOs with political connections can access disproportionate government resources, such as tax rebates (Chen et al., 2011), preferential bank loans (Dinç, 2005), subsidies (Hung et al., 2015), and general government support (Al-Hadi et al., 2016). These resources can reduce obstacles to finance and reduce investment uncertainty in green innovation.

Social networks also improve the information's flow and quality. High-level social ties provide critical information that the market may lack (Lin, 2017).

Innovation requires substantial information and new technical knowledge (Hall et al., 2005). Politically connected CEOs can maintain strong ties with the government, facilitating access to current and anticipated environmental regulations. This improves the exchange of essential knowledge, reduces policy uncertainty, enhances internal knowledge, aids investment decisions, and offers early advantages in green innovation.

Third, CEOs' risk tolerance rises with social capital. According to Ambrus et al. (2014), social networks encourage risk-taking by offering advantages for risk-sharing. Stronger risk propensity is frequently associated with influential social positions (Ferris et al., 2017). Political ties may allow CEOs to share environmental innovation risks with the government (Bloch et al., 2008), making them more willing to undertake risky green projects.

Fourth, resources gained through social ties serve as social status markers, enhancing credibility and respect (Lin, 2017). Social capital literature suggests that institutions and regulations shape public trust (Brehm & Rahn, 1997; Rothstein & Stolle, 2002). CEOs with political experience can convince stakeholders of their organization's legitimacy and ability to handle environmental uncertainty, attracting more intellectual capital and supporting green innovation (Huang et al., 2021).

Lastly, social ties can strengthen a person's sense of identity (Lin, 2017). CEOs with close government ties can reinforce their affiliation, increasing support for government-led innovation and environmental protection. State-owned firms often show higher environmental awareness and investment in corporate social performance (CSP) (Frag et al., 2015). Therefore, politically connected CEOs are more likely to adopt green innovation strategies aligned with national laws.

Research Methods

The relationship between CEOs and green innovation is examined and summarized in this study through the use of the systematic literature review approach. Heubeck (2024) is cited in the systematic literature review approach used in this investigation. The following five steps make up the systematic literature review conducted in this article: (1) establishing the review focus; (2) choosing pertinent articles; (3) assessing their quality and applicability; (4) extracting and assembling data; and (5) reporting the results. In the beginning, the analysis of empirical research on CEO traits and green innovation is the primary goal of

this review. The search phrases for CEO traits and green innovation are compiled in Figure 1. Second, this business-centered evaluation restricted the subject area to journals in business, management, accounting, and finance in order to choose pertinent articles (Paul & Criado, 2020; Heubeck, 2024).

Fig. 1. Search strings and inclusion criteria

<p>Search strings (CEO OR Chief Executive Officer) AND (Green Innovation)</p> <p>Inclusion criteria Search by Title Subject area: Business, Management, Accounting, and Finance Document type: Article Source type: Journal Language: English</p> <p>Databases Scopus</p>
--

Boolean operators were used in the article title on Scopus to refine the search string. To avoid omitting pertinent findings, this evaluation covers all papers released in Scopus up until September 23, 2024, without setting a start date.

The PRISMA framework (Heubeck, 2024) is followed in the literature search process, as shown in Table 1. After the first search, 78 articles were found.

Table 1. Literature search procedure

Stage	Filtering step	Articles in sample	Exclusion and inclusion criteria	Articles removed
Identification	Articles identified from databases Scopus (n = 78)	78	Exclusion of duplicate articles	0
Screening	Articles reassessed for publication type and journal topic area	78	Articles from publications other than business, management, accounting, or finance are excluded	27
	Journal quality assessment	51	Exclusion of articles without journal ranking from Q1 until Q3	3
	Article can not to access full text reading	48	Exclusion of articles can not to access full text reading	16
	Articles filtered using keywords, titles, abstracts, and keyword searches	32	Articles outside of the scope of the review are excluded after a thorough examination of the title, abstract, keywords, research methodology, research model, and variable descriptions	14

	Reading articles in full to determine ultimate inclusion	18	Using full-text reading to filter out publications unrelated to the review's research objective	6
Inclusion	Final review sample	12		

Table 2 contains the titles of articles used as final samples in this research. The study analyzes these articles to identify CEO characteristics that impact green innovation.

Table 2. List of Source Articles

Title, Author, and Year	Country	Journal
CEO's IT background and continuous green innovation of enterprises: evidence from China (Pan et al., 2024)	Chinese	Sustainability Accounting, Management and Policy Journal (Q1)
Pollution and green innovation: Evidence from CEOs' early-life experience (He et al., 2024)	Chinese	International Review of Economics and Finance (Q1)
CEO's financial background and corporate green innovation (Guo et al., 2024)	Chinese	Sustainability (Q1)
CEO's science and engineering: Background and green innovation: Evidence from China (Zeb et al., 2024)	Chinese	Sage Open (Q1)
Professional experience of CEOs in industry associations and corporate green innovation-empirical evidence from China (Haojun & Jiazhu, 2024)	Chinese	Pacific-Basin Finance Journal (Q1)
Female CEOs and green innovation (Javed et al., 2023)	Chinese	Journal of Business Research (Q1)
Watch me invest: Does CEO narcissism affect green innovation? CEO personality traits and eco-innovation (Khanchel et al., 2023)	Chinese	Business Ethics, the Environment & Responsibility (Q1)
Do politically connected CEOs promote Chinese listed industrial firms' green innovation? The mediating role of external governance environments (Huang et al., 2021)	Chinese	Journal of Cleaner Production (Q1)
CEO foreign experience and green innovation: Evidence from China (Quan et al., 2021)	Chinese	Journal of Business Ethics (Q1)
CEO hometown identity and firm green innovation (Ren et al., 2020)	Chinese	Business Strategy and the Environment (Q1)
The impact of the CEO's green ecological experience on corporate green innovation – the moderating effect of corporate tax credit rating and tax burden (Wang et al., 2023)	Chinese	Frontiers in Environmental Science (Q2)
CEO's time perspective influence on green innovation (Hussain et al., 2023)	Chinese	Spanish Journal of Finance and Accounting (Q3)

Results and Discussion

CEO Characteristics that can Enhance Green Innovation

Pan et al. (2024) conducted a study to investigate if an organization's ongoing green innovation might be impacted by the information technology (IT) background of the chief executive officer (CEO). Data from China's listed businesses is used in this analysis for the years 2011 through 2019. This study shows that a company's continual green innovation can increase when its CEO has an IT background, based on the upper echelons idea. CEOs with an information technology (IT) background can drive green innovation due to their strong technical skills and understanding of information systems and sustainability issues. They can allocate more resources to green innovation and reduce uncertainty in assessing the benefits and risks of sustainable innovation (Haislip & Richardson, 2018). Their experience with clean technology and green practices enables them to identify new market opportunities and integrate green innovation into the company's strategy (Wang et al., 2022). Moreover, an IT background allows CEOs to optimize the use of information systems, enhance the efficiency of green innovation processes, and respond more quickly and effectively to environmental pressures from stakeholders (Stiglitz, 2015).

The impact of CEOs with a background in science and engineering (CEOSEB) on green innovation is examined in the Zeb et al. (2024) study. The study, which uses data from publicly traded companies on the Shanghai and Shenzhen Stock Exchanges between 2008 and 2018, shows that CEOSEB encourages green innovation for a number of reasons based on upper echelons theory. In order for CEOSEB to come across as informed, they must first learn how to identify environmental damage. Second, by drawing in environmentally conscious investors, their networks enable them to leverage crucial outside resources like scientific expertise and R&D teams, which relieves budgetary limitations. Thirdly, the construction of useful research and development teams and the assessment of the long-term benefits of green innovation are made easier by their strategic positions and competencies. The technological expertise of CEOSEB facilitates the conception, promotion, and implementation of eco-friendly concepts.

The research by Haojun & Jiazhu (2024) looks at how CEOs' professional experience in industry

organizations affected green innovation across Chinese-listed enterprises from 2007 to 2021. Based on the imprinting principle, the study discovers that CEO involvement in industry associations significantly and favourably influences green innovation. This work experience fits the "imprinting" method, making a lasting impression on the CEO's abilities and thinking that affects green innovation in the organization. Industry association regulatory frameworks initially provide peer monitoring and ethical principles at the cognitive imprinting stage (Buchanan & Marques, 2018). Members of industrial associations conform to society's behavioural norms regarding their social standing and identity (Qiao et al., 2014). To meet stakeholder expectations and preserve a positive public image, members of industry groups actively cultivate their sense of social responsibility while developing industry standards and behavioural norms (Luo & Liu, 2020). Their enhanced subjective commitment to green innovation demonstrates their proactive attitude toward sustainable environmental development.

CEOs who have worked professionally for industry groups can also benefit politically by learning about development standards, industry rules, and the validity of green innovation concerns. This lessens the detrimental consequences of perceived political unpredictability on investments promoting environmental sustainability (Liu et al., 2021). Furthermore, CEOs can overcome resource scarcity by utilising outside networks and securing funds for green innovation, thanks to their experience. CEOs with this experience can leverage their training to promote cooperation, provide technical assistance, and establish stakeholder alliances via certification and trust systems, increasing their credibility in new domains (Kerlin et al., 2021). As a result, CEOs with expertise in industry associations can lessen the effect of outside uncertainties on their company's green innovation initiatives by securing the resources they need when faced with the challenges and high stakes of environmental innovation.

A study by Huang et al. (2021) examined how CEOs with political ties affected green innovation in businesses listed between 2008 and 2015 on Chinese stock exchanges. The findings indicate that CEOs with influence in politics considerably increase environmental innovation.

The study finds five ways political relationships foster green innovation, all in line with social network theory. According to Li et al. (2008), CEOs with political connections are a crucial source of social capital because they grant their businesses access to a

disproportionate amount of government funding. These resources include government subsidies (Hung et al., 2015), tax benefits (Chen et al., 2011), and preferential bank loan access (Dinç, 2005). These resources help reduce implementation uncertainty, remove financial barriers to green innovation investments, and encourage increased adoption of green innovation by businesses. Information quality and quantity are influenced by social networks as well. CEOs with political links can build large networks with government agencies, receive early access to the most recent updates on environmental policy, and predict the course of future policy. Political ties improve the flow of critical information between businesses and the government, lower the risks of unclear policies, supplement internal business knowledge, help CEOs make well-informed investment decisions in green innovation, and provide early adopters of green innovation with a competitive advantage.

Third, CEOs' unofficial insurance networks may enable them to share the risks of green technology with the government (Bloch et al., 2008). Consequently, CEOs with these ties frequently show higher risk appetites and are more inclined to pursue audacious green ideas. Fourth, the resources derived from social networks can function as markers of social standing, demonstrating their capacity to obtain resources via these relationships (Lin, 2017). These metrics affect outward recognition and trust. According to the social capital literature, government actions can impact social capital, particularly general trust (Brehm & Rahn, 1997; Rothstein & Stolle, 2002). CEOs with political connections convey to stakeholders their organization's authority and capacity to handle environmental uncertainty. By boosting public confidence and the organization's attractiveness, these signals help the business draw in more intellectual capital—such as creative workers—which fosters green innovation. Furthermore, social connections can support an individual's sense of self (Lin, 2017). CEOs can increase their visibility as government figures by establishing contacts with the government. This can result in increased support for legislative advances and environmental protection initiatives. Therefore, by national rules, CEOs with political connections are more likely to promote environmentally friendly innovative strategies aggressively.

Quan et al. (2023) analyze the impact of CEOs' worldwide experiences on green innovation in publicly traded enterprises from 2007 to 2018, focusing on the Shanghai and Shenzhen Stock

Exchanges. According to the imprinting idea, CEOs' experiences abroad may impact their values and perspectives. Three significant facets of this theory are delineated by Marquis and Tilcsik (2013): (1) a sensitive phase in which people are highly vulnerable to environmental influences; (2) a substantial environmental impact during this phase, leading the person to internalize those influences; and (3) the enduring nature of traits formed during this sensitive phase, even when presented with changing environmental conditions. Studying or working overseas represents a significant "imprinting" period in which people are especially susceptible to external factors influencing their behaviour (Schein, 1971). Imprinting is more likely during this transitional stage because people are more receptive to environmental cues. Because of their experiences in industrialized nations, managers who return from abroad frequently make ecological conservation and social responsibility standard operating procedures. Studies reveal that these returning managers typically behave more morally and socially conscious (Wen & Song, 2017; Zhang et al., 2018). CEOs with international experience have better environmental ethics, which makes them more likely to back environmentally favorable innovations.

The impact of female CEOs on green innovation in non-financial companies listed in China between 2008 and 2016 is investigated in the study by Javed et al. (2023). It discovers that, compared to non-state-owned companies and less developed locations, female CEOs in state-owned enterprises and more developed regions spur green innovation. The study also shows that larger companies and those in environmentally sensitive industries benefit more from having female CEOs driving green innovation. The upper echelons theory holds that the demographics of a company's top management influence its strategic decisions (Hambrick & Mason, 1984). CEO choices greatly influence investments in green innovation since they are crucial in determining business strategy (Sharma, 2000). Age, gender, and educational attainment are among the CEO characteristics and demographics that affect strategic decision-making (Johnson et al., 2013). By bringing different viewpoints to the table, gender diversity in leadership can enhance decision-making (Boone & Hendriks, 2009). Studies show that organizations with a more significant percentage of female executives are more likely to be recognized as top firms and perform better in corporate social responsibility (Landry et al., 2016). Women frequently prioritize improving the neighbourhood and adopting eco-friendly behaviours

(Ryan, 2017). Furthermore, according to gender socialization theory, because of their upbringing, female CEOs are more likely to give societal and environmental issues top priority (Eagly & Crowley, 1986; Adams et al., 2011). Consequently, the gender of CEOs influences environmental policies, with female CEOs typically managing ecological impact more effectively (McGuinness et al., 2017).

According to a study by He et al. (2024), green innovation in China's highly polluted industries between 2008 and 2021 is impacted by early exposure to environmental pollution. It shows that CEOs are more likely to promote green innovation if they grew up in high-pollution locations. The imprinting theory holds that an individual's behaviour, psychology, and thought processes are shaped by events that occur throughout crucial developmental stages (Marquis & Tilcsik, 2013). Early exposure to pollution increases people's knowledge of the dangers of environmental harm and makes them prioritize environmental conservation when making decisions (Lu, 2020). As a result, in their strategic choices, CEOs with such early experiences typically emphasize the detrimental effects of environmental contamination. According to their risk assessments, these CEOs are more likely to seek practical solutions, with green innovation emerging as the most popular and viable choice (Cui et al., 2022; Guo et al., 2023; Liu & Li, 2022).

Ren et al. (2020) looked into how a CEO's hometown identity affected green innovation in Chinese publicly traded companies that operate in highly polluting industries between 2002 and 2016. The results show that a CEO's sense of place of origin positively influences green innovation. Upper echelons theory holds that a CEO's psychological preferences or biases significantly impact the decisions and results of the company (Hambrick & Mason, 1984). As a type of place-based identification, hometown identity is associated with pro-environmental behaviour and shapes company strategy (Carrus et al., 2005). Strong emotional ties to one's hometown encourage environmentally conscious behaviours and attitudes. Thanks to green innovation, businesses may use resources more effectively, generate less waste, and reduce pollution levels (Sierzchula & Nemet, 2015). Because of this, companies operated by CEOs who have connections in their hometowns are more likely to develop sustainable products and improve their environmental performance in order to solve environmental challenges in their communities.

Hussain et al. (2023) investigate how a CEO's attitude on time affects green innovation in

manufacturing firms that are listed on the Shanghai and Shenzhen Stock Exchanges between 2004 and 2018. The findings indicate a positive correlation between green innovation and CEO tenure and age. Longer CEO tenure results in "company-specific experience," or what Graf-Vlachy et al. (2020) call the "accumulation of expertise in the CEO role," and broadens their cognitive framework. "Longer-serving CEOs gain from their broader temporal experience, which helps them make complicated and unclear decisions on company innovation. El Sawy (1983) asserts that a CEO's planning horizon can be expanded by taking a more comprehensive look at the past and future of the organization. Therefore, CEOs with longer tenure can better understand the company's environmental decisions and long-term objectives by utilizing their broader viewpoint and appreciating the advantages and disadvantages of green innovation. They are also more skilled at negotiating the organization's culture, organizing the strategy and operations of the business, and efficiently using resources to implement creative solutions that meet stakeholder expectations and lessen negative environmental effects.

Wang and colleagues (2023) study looks into how a CEO's background in green ecology affects green innovation in companies that list on Chinese stock exchanges between 2014 and 2020. The findings demonstrate that such experience has a positive effect on a company's innovation efforts. According to the Upper Echelons Theory (Hambrick & Mason, 1984), a CEO's traits have a big impact on the performance and choices made by the organization. It has been observed that a CEO with green ecological experience helps the organization respond more quickly to policies about sustainability and better handle stakeholder demands. Additionally, businesses need to implement appropriate corporate policies and address issues related to sustainable development. A CEO's experience in green ecology shapes management strategies and company decisions about green innovation. When making company decisions, CEOs with environmental experience are also more likely to be environmentally concerned, which increases their commitment to invest in green innovation creation and environmental research.

CEO Characteristics that can Reduce Green Innovation

Guo & Zhao (2024) investigate the impact of a CEO's financial background on green innovation in non-financial public companies listed on the China

Stock Exchange between 2011 and 2021. The findings indicate a negative correlation between a CEO's financial background and green innovation. The imprinting theory holds that CEOs form psychological imprints at formative moments that influence various aspects of their professions, such as their abilities and cognitive processes. The focus on professionalism, intensity, and risk-taking from the finance industry that CEOs with a history in finance bring to their decision-making can affect the company's approach to innovation.

First, because of their deep knowledge of finance, they frequently overlook long-term, riskier, and innovative projects in favour of short-term initiatives with quick financial rewards. Second, according to behavioural consistency theory, CEOs with a history in finance will stick to the behavioural patterns they learned in their prior positions, prioritizing investments and financial measures above green innovation tactics. Finally, CEOs' conservative approach to innovation is influenced by the speculative nature of China's capital market, which prioritizes short-term profits over environmentally friendly projects. Consequently, CEOs with a finance background might value financial considerations above innovation in the environment, which could hinder green innovation endeavors.

Khanchel et al. (2023) also investigated the impact of CEO narcissism on green innovation in S&P 500-listed American companies over a ten-year period. Green innovation is severely hampered by CEO narcissism, according to the study. The drawbacks of narcissism in leadership are highlighted by these findings, which support the upper echelons theory.

Conclusion

The primary purpose of this study is to critically examine the research on the association between CEO characteristics and green innovation. Its objectives are to evaluate the corpus of existing research, pinpoint areas of not enough research, and recommend a course of action for more study. Through an analysis of papers from credible journals indexed by Scopus and a critical evaluation of the shortcomings of current research, this study contributes to the body of knowledge on green innovation.

The findings indicate that theoretical frameworks frequently used to examine the impact of CEO attributes on green innovation include the upper echelons theory, gender socialization theory, imprinting theory, and social network theory. Some factors that have been shown to support green

innovation include a CEO's age and tenure, identification as a native place, political connections, gender (for female CEOs), previous involvement in industry associations, familiarity with green ecological challenges, and expertise in science, engineering, and information technology. On the other hand, a wealthy background and narcissistic CEOs might be counterproductive to green innovation.

Additionally, the study highlights several gaps in the literature by focusing primarily on developed companies—China in particular—which suggests that future research in developing countries is necessary. Further research must focus on these qualities as well as other variables that may increase or reduce the influence of CEO characteristics on innovation in the environment, as some of the attributes of CEOs have not been fully investigated. This study is constrained, though. The association between CEO traits and green innovation is not taken into consideration, nor are possible mediating and moderation impacts taken into consideration.

References

- Adams, R. B., Licht, A. N., Sagiv, L. (2011). Shareholders and stakeholders: How do directors decide? *Strategic Management Journal*, 32(12), 1331-1355. <https://doi.org/10.1002/smj.940>
- Al-Hadi, A., Taylor, G., Al-Yahyaee, K. H. (2016). Ruling family political connections and risk reporting: Evidence from the GCC. *The International Journal of Accounting*, 51(4), 504-524. <https://doi.org/10.1016/j.intacc.2016.10.004>
- Ambrus, A., Mobius, M., Szeidl, A. (2014). Consumption Risk-Sharing in Social Networks. *American Economic Review*, 104(1), 149-182. DOI: 10.1257/aer.104.1.149
- Arena, C., Michelon, G., & Trojanowski, G. (2018). Big egos can be green: A study of CEO hubris and environmental innovation. *British Journal of Management*, 29(2), 316-336. <https://doi.org/10.1111/1467-8551.12250>
- Beutel, A. M. & Marini, M. M. (1995). Gender and Values. *American Sociological Review*, 60(3), 436-448. <https://doi.org/10.2307/2096423>
- Bloch, F., Genicot, G., Ray, D. (2008). Informal insurance in social networks. *Journal of Economic Theory*, 143(1), 36-58. <https://doi.org/10.1016/j.jet.2008.01.008>
- Boone, C., & Hendriks, W. (2009). Top management team diversity and firm performance: Moderators of functional-background and locus-of-control diversity. *Management Science*, 55(2), 165-180. <https://doi.org/10.1287/mnsc.1080.0899>
- Brehm, J. & Rahn, W. (1997). Individual-level evidence for the causes and consequences of social capital. *American Journal of Political Science*, 41(3), 999-1023. <https://doi.org/10.2307/2111684>
- Buchanan, S., & Marques, J. C. (2018). How home country industry associations influence MNE international CSR practices: Evidence from the Canadian mining industry. *Journal of World Business*, 53(1), 63-74. <https://doi.org/10.1016/j.jwb.2017.07.005>
- Carrus, G., Bonaiuto, M., Bonnes, M. (2005). Environmental concern, regional identity, and support for protected areas in Italy. *Environment and Behavior*, 37(2), 237-257. <https://doi.org/10.1177/0013916504269644>
- Chang, C. H. & Chen, Y. S. (2013). Green organizational identity and green innovation. *Management Decision*, 51(5), 1056-1070.
- Chen, C.J.P., Li, Z., Su, X., Sun, Z. (2011). Rent-seeking incentives, corporate political connections, and the control structure of private firms: Chinese evidence. *Journal of Corporate Finance*, 17(2), 229-243. <https://doi.org/10.1016/j.jcorpfin.2010.09.009>
- Cheng, B., Li, Z., Qiu, B., Xiong, T. (2023). Does collective decision-making promote SOE's green innovation? Evidence from China. *Journal of Business Ethics*, 191, 481-500. <https://doi.org/10.1007/s10551-023-05495-w>
- Cui, J., Dai, J., Wang, Z., Zhao, X. (2022). Does environmental regulation induce green innovation? A panel study of Chinese listed firms. *Technological Forecasting and Social Change*, 176, 121492.
- Dinç, I. S. (2005). Politicians and banks: Political influences on government-owned banks in emerging markets. *Journal of Financial Economics*, 77(2), 453-479. <https://doi.org/10.1016/j.jfineco.2004.06.011>
- Eagly, A. H., & Crowley, M. (1986). Gender and helper behavior: A meta-analytic review of the social psychological literature. *Psychological Bulletin*, 100(3), 283-308. <https://doi.org/10.1037/0033-2909.100.3.283>
- El Sawy, O. A. (1983). Temporal perspective and managerial attention: A study of chief executive strategic behavior. Doctoral dissertation [Dissertation Abstracts International]. Stanford University.
- Farag, H., Meng, Q., Mallin, C. (2015). The social, environmental and ethical performance of Chinese companies: Evidence from the Shanghai Stock Exchange. *International Review of Financial Analysis*, 42(December), 53-63. <https://doi.org/10.1016/j.irfa.2014.12.002>
- Ferris, S. P., Javakhadze, D., Rajkovic, T. (2017). CEO social capital, risk-taking and corporate policies. *Journal of Corporate Finance*, 47, 46-71. <https://doi.org/10.1016/j.jcorpfin.2017.09.003>
- Fine, M. (1992). Women and gender: A feminist psychology. *Psychology of Women Quarterly*, 16(3). <https://doi.org/10.1111/j.1471-6402.1992.tb00260.x>
- Graf-Vlachy, L., Bundy, J., Hambrick, D. C. (2020). Effects of an advancing tenure on CEO cognitive complexity. *Organization Science*, 31(4), 936-959. <https://doi.org/10.1287/orsc.2019.1336>
- Greenhalgh, S. & Miller, B. D. (1993). Sex and gender hierarchies. *Population and Development Review*, 19(4), 875. <https://doi.org/10.2307/2938427>
- Guo, M., Wang, H., Kuai, Y. (2023). Environmental regulation and green innovation: Evidence from heavily polluting firms in China. *Finance Research Letters*, 53(103624). <https://doi.org/10.1016/j.frl.2022.103624>
- Guo, R. & Zhao, J. (2024). CEO's financial background and corporate green innovation. *Sustainability*, 16(4129), 1-26. <https://doi.org/10.3390/su16104129>

- Haislip, J. Z. & Richardson, V. J. (2018). The effect of CEO IT expertise on the information environment: Evidence from earnings forecasts and announcements. *Journal of Information Systems*, 32(2), 71-94. <https://doi.org/10.2308/isys-51796>
- Hall, B. H., Jaffe, A., Trajtenberg, M. (2005). Market value and patent citations. *The RAND Journal of Economics*, 36(1), 16-38.
- Hambrick, D.C. (2007). Upper echelons theory: an update. *Academy of Management Review*, 32(2). <https://doi.org/10.5465/amr.2007.24345254>
- Hambrick, D.C. & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its managers. *Academy of Management Review*, 9(2). doi:10.5465/amr.1984.4277628
- Hamilton, L.C. (1985). Concern about toxic wastes: Three demographic predictors. *Sociological Perspectives*, 28(4), 463-486. <https://doi.org/10.2307/1389229>
- Haojun, W., & Jiazhu, L. (2024). Professional experience of CEOs in industry associations and corporate green innovation-empirical evidence from China. *Pacific-Basin Finance Journal*, 85(102383), 1-14. <https://doi.org/10.1016/j.pacfin.2024.102383>
- He, N., Yang, J., Ren, J. (2024). Pollution and green innovation: Evidence from CEOs' early-life experience. *International Review of Economics and Finance*, 93, 65-79. <https://doi.org/10.1016/j.iref.2024.03.015>
- Heubeck, T. (2024). Untangling the Paradoxical Relationship Between Religion and Business: A Systematic Literature Review of Chief Executive Officer (CEO) Religiosity Research. <https://doi.org/10.1007/s10551-024-05688-x>
- Horbach, J. & Jacob, J. (2018). The relevance of personal characteristics and gender diversity for (eco-) innovation activities at the firm-level: results from a linked employer-employee database in Germany. *Business Strategy and the Environment*, 27(7), 924-934. <https://doi.org/10.1002/bse.2042>
- Huang, M., Li, M., & Liao, Z. (2021). Do politically connected CEOs promote Chinese listed industrial firms' green innovation? The mediating role of external governance environments. *Journal of Cleaner Production*, 278, 123634. <https://doi.org/10.1016/j.jclepro.2020.123634>
- Hung, M., Wong, T.J., Zhang, F. (2015). The value of political ties versus market credibility: evidence from corporate scandals in China. *Contemporary Accounting Research*, 32(4), 1641-1675. <https://doi.org/10.1111/1911-3846.12134>
- Hussain, M.J., Liang, T.G., Ashraf, A., Alkebe, R.H. (2023). CEO's time perspective influence on green innovation. *Spanish Journal of Finance and Accounting*, 1-32. DOI:10.1080/02102412.2023.2256082
- Javed, M., Wang, F., Usman, M., Gull, A. A., Zaman, Q.U. (2023). Female CEOs and green innovation. *Journal of Business Research*, 157(113515), 1-15.
- Johnson, S. G., Schnatterly, K., Hill, A.D. (2013). Board composition beyond independence: Social capital, human capital, and demographics. *Journal of Management*, 39(1), 232-262. <https://doi.org/10.1177/0149206312463938>
- Kerlin, J.A., Lall, S.A., Peng, S., Cui, T.S. (2021). Institutional intermediaries as legitimizing agents for social enterprise in China and India. *Public Management Review*, 23(5), 731-753. <https://doi.org/10.1080/14719037.2020.1865441>
- Khanchel, I., Lassoued, N., Khiari, C. (2023). Watch me invest: Does CEO narcissism affect green innovation? CEO personality traits and eco-innovation. *Business Ethics, the Environment & Responsibility*, 33(3), 486-504. <https://doi.org/10.1111/beer.12621>
- Kraus, S., Breier, M., Lim, W. M., Dabić, M., Kumar, S., Kanbach, D., et al. (2022). Literature reviews as independent studies: Guidelines for academic practice. *Review of Managerial Science*, 16(8), 2577-2595. <https://doi.org/10.1007/s11846-022-00588-8>
- Kumar, S., Sahoo, S., Lim, W. M., & Dana, L.-P. (2022). Religion as a social shaping force in entrepreneurship and business: Insights from a technology-empowered systematic literature review. *Technological Forecasting and Social Change*, 175, 121393. <https://doi.org/10.1016/j.techfore.2021.121393>
- Landry, E. E., Richard, A. B., Bosco, S. M. (2016). Recognition for sustained corporate social responsibility: Female directors make a difference. *Corporate Social Responsibility and Environmental Management*, 23(1), 27-36. <https://doi.org/10.1002/csr.1358>
- Lane, R. E. (1976). The Nature of Human Values. By Milton Rokeach. *American Political Science Review*, 70(3), 965-966. DOI: 10.2307/1959882
- Li, H., Meng, L., Wang, Q., Zhou, L. (2008). Political connections, financing and firm performance: Evidence from Chinese private firms. *Journal of Development Economics*, 87(2), 283-299. <https://doi.org/10.1016/j.jdeveco.2007.03.001>
- Lin, N. (2017). Building a network theory of social capital. In: *Social Capital*. Routledge, 3-28. [http://refhub.elsevier.com/S0959-6526\(20\)33679-9/sref56](http://refhub.elsevier.com/S0959-6526(20)33679-9/sref56)
- Lin, C. Y., Ho, P. H., Shen, C. H., Wang, Y. C. (2016). Political connection, government policy, and investor trading: evidence from an emerging market. *International Review of Economics & Finance*, 42(March), 153-166. <https://doi.org/10.1016/j.iref.2015.09.008>
- Liu, G., Hu, M., Cheng, C. (2021). The information transfer effects of political connections on mitigating policy uncertainty: Evidence from China. *Journal of Corporate Finance*, 67(101916). <https://doi.org/10.1016/j.jcorpfin.2021.101916>
- Liu, M., & Li, Y. (2022). Environmental regulation and green innovation: Evidence from China's carbon emissions trading policy. *Finance Research Letters*, 48(103051). <https://doi.org/10.1016/j.frl.2022.103051>
- Lu, J. G. (2020). Air pollution: A systematic review of its psychological, economic, and social effects. *Current opinion in psychology*, 32, 52-65. <https://doi.org/10.1016/j.copsyc.2019.06.024>
- Luo, J., & Liu, Q. (2020). Corporate social responsibility disclosure in China: Do managerial professional connections and social attention matter?. *Emerging Markets Review*, 43(100679). <https://doi.org/10.1016/j.ememar.2020.100679>
- Lv, C., Shao, C., Lee, C.C. (2021). Green technology innovation and financial development: Do environmental regulation and innovation output matter?. *Energy Economics*, 98(105237). <https://doi.org/10.1016/j.eneco.2021.105237>
- Marquis, C. & Tilcsik, A. (2013). Imprinting: toward a multilevel theory. *Academy of Management Annals*, 7(1), 195-245.

- McGuinness, P. B., Vieito, J. P., & Wang, M. (2017). The role of board gender and foreign ownership in the CSR performance of Chinese listed firms. *Journal of Corporate Finance*, 42, 75–99. <https://doi.org/10.1016/J.JCORPFIN.2016.11.001>
- Pan, J., Bao, H., Cifuentes-Faura, J., Liu, X. (2023). CEO's IT background and continuous green innovation of enterprises: evidence from China. *Sustainability Accounting, Management and Policy Journal*, 15(4), 807-832. <https://doi.org/10.1108/SAMPJ-07-2023-0497>
- Paul, J., & Criado, A. R. (2020). The art of writing literature review: What do we know and what do we need to know? *International Business Review*, 29(4), 101717. <https://doi.org/10.1016/j.ibusrev.2020.101717>
- Qiao, P., Ju, X., Fung, H. (2014). Industry association networks, innovations, and firm performance in China small and medium-sized enterprises. *China Economic Review*, 29(June), 213-228. <https://doi.org/10.1016/j.chieco.2014.04.011>
- Quan, X., Ke, Y., Qian, Y., & Zhang, Y. (2023). CEO foreign experience and green innovation: Evidence from China. *Journal of Business Ethics*, 182(2), 535-557. <https://doi.org/10.1007/s10551-021-04977-z>
- Ren, S., Wang, Y., Hu, Y., Yan, J. (2020). CEO hometown identity and firm green innovation. *Business Strategy and the Environment*, 30(2), 756-774. <https://doi.org/10.1002/bse.2652>
- Rothstein, B., & Stolle, D. (2002). How political institutions create and destroy social capital: an institutional theory of generalized trust. In: Delivery at the Annual Meeting of the American Political Science Association, Boston, August – September.
- Ryan, L.V. (2017). Sex differences through a Neuroscience lens: Implications for business ethics. *Journal of Business Ethics*, 144, 771-782. <https://doi.org/10.1007/s10551-016-3110-1>
- Schein, E.H. (1971). The individual, the organization, and the career: A conceptual scheme. *The Journal of Applied Behavioral Science*, 7(4), 401-426. <https://doi.org/10.1177/002188637100700401>
- Sharma, S. (2000). Managerial interpretations and organizational context as predictors of corporate choice of environmental strategy. *Academy of Management Journal*, 43(4), 681–697. <https://doi.org/10.2307/1556361>
- Sierzchula, W., & Nemet, G. (2015). Using patents and prototypes for preliminary evaluation of technology-forcing policies: Lessons from California's zero emission vehicle regulations. *Technological Forecasting and Social Change*, 100, 213–224. <https://doi.org/10.1016/j.techfore.2015.07.003>
- Stern, P.C., Dietz, T., Kalof, L. (1993). Value orientations, gender, and environmental concern. *Environment and Behavior*, 25(5), 322-348. <https://doi.org/10.1177/0013916593255002>
- Stiglitz, J. E. (2015). Leaders and followers: Perspectives on the Nordic model and the economics of innovation. *Journal of Public Economics*, 127(July), 3-16. <https://doi.org/10.1016/j.jpubeco.2014.09.005>
- Wang, K. & Jiang, W. (2021). State ownership and green innovation in China: The contingent roles of environmental and organizational factors. *Journal of Cleaner Production*, 314, 128029. <https://doi.org/10.1016/j.clepro.2021.128029>
- Wang, X., Xu, Z., Qin, Y., Skare, M. (2022). Innovation, the knowledge economy, and green growth: Is knowledge-intensive growth really environmentally friendly?. *Energy Economics*, 115(106331). <https://doi.org/10.1016/j.eneco.2022.106331>
- Wang, L., Li, Y., Lu, S., Boasson, V. (2023). The impact of the CEO's green ecological experience on corporate green innovation-The moderating effect of corporate tax credit rating and tax burden. *Frontiers in Environmental Science*, 11(1126692), 1-14. <https://doi.org/10.3389/fenvs.2023.1126692>
- Wang, Z., Sun, X., Li, W. (2023). Cultural diversity and green innovation: Evidence from China. *Finance Research Letters*, 58, 104379
- Wen, W., & Song, J. (2017). Can returnee managers promote CSR performance? Evidence from China. *Frontiers of Business Research in China*, 11(12), 1-26. DOI: 10.1186/s11782-017-0012-8
- Weng, H.H.R., Chen, J.S., Chen, P.C. (2015). Effects of green innovation on environmental and corporate performance: A stakeholder perspective. *Sustainability*, 7(5), 4997-5026. <https://doi.org/10.3390/su7054997>
- Williams, J. E., & Best, D. (1990). Sex and psyche: Gender and self viewed cross-culturally. *Choice Reviews Online*, 28(02). <https://doi.org/10.5860/choice.28-1259>
- Xin, K. R., & Pearce, J. L. (1996). Guanxi: Connections and substitutes for formal institutional support. *Academy of Management Journal*, 39, 1641-1658
- Yu, M. (2023). CEO duality and firm performance: A systematic review and research agenda. *European Management Review*, 20(2), 346–358. <https://doi.org/10.1111/emre.12522>
- Zeb, A., Ullah, I., Iqbal, A., Rahman, M. U., Aziz, S. (2024). CEO's science and engineering: Background and green innovation: Evidence from China. *Sage Open*, (January-March), 1-18. <https://doi.org/10.1177/21582440241232767>
- Zelezny, L.C., Chua, P. P., Aldrich, C. (2000). New ways of thinking about environmentalism: Elaborating on gender differences in environmentalism. *Journal of Social Issues*, 56(3), 443-457. <https://doi.org/10.1111/0022-4537.00177>
- Zhang, J., Kong, D., Wu, J. (2018). Doing good business by hiring directors with foreign experience. *Journal of Business Ethics*, 153, 859-876. <https://doi.org/10.1007/s10551-016-3416-z>
- Zhou, M., Chen, F., & Chen, Z. (2021). Can CEO education promote environmental innovation: Evidence from Chinese enterprises. *Journal of Cleaner Production*, 297, 126725.
- Zhou, Y., Du, Y., Lei, F., Su, Z., Feng, Y., Li, J. (2021). Influence of financialization of heavily polluting enterprises on technological innovation under the background of environmental pollution control. *International Journal of Environmental Research and Public Health*, 18(4), 13330. <https://doi.org/10.3390/ijerph182413330>