

From disclosure to impact: How board diversity and independence drive corporate environmental performance under provincial corruption pressure?

Journal of Asian
Business and
Economic Studies

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Received 29 August 2025

Revised 5 December 2025

4 March 2026

14 April 2026

27 May 2026

21 July 2026

Accepted 22 July 2026

Abstract

Purpose – This study aims to investigate how corporate boards shape environmental performance in Vietnamese manufacturing firms and examines whether province-level environmental corruption attenuates or amplifies these governance effects.

Design/methodology/approach – We manually construct an Environmental Performance Index (EPI) from the quantitative items that listed firms are required to disclose under Circular 96/2020/BTC. The index captures three pillars, namely regulatory compliance, resource stewardship and green initiatives. It is calculated by using z-standardized, industry-adjusted scores, which are subsequently rescaled to a 0–100 range to ensure comparability across firms. We estimate the baseline relationships using a censored Tobit model and conduct robustness checks using instrumental variables (IV)-two-stage least squares (2SLS) estimations to mitigate potential endogeneity concerns.

Findings – Greater gender diversity and board independence are positively associated with firms' environmental performance, whereas expertise diversity exhibits a comparatively modest effect. Provincial environmental corruption significantly moderates these relationships. Specifically, the positive association between female board representation and environmental performance is strengthened in more corrupt provinces, while the beneficial influence of board independence is attenuated as corruption pressure intensifies. These results are robust to alternative specifications and an IV-2SLS estimation strategy.

Originality/value – Methodologically, the study pioneers a disclosure-based, multi-dimensional EPI for an emerging market and combines it with a corruption metric that targets the environmental enforcement channel. Practically, the findings reveal that board gender diversity promotes firm environmental performance under higher corruption, underscoring the role of sound corporate governance in sustaining environmental outcomes during institutional weaknesses.

Keywords Corporate governance, Environmental performance, Provincial corruption

Paper type Research article

1. Introduction

In recent years, regulators, corporate leaders, scholars and the public have paid increasing attention to firms' environmental, social and governance (ESG) performance (Ho *et al.*, 2024).

JEL Classification — G34, M14, K32

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Funding: This research is funded by the Vietnam National Foundation for Science and Technology Development (NAFOSTED) under grant number: 502.02-2024.16.



Journal of Asian Business and Economic
Studies

Emerald Publishing Limited

2515-964X
DOI 10.1108/JABES-08-2025-0435

From a policy perspective, beyond compliance with the Law on Enterprises and the Law on Securities, the State Securities Commission, supported by the International Finance Corporation, has promoted the Vietnam Corporate Governance Code of Best Practices. This code integrates international standards such as the G20/Organisation for Economic Co-operation and Development (OECD) Principles and the Association of Southeast Asian Nations (ASEAN) Corporate Governance Scorecard (Truong *et al.*, 2023), encourages environmental disclosures aligned with the Global Reporting Initiative (GRI) and Integrated Reporting and recommends that boards adopt policies fostering environmentally responsible value chains and sustainable development. From a stakeholder perspective, shareholders increasingly look beyond short-term earnings toward long-run sustainability, with environmental stewardship now regarded as a core dimension of firm performance (Dyck *et al.*, 2019). Understanding what drives firms toward greener behavior therefore requires examining both internal governance structures and the institutional environment in which firms operate (Ortiz-de-Mandojana *et al.*, 2014). From an institutional theory perspective, firms operate within a multi-layered institutional environment, in which formal rules (e.g. environmental regulations and enforcement) and informal constraints (e.g. corruption, rent seeking and local political business networks) jointly determine organizational incentives and legitimacy. In Vietnam, where institutional quality varies markedly across provinces, corruption may therefore attenuate the effectiveness of corporate governance in delivering environmental outcomes. At the same time, heightened stakeholder scrutiny and reputational risk in such contexts may amplify the influence of board members who are more strongly associated with ethical orientation and stakeholder responsiveness.

Despite its importance, empirical evidence at the intersection of governance, environmental performance and the institutional context remains limited. Most studies rely on US data from commercial ESG ratings or cross-sectional surveys in developing economies and many employ single environmental measures or count-based disclosure scores as proxies for performance (Ong and Djajadikerta, 2018). Research on how province-level corruption shapes firm-level environmental outcomes is particularly scarce. Chinese evidence linking anti-corruption campaigns to greener corporate behavior underscores the need for comparable studies in other settings (Chen *et al.*, 2022; Boubaker *et al.*, 2024). While recent work has examined how such campaigns affect firms' environmental strategies, little is known about how local institutional conditions, specifically corruption in environmental inspections, shape firms' environmental outcomes and how governance mechanisms respond to these pressures.

To address these gaps, we constructed a ten-year panel (2014–2023) of 182 listed Vietnamese manufacturing firms and developed a multi-dimensional environmental performance index (EPI) from quantitative disclosures mandated by Circular 96/2020/TT-BTC. Unlike much of the literature that relies on disclosure-based or single-metric proxies, we employ an absolute index grounded in regulatory requirements. The index aggregates standardized information on emissions, energy and water use, resource management and legal compliance, ensuring policy alignment, data reliability and cross-firm comparability. We link this index to board gender diversity, independence, expertise diversity and other board attributes, alongside a province-level environmental corruption indicator from the Provincial Competitiveness Index (PCI) survey.

Our findings show that good corporate governance practices, including greater gender and expertise diversity and stronger board independence, significantly improve firms' environmental performance. Moreover, we demonstrate that in provinces characterized by corruption among environmental inspectors, female board presence, board independence and expertise diversity have a stronger effect on firm environmental performance. It underscores the critical role of robust governance mechanisms in weak institutional environments. By focusing on Vietnam, the study not only fills a methodological gap in measuring firm-level environmental performance in data-constrained emerging markets but also generates insights that are transferable to other Asian economies, where formal sustainability mandates co-exist with persistent institutional weaknesses.

2. Literature review and hypothesis development

2.1 Female presence and firm environmental performance

Social role theory posits that gender-based socialization shapes distinct behavioral tendencies, with females expected to adopt more communal and caring roles in contrast to the agentic behaviors typically associated with males (Liao *et al.*, 2018). These internalized gender roles translate into systematic differences in boardroom decision-making. In particular, female directors tend to exhibit greater sensitivity toward social and environmental issues, exercise more cautious risk judgment and place stronger emphasis on stakeholder welfare, which makes them more inclined to prioritize environmental risk mitigation and responsible corporate conduct.

Complementing this, feminist caring theory suggests that women's stronger environmental concern stems from social norms that cultivate an ethic of care and a community-oriented worldview (Gebauer *et al.*, 2013). This ethical orientation further predisposes female directors to advocate for greater environmental accountability within the firm. Adams *et al.* (2011) and Nguyen and Tran (2020) corroborate this argument. They find that female directors are more attuned to stakeholder welfare, thus more inclined to mitigate firms' environmental risks and implement Corporate Social Responsibilities (CSR) initiatives. Similarly, Lestari *et al.* (2024) demonstrated a non-linear relationship, whereby women on board ratio of at least 8.35% positively contribute to corporate sustainable growth among ESG-implementing firms in Indonesia.

Empirical evidence on women's role in curbing environmental misconduct, though limited, is instructive. Cumming *et al.* (2015) and Liu (2018) show that boards with more women record fewer environmental violations. Women's pro-environmental orientation extends to private-sphere behaviors such as recycling, reducing fuel use and choosing eco-friendly products (Hunter *et al.*, 2004). We therefore expect female directors to champion recycling policies, renewable energy adoption and other resource-saving practices at the corporate level. Beyond risk avoidance, female representation often fosters innovation that improves corporate social responsibility. Post *et al.* (2015) link gender-diverse boards to stronger environmental partnerships, which is consistent with evidence that a higher proportion of women correlates with better overall environmental performance (McGuinness *et al.*, 2017; Elmagrhi *et al.*, 2018).

Based on these arguments, we hypothesize the following:

- H1. Female presence on the board is associated with stronger corporate environmental performance.

2.2 Board independence and firm environmental performance

A core agency problem arises when managers prioritize short-term gains such as earnings or personal incentives over long-term value-creation strategies, including environmental initiatives (de Villiers *et al.*, 2011). Not only positively associated with better firm performance proxied by Return on Assets (ROA) (Shahid *et al.*, 2020), independent directors have no material ties to firms; hence, they are better placed than insiders to question short-term priorities and uphold long-term objectives, including environmental goals (Post *et al.*, 2015). Similarly, de Villiers *et al.* (2011) show that independent boards resist pressure to cut environmentally beneficial investments. Accordingly, a greater share of independent directors should lower the likelihood that firms overlook compliance obligations.

Empirically, Kassinis and Vafeas (2002) find that independent directors engage proactively with stakeholders to preempt environmental litigation, while Ong and Djajadikerta (2018) show that independent heavy boards demand richer sustainability disclosure. Taken together, these findings imply that independence encourages resource stewardship as well as compliance. Independence also appears to spur forward-looking environmental initiatives. Post *et al.* (2015) documented a higher incidence of renewable energy alliances among firms

whose boards are dominated by independent directors. [Galbreath \(2016\)](#) likewise observes that independent directors frame clean energy investments as strategic opportunities rather than mere compliance costs.

Building on this literature, we advance our hypothesis as follows:

- H2.* A higher proportion of independent directors is positively associated with greater corporate environmental performance.

2.3 Board expertise diversity and firm environmental performance

Upper Echelons Theory ([Hambrick and Mason, 1984](#)) argues that the values, experiences and cognitive bases of top executives are represented in organizational outcomes. Demographic characteristics that can be observed such as functional background, education and gender, serve as proxies for deeper cognitive frames that shape strategic decision-making. Previous research indicates that the functional background among executives has special relevance to environmental strategy ([Geletkanycz and Black, 2001](#)). In particular, executives from throughput functions (e.g. operations and accounting) typically emphasize efficiency and compliance, while executives from output-oriented functions (e.g. marketing and R&D) emphasize innovation and stakeholder-oriented initiatives. Accordingly, greater board expertise diversity increases the breadth of information, problem-solving capacity and environmental awareness and thus supports holistic approaches to sustainability strategies.

Recent empirical studies underscore the salience of expertise. [Kim et al. \(2023\)](#) show that directors with environmental credentials exert an influence on sustainability outcomes that often exceeds traditional governance metrics. [Asad et al. \(2024\)](#) find that such expertise lowers information asymmetry and improves the evaluation of pro-environmental investments. Taken together, these findings suggest that industry-specific knowledge not only fosters environmental innovation but also advances firms' ESG agendas.

Drawing on resource dependence theory and empirical evidence, we argue that expertise diversity enhances environmental performance through four interrelated mechanisms: (1) a broader knowledge base for interpreting ecological challenges; (2) more comprehensive assessment of environmental risks and opportunities; (3) heightened sensitivity to the concerns of environmental stakeholders and (4) greater capacity to devise and implement innovative sustainability strategies. Accordingly, we propose:

- H3.* An increase in board expertise diversity is positively associated with overall firm environmental performance.

2.4 The moderating effect of environmental corruption

The central premise of institutional theory holds that organizations actively seek external legitimacy by conforming to the institutional contexts in which they operate ([Glynn and Abzug, 2002](#)). This conformity occurs through isomorphic processes whereby organizations adopt similar structures, practices and behaviors to those considered appropriate within their environmental contexts. Within contemporary business contexts, [Rodriguez et al. \(2005\)](#) assert that corruption influences organizational legitimacy through its effects on both formal and informal activities. When corruption becomes institutionalized within business environments, organizations may paradoxically need to navigate these corrupt practices to maintain legitimacy with certain stakeholders while simultaneously establishing legitimacy with others demanding ethical conduct.

Based on this theory, we argue that corruption, especially at the regional or local level, can moderate the impact of corporate governance on firm environmental performance. The prevalence of corruption will weaken or distort the institutional pressures that would normally shape corporate environmental responsibility. When regulatory enforcement becomes

inconsistent and normative institutional standards lose their credibility, legitimacy from environmental commitments is also diminished.

Empirically, [Chen et al. \(2022\)](#) indicated that high-corruption enterprises' environmental responsibility performance improved after the government's national anti-corruption campaign came into practice. Similarly, in China, [Boubaker et al. \(2024\)](#) proved that anti-corruption policies promoted local authorities' environmental commitments and regulatory effectiveness, thereby facilitating better environmental responsibility performance among firms. Moreover, corruption prevention at the corporate level also has positive impacts on firm environmental performance, with anti-bribery policies improving integrity, reducing litigation risk and preserving corporate reputation ([Sarhan and Gerged, 2023](#)).

Building on this reasoning, we propose the following hypothesis:

H4. Provincial environmental corruption moderates the relationship between board characteristics and firms' environmental performance.

3. Data and methodology

3.1 Data and variables

We select companies listed on the Hanoi and Ho Chi Minh stock exchanges and exclude financial companies and service companies. Moreover, manufacturing companies without quantitative environmental information are also excluded. Overall, we gathered environmental data for 182 companies in 10 years from 2014 to 2023 [\[1\]](#).

3.1.1 Environmental performance measurement. The data and variable selection are based on Circular 96/2020/BTC by the Ministry of Finance. According to [Appendix IV](#), Cir. 96, listed companies have to disclose their impact on the environment and society, with the bare minimum of the following information on their environmental impact, including emission, resource management, energy consumption, water consumption and compliance with the law on environmental protection.

We calculate our EPI based on the disclosed quantitative data. This method ensures data consistency, objectivity and cross-firm comparability in a context where alternative ESG ratings or third-party environmental scores are largely unavailable or inconsistent for Vietnamese firms. Moreover, as the circular is directly linked to environmental regulation and enforcement in Vietnam, the circular-based EPI would be a suitable and policy-relevant proxy for corporate environmental performance in the Vietnamese institutional setting.

To enable comparison across firms of different sizes and sectors, all metrics will be normalized following these steps:

3.1.1.1 Standardization. Each normalized variable will be converted to a standardized score (z-score) to make disparate metrics comparable:

$$Z = \frac{X - \mu}{\sigma} \quad (1)$$

Where:

- (1) X = firm's normalized value;
- (2) μ = industry mean and
- (3) σ = industry standard deviation.

3.1.1.2 Performance score transformation. Z-scores will be converted to a 0–100 scale with higher scores indicating better environmental performance and map values within ± 3 standard deviations to a 0–100 scale:

First, for negative indicators (penalty times and amount in compliance):

$$Score_{negative} = 100 - \frac{Z + 3}{6} \times 100 \quad (2)$$

Next, for positive indicators (resource use and environmental initiatives):

$$Score_{positive} = \frac{Z + 3}{6} \times 100 \quad (3)$$

3.1.1.3 Sub-indices creation and environmental performance aggregation. After standardization, the author then calculates three sub-indices, including compliance, resource and initiatives, using simple averages of the environmental metrics that make up these sub-indices. The environmental performance score is finally calculated as the simple average of compliance, resource use and environmental initiatives (see Table A1 [2]).

3.1.2 *Explanatory variables: corporate governance mechanisms.* We explore the corporate governance mechanisms through board independence (measured by the proportion of independent directors), gender diversity and expertise diversity, which are measured by the proportion of female directors and the expertise and professional experiences of the board. Besides, we also control for some other board characteristics, including board size, Chief Executive Officer (CEO) duality and managerial shareholdings.

3.1.3 *Environmental corruption variable.* We draw from previous literature using components of the informal cost index in the PCI database to measure corruption levels in Vietnamese provinces (Tran, 2021). Since this study specifically focuses on environmental performance and corporate governance, the author selects a targeted corruption measure: “The percentage of companies that agree they always or often have to pay informal costs to environmental inspectors” as a proxy for provincial environmental corruption. This specific indicator provides a more precise measurement of corruption directly related to environmental governance and regulatory enforcement in the local business environment.

3.2 Empirical specification

This study employs the following model to estimate the impact of corporate governance mechanisms on firm environmental performance:

$$EP_{it} = \beta_0 + \beta_1 Female_{it} + \beta_2 Independence_{it} + \beta_3 Expertise_{it} + \beta_4 \gamma_{it} + u_t + \theta_k + \varepsilon_{it} \quad (4)$$

Where EP_{it} represents environmental performance of firm i in year t ;

$Female_{it}$, $Independence_{it}$, $Expertise_{it}$, are corporate governance mechanisms, including female presence, board independence, expertise diversity

γ_{it} is the vector of other corporate governance and control variables, including institutional ownership, foreign ownership, firm age, firm size, leverage, sales growth and profitability

u_t and θ_k are the time and industry fixed effect,

ε_{it} represents the error term.

The baseline model is estimated using a Tobit regression, as the EPI is bounded between 0 and 100 and exhibits mass points at the lower bound due to firms reporting minimal compliance level disclosures. The Tobit specification therefore accounts for the censored nature of the dependent variable and avoids biased estimates that may arise from linear estimators.

To examine the moderating effect of environmental corruption, we employ the following equation:

$$EP_{it} = \beta_0 + \beta_1 Female_{it} \times PC_{jt} + \beta_2 Independence_{it} \times PC_{jt} + \beta_3 Expertise_{it} \times EC_{jt} + \beta_4 \gamma_{it} + u_t + \theta_k + \varepsilon_{it} \quad (5)$$

Where PC_{jt} represents provincial environmental corruption of province j in year t .

While the Tobit models provide the primary estimates, board characteristics may be endogenous for several reasons. First, reverse causality may arise if firms with stronger environmental performance attract or voluntarily appoint more female, independent or expert directors. Second, omitted firm-specific traits such as managerial quality, ethical culture or long-term sustainability orientation may jointly influence board composition and environmental outcomes. To address these concerns, we conducted robustness checks using fixed effects instrumental variables (IV)-two-stage least squares (2SLS) models.

The second-stage IV equation is specified as follows:

$$EP_{it} = \alpha_0 + \alpha_1 Female_{it} + \alpha_2 Independence_{it} + \alpha_3 Expertise_{it} + \lambda W_{it} + \delta_t + \varepsilon_{it} \quad (6)$$

Where $Female_{it}$, $Independence_{it}$ and $Expertise_{it}$ are treated as endogenous regressors, W_{it} is a vector of exogenous controls

Following the dynamic governance argument of [Wintoki et al. \(2012\)](#), we treat the proportion of female directors, board independence and board expertise diversity as potentially endogenous. Our identification strategy exploits two sources of plausibly exogenous variation in these board characteristics.

First, we use their two-year lagged values as internal instruments. Board composition is highly persistent because director appointments and removals are infrequent. Consequently, the composition in year $t-2$ is strongly correlated with the composition in year t . Conditional on firm-fixed effects, these lagged variables are predetermined with respect to contemporaneous environmental shocks and are unlikely to be influenced by current period movements in firms' environmental performance ([Wintoki et al., 2012](#)). Second, we employ industry-year averages of female board presence, board independence and board diversity as peer-based instruments. This approach is consistent with recent evidence that treats industry-wide board diversity as an exogenous driver of firms' diversity choices rather than their firm-specific ESG outcomes ([Menicucci and Paolucci, 2025](#)).

The exclusion restriction is plausible as it is conditional on firm-level controls and year fixed effects, and lagged governance variables affect current environmental performance only through current board composition, while industry average governance measures shape a focal firm's board choices but not its environmental outcomes directly.

4. Empirical results

4.1 Descriptive statistics

Descriptive statistics for the main variables are shown in [Table A3 \[2\]](#). The Compliance Index exhibits the widest range (0–75.67), suggesting substantial heterogeneity in firms' adherence to environmental regulations. The Resource Index varies within a narrower band (47.78–74.55), implying relatively similar practices in resource management. The Environmental Initiatives Index displayed the greatest dispersion (42.30–86.84), consistent with large cross-firm differences in the adoption of energy-saving and emission-reduction initiatives. The overall EPI ranges from 30.03 to 66.63 (mean = 49.82; SD = 4.41), which confirms that most firms cluster around a neutral to moderately positive environmental profile.

On the governance side, female representation is low (mean = 0.09) and board independence averages 0.25, below the recommended one-third threshold, indicating that many firms fall short of best practice governance standards. Finally, expertise diversity averages 2.87 on a 1–5 scale, suggesting that boards typically encompass around three distinct educational or professional backgrounds.

4.2 The effect of corporate governance mechanisms on firm environmental performance

The results of the baseline models (shown in [Table A4 \[2\]](#)) support [Hypothesis 1](#), as female presence is positively associated with firm environmental compliance. A one-unit increase in the proportion of female directors corresponds to a 2.160% point increase in the firm's compliance index with 1% statistical significance. This finding reinforces the theoretical perspective that women are likely to adhere to strict legal standards and advocate for responsible behaviors, consistent with the suggestion that gender diversity reduces environmental violations.

Female presence, board independence and expertise diversity positively affect firm environmental initiatives, consistent with our hypotheses. Our findings are in line with the findings of [Elmagrhi et al. \(2018\)](#) and [McGuinness et al. \(2017\)](#) that a gender-diverse board would foster corporate environmentally responsible behavior by integrating broader perspectives and values.

The estimated coefficient on the impact of board expertise diversity on environmental initiatives is $\beta = 0.595$ ($p < 0.05$), suggesting that a heterogeneous board in terms of functional background and skills would promote more responsible actions for the environment by firms. Expertise diversity enables firms to draw on a broader knowledge base and professional judgment when addressing complex sustainability challenges, ranging from environmental risk management to compliance with evolving green regulations. As a result, the finding supports the resource dependence theory, which posits that boards serve as a critical resource pool, enabling the firm to manage external dependencies and improve strategic responsiveness.

The results also indicate that board size exerts a positive and statistically significant effect on firms' overall environmental performance ($\beta_{\text{Boardsize}} = 0.151$, $p < 0.1$). A larger board may enhance the firm's ability to oversee environmental matters by pooling a broader range of skills, experience and external networks. Board independence also showed a coefficient $\beta = 1.480$ ($p < 0.01$). Similarly, board expertise diversity is positively associated with improved environmental outcomes. The finding implies that firms with a more functionally diverse board, particularly those including legal, scientific, environmental, or sustainability professionals, are more capable of integrating environmental considerations into their strategic and operational decisions. These findings provide further support for resource dependence theory and underscore the importance of the board as a resource through which firms gain access to external resources, knowledge and legitimacy. In this context, larger, more independent and professionally diverse boards can act as conduits to human capital and environmental expertise, thereby enabling the firm to respond proactively to sustainability challenges and stakeholder pressures. Empirically, these results are consistent with the findings of [de Villiers et al. \(2011\)](#), who concluded that larger and more diverse boards are positively linked with higher levels of environmental performance disclosure and environmental engagement.

4.3 The moderating effect of environmental corruption

We employ the interaction terms of provincial environmental corruption with corporate governance variables. The results in [Table 1](#) show that environmental corruption is significantly detrimental to firm environmental performance. It supports previous findings from [Boubaker et al. \(2024\)](#) that anti-corruption schemes can improve corporate environmental outcomes.

The results also confirm our [Hypothesis 4](#) that strong corporate governance mechanisms such as more women directors and larger boards have a positive impact on firm environmental performance under a corruption context. With more members, boards usually have a wider range of skills and are better at keeping an eye on management, especially in unclear or risky situations ([Hafsi and Turgut, 2013](#)).

Table 1. The moderating effect of provincial environmental corruption

	Compliance _{it}	Resource efficiency _{it}	Environmental initiatives _{it}	EPI _{it}
Provincial corruption _{it} (PC)	−0.308 (−0.10)	0.588 (0.25)	−22.58*** (−3.35)	−7.432*** (−2.80)
Female presence _{ijt}	1.133 (1.15)	0.383 (0.52)	4.150** (1.99)	1.888** (2.30)
PC _{jt} × Female presence _{ijt}	10.55** (2.22)	5.688 (1.61)	12.17 (1.21)	9.471** (2.38)
Board independence _{ijt}	0.453 (0.72)	0.168 (0.36)	3.031** (2.25)	1.218** (2.30)
PC _{jt} × Board independence _{ijt}	0.651 (0.23)	2.564 (1.20)	6.244 (1.03)	3.152 (1.31)
Board diversity _{ijt}	−0.0242 (−0.17)	0.162 (1.57)	0.283 (0.96)	0.141 (1.21)
PC _{jt} × Board diversity _{ijt}	−0.255 (−0.44)	−0.933** (−2.15)	2.119* (1.71)	0.310 (0.64)
Board size _{ijt}	0.135 (1.23)	0.127 (1.57)	−0.138 (−0.60)	0.0410 (0.45)
PC _{jt} × Board size _{ijt}	0.100 (0.23)	0.234 (0.72)	2.298** (2.47)	0.878** (2.39)
Constant	51.22*** (60.65)	43.86*** (69.73)	23.13*** (12.92)	39.41*** (55.77)
Other board characteristics	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes
Industry fixed-effect	Yes	Yes	Yes	Yes
Year fixed-effect	Yes	Yes	Yes	Yes
var(e.dependent variable)	20.20*** (29.81)	11.20*** (29.87)	90.81*** (29.87)	14.14*** (29.87)
Observations	1785	1785	1785	1785

Note(s): The dependent variable is the environmental performance index (EPI). *t*-statistics in parentheses (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$)

Moreover, female board representation plays a pivotal counteractive role. Consistent with findings from [Liu \(2018\)](#), the ethical orientation, stakeholder sensitivity and risk aversion typically associated with female directors strengthen a firm's capacity to withstand the institutional pressures of corruption. The key point is that when power is shared through larger and more diverse boards, firms are less likely to fall into unethical behavior because a more diverse and larger board creates a better balance between management control and ethical governance. This supports the findings of [Sarhan and Gerged \(2023\)](#) that strict internal rules and ethical leadership make these governance features even more effective by building a company culture of transparency and responsibility.

4.4 Sub-period analysis: the moderating effect of Circular 96/2020/BTC

The Circular 96/2020/BTC has been enforced since 2021 with several amendments to the 2015 version. We analyze the impact of the enforcement of the circular by dividing our sample into before and after 2021.

The results of the estimation ([Table A5 \[2\]](#)) show some noticeable differences in the impact of different board characteristics on firm environmental performance. First, female presence has a stronger impact with greater and more statistically significant coefficients with compliance, resource efficiency, environmental initiatives and overall environmental performance in the period after the amendment of the circular. In contrast, board independence and expertise diversity tend to have a more positive impact on environmental performance before 2021.

We explain the above findings as follows. First, female directors tend to exhibit stronger ethical considerations and greater sensitivity towards sustainability compliance (Adams and Ferreira, 2009). When stricter reporting and compliance are imposed by Circular 96, female directors might play a more significant role in maintaining environmental transparency. Furthermore, prior studies also provide evidence of a positive link between more gender-diverse boards and increased monitoring (Adams and Ferreira, 2009). Such an internal governance mechanism can be even more crucial in the context of tougher disclosure requirements. Moreover, gender diversity has less influence on bank performance in contexts with weaker regulatory and investor protection environments (García-Meca *et al.*, 2015). Therefore, our result supports the notion from the literature that the female presence becomes more relevant on the board in a more stringent regulatory context.

The sub-period analysis further shows that board independence and expertise diversity exerted stronger effects on environmental performance before the implementation of Circular 96. This pattern is consistent with prior evidence indicating that independent directors play an important monitoring role in shaping firms' environmental strategies (de Villiers *et al.*, 2011). In contexts where environmental regulation is relatively weak or enforcement is inconsistent, independent directors might provide external oversight that encourages transparency and environmental disclosure. Similarly, expertise diversity has been found to enrich firms' environmental decision-making by contributing functional knowledge and stakeholder-oriented perspectives (Hafsi and Turgut, 2013). Before the enhanced reporting and monitoring requirements under Circular 96, internal board competencies played a more central role in guiding environmental initiatives.

5. Robustness checks

To further mitigate endogeneity concerns, in particular reverse causality from environmental performance to subsequent board restructuring and omitted firm-level traits, we re-estimate the baseline and moderating specifications using fixed-effects IV–2SLS models.

The first-stage diagnostics reported in Table A6 [2] indicate that the instruments are empirically strong. In both the baseline IV model (Model 1) and the moderating effect model (Model 2), the F-statistics for the instrumental variables are all highly significant and well above the conventional threshold of 10 suggested by Staiger and Stock (1997) for avoiding weak instrument problems. Shea's partial R^2 values further show that the instruments explain a substantial share of the variation in each endogenous board variable. These diagnostics confirm that the lagged and peer average instruments and their interactions provide ample exogenous variation for both the level and interaction terms.

Turning to the second stage, the 2SLS estimates in Table A6 [2] are broadly consistent with the Tobit results reported in Tables A4 and A5 [2]. In the baseline model (Model 1), female board presence, board independence and board expertise diversity remain positive and statistically significant predictors of environmental performance, with coefficients of comparable magnitude to the Tobit models (albeit estimated with slightly larger standard errors). This pattern suggests that the strong positive associations documented in the Tobit models are not driven by reverse causality or unobserved firm characteristics. On the other hand, once we isolate the exogenous component of board composition through our instruments, the estimated effects on environmental performance remain economically and statistically meaningful.

When we augment the IV specification with interaction terms between board characteristics and provincial corruption (Model 2), we continue to find significant interaction coefficients in the expected direction. The interaction between female board presence and provincial corruption remains positive and significant, whereas the interaction between board independence and provincial corruption is negative and marginally significant. However, the interaction involving board expertise diversity is statistically insignificant. Thus, even after addressing endogeneity in the board variables and their interactions, provincial

corruption continues to condition the impact of board structure on environmental performance in the same way as in the Tobit specification. Overall, the IV results in [Table A6 \[2\]](#) reinforce our main conclusions and indicate that the governance and environment relationships, including the moderating role of local corruption, can be interpreted as robust and plausibly causal rather than artefacts of endogenous board selection.

6. Conclusion

This study shows that three governance mechanisms, namely female board representation, board independence and the diversity of directors' professional expertise, play a pivotal role in shaping environmental outcomes among Vietnamese firms. A higher proportion of women on the board systematically raises environmental scores and attenuates the adverse impact of provincial environmental corruption. A larger share of independent directors similarly fosters proactive environmental initiatives and overall performance, while limiting corruption-related setbacks. In addition, each incremental unit of expertise diversity adds 0.595 points to firms' environmental initiatives and 0.184 points to the composite EPI. These findings underscore the value of heterogeneous professional backgrounds in addressing environmental issues.

Testing these relationships in an emerging market context, the study addresses an important gap in the governance and environment literature, which remains heavily skewed toward developed economies, using a multi-perspective lens (agency, upper echelon and resource dependency theory). Moreover, by examining how environmental corruption moderates the effectiveness of various governance structures, our study extends institutional theory beyond its traditional applications. It demonstrates how formal organizational governance mechanisms can either succumb to or successfully counterbalance the informal institutional pressures created by corrupt practices.

Beyond these theoretical contributions, the study proposes a standardized measurement protocol rooted in Vietnam's Circular 96/2020/BTC that can be replicated to benchmark environmental progress over time. This framework supports firms in enhancing the completeness and comparability of their disclosures while providing regulators, investors and non-governmental organizations with a more transparent basis for monitoring sustainability performance. The empirical results also translate into concrete governance levers for boards to increase independent and gender-diverse director appointments beyond statutory minima.

Our empirical findings and contribution are particularly relevant in the Vietnamese institutional context, where corporate governance reforms are still evolving and practices such as high board independence and meaningful female representation remain unevenly adopted across listed firms. Firms that move beyond statutory minima in appointing independent and female directors therefore gain not only internal monitoring and advisory benefits but also a stronger institutional shield against opportunistic behavior and regulatory capture. These patterns align with Vietnam's ongoing twin transitions toward digitalization and green growth. It highlights that upgrading board structures can enhance both firms' environmental compliance and their competitiveness in an institutional environment, where market-supporting institutions are still consolidating.

We thereby make the following recommendations. Since strengthening corporate governance codes will have limited impact unless accompanied by credible anti-corruption enforcement, policymakers could mandate minimum thresholds for independent and female directors, align disclosure guidance with international best practices and strengthen judicial oversight of corruption to create a mutually reinforcing governance architecture. For corporate leaders, the findings imply that deepening board independence safeguards long-term ecological objectives against short-term financial pressures and conflicts of interest. Broadening board diversity, especially by appointing more women and specialists in environmental science, engineering, law and sustainable finance, can enrich strategic debate and strengthen the oversight of environmental risk. Finally, enhancing transparency and

accountability through clear lines of environmental responsibility, ESG-linked performance evaluation and external verification of sustainability information can further consolidate firms' environmental credibility.

Notes

1. Control variables are report in [Appendix Table A2](#).
2. Please see [Appendix Tables A1–A6](#) in the [Supplementary Online Appendix](#).

Supplementary material

The supplementary material for this article can be found online.

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