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The Effect of Carbon Emissions on Earnings Quality with The Moderation of Gender Diversity in Indonesia

ABSTRACT
This study investigates whether corporate carbon emissions influence earnings quality and whether board gender diversity moderates this relationship. Using panel data on high-carbon firms listed on the Indonesia Stock Exchange (2021–2023), we estimate random-effects models and moderated regression, with earnings quality proxied by performance-matched discretionary accruals. Overall, carbon emissions are not significantly associated with earnings quality, nor does gender diversity exert a moderating effect. Yet regional ethics conditions matter: in higher-ethics provinces, greater emissions correspond to lower earnings quality, consistent with intensified earnings management and rebound effects; in lower-ethics provinces, greater emissions align with improved earnings quality, indicative of activity.

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INTRODUCTION

Earnings play a fundamental role in financial reporting, providing essential insights into a company's operational performance, future potential, and corporate valuation (Dechow et al., 2010). High-quality earnings accurately reflect a company's true economic condition, fostering investor confidence and enhancing corporate credibility. In Indonesia, critical sectors including energy, industry, basic materials, and transportation are identified as major carbon emission contributors, underscored by Presidential Regulation No. 98 of 2021 regarding the Economic Value of Carbon (Republic of Indonesia, 2021). These sectors face dual pressures: the imperative to drive economic growth and simultaneously fulfill ethical environmental responsibilities (Rifha, 2022). For instance, PT Garuda Indonesia (Persero) Tbk, operating within the carbon-intensive transportation sector, faced significant public and regulatory backlash due to earnings manipulation in 2019, reporting fictitious revenues of USD 239.94 million, clearly violating accounting standards (Rifha, 2022).

The urgency of mitigating carbon emissions is amplified globally through initiatives like the Paris Agreementof2015.Indonesia,anotableglobalemitter, saw its energy sector emissions rise significantly from approximately 600 million tons of CO_2 in 2021 to 674.5 million tons in 2023 (CountryEconomy, 2023; International Energy Agency, n.d.; WRI Indonesia, 2023). This escalation heightens pressures on companies to adopt sustainable practices that often involve substantial costs, potentially undermining short-term profitability and earnings quality (Bilal et al., 2022). According to legitimacy theory, firms facing heightened public scrutiny due to their environmental impact are compelled to disclose their social and environmental performance to sustain societal legitimacy (Deegan, 2002; Suchman, 1995). Consequently, this scenario increases the risk of earnings management practices aimed at protecting corporate reputation, adversely affecting earnings quality (Tohang et al., 2024; Houqe et al., 2024).

The objective of this study is to empirically analyze the negative relationship between carbon emissions and earnings quality, along with examining whether board gender diversity moderates this relationship. To accomplish these objectives, this research employs Kothari et al.'s (2005) discretionary accrual model to inversely assess earnings quality through accrual-based earnings management. The methodological approach comprises panel data regression analyses, robustness testing, and subgroup analyses differentiated by regional ethical standards.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Existing literature provides mixed evidence regarding the impact of carbon emissions on earnings quality. Some studies suggest that higher carbon emissions correlate with reduced earnings stability and increased real earnings management, especially in firms with low transparency (Houqe et al., 2024; Velte, 2021). In contrast, other research highlights a positive relationship between stringent environmental regulations, transparent carbon disclosure, and improved financial reporting quality (Bilal et al., 2022; Perera & Jubb, 2024).

Additionally, board gender diversity emerges as an important governance factor influencing financial transparency. Female directors are often recognized for higher ethical standards, increased caution, and effective oversight, resulting in reduced earnings manipulation (Adams & Ferreira, 2009; Ardhaoui et al., 2024). Based on legitimacy theory and gender socialization theory, this study formulates the following hypotheses:

Hypothesis 1: Higher carbon emissions negatively influence earnings quality, as firms facing significant environmental scrutiny may resort to earnings management to maintain legitimacy (Velte, 2021; Bilal et al., 2022).

Hypothesis 2: Board gender diversity moderates the negative impact of carbon emissions on earnings quality. Specifically, a higher proportion of female directors mitigates opportunistic reporting behaviors due to their ethical perspectives and robust oversight capabilities (Ardhaoui et al., 2024; Houqe et al., 2024).

RESEARCH METHODS

This study employs a quantitative research design, analyzing publicly listed Indonesian companies in carbon-intensive sectors (energy, industry, basic materials, transportation) from 2021 to 2023. The primary materials consist of financial reports, sustainability reports, and secondary data from the Indonesia Stock Exchange (IDX). The main tools include statistical software for panel data analysis.

Data collection techniques involve reviewing financial statements and sustainability reports. Operational definitions of variables include earnings quality measured through discretionary accruals (Kothari et al., 2005), carbon emissions (logarithmic measurement of total CO_2 emissions), and board gender diversity (proportion of female directors). The analysis techniques comprise panel data regression models, robustness testing, and subgroup analyses by regional ethical standards.

RESULTS AND DISCUSSION

In the full sample (Table 1), CE is statistically insignificant (t = −1.1228, p = 0.2626), indicating no association with discretionary accruals.. This implies that the amount of carbon emissions disclosed by companies does not have a direct or significant impact on the practice of earnings manipulation. One possible explanation is that carbon disclosure in Indonesia is still voluntary and lacks regulatory enforcement (Febriansyah et al., 2019). In this study, only 58% of the sample companies presented sustainability reports. Supporting this, Ratmono et al. (2022) reported that the average carbon disclosure by Indonesian firms only reached 41.79% of CDP global standards.

Unlike developed countries such as the U.S., EU, and Australia that mandate real-time monitoring systems like Continuous Emissions Monitoring Systems (CEMS) and require external verification such as the National Greenhouse and Energy Reporting (NGER) (Wang et al., 2022; Xu & Andrew, 2021), Indonesia primarily relies on estimation based on activity data multiplied by emission factors (OECD, 2024). This methodology allows for aggregated and less transparent reporting, increasing the likelihood of under-reporting.

Table 1. Main regression

Variable	t-Statistic	Prob.
C	1.581891	0.1149
CE	-1.12278	0.2626
GP	0.810329	0.4185
CE*GP	-0.515993	0.6063
SIZE	4.123738	0.0001

The results of the random effect model analysis presented in Table 1 indicate that carbon emissions (CE) have no significant impact on earnings quality (t = -1.12278, p = 0.2626). This finding suggests that higher levels of carbon emissions do not necessarily result in increased discretionary accruals or earnings management practices, thereby failing to support Hypothesis 1. Several justifications may explain this unexpected finding. First, the voluntary nature of carbon disclosure practices in Indonesia might reduce external pressure or incentive for companies to engage in earnings management related to environmental performance. Additionally, firms may perceive minimal immediate market consequences or stakeholder reactions from carbon emission disclosures, leading to less motivation to alter earnings reporting practices. Another plausible explanation could be the uniformity in governance standards or regulatory environments within the sampled sectors, leading to consistent financial reporting behaviors irrespective of emission levels.

Houten & Wedari (2023) found that carbon disclosure and carbon reduction targets did not significantly affect the market value of high-emitting Indonesian firms. This suggests that investors may still be indifferent to environmental performance, reducing incentives for firms to manage earnings based on environmental considerations. Furthermore, companies may focus more on greenwashing—conveying an image of environmental responsibility without actual emissions reduction efforts (Geraldina et al., 2023). In European contexts, Velte (2021) noted that firms with high carbon emissions may practice real earnings management (REM), altering operational decisions to appear more environmentally responsible rather than genuinely modifying production or investments. This behavior implies that the volume of emissions, when not accompanied by strong external pressure or verification mechanisms, no longer correlates with financial reporting quality.

The moderating variable, board gender diversity (GP), does not significantly influence the relationship between carbon emissions and earnings quality in Table 1 (interaction term CE*GP: t = -0.515993, p = 0.6063), thereby not supporting Hypothesis 2. This result suggests that the presence of female directors alone may be insufficient to substantially impact corporate

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financial reporting practices under environmental scrutiny. Here, external pressure and institutional voids dominate corporate decision-making, and gender composition becomes irrelevant compared to the broader influence of greenwashing and governance weaknesses (Gneezy & Croson, 2009; Salihi et al., 2024). Although women on boards are generally associated with greater risk aversion and sensitivity to environmental and social issues (Bear et al., 2010; Gneezy & Croson, 2009; Liao et al., 2015), their effectiveness is largely influenced by institutional context. In Indonesia, weak corporate governance structures limit the ability of female directors to perform monitoring functions effectively (Adams & Ferreira, 2009; Wahid, 2019).

One potential justification for this finding is that gender diversity, without a broader corporate culture supportive of transparency and ethical behavior, might not effectively counteract incentives for earnings manipulation. Additionally, structural and cultural factors prevalent within Indonesian firms could limit the capacity of board gender diversity to significantly affect decision-making processes related to financial reporting. Low female representation on boards also limits their ability to influence strategic decisions. Furthermore, the lack of mandatory environmental regulation, external audits, and detailed emission reporting reduces the opportunity for female directors to intervene in environmental governance or restrict earnings management behaviors. Geraldina et al. (2023) emphasize that in institutional environments with low enforcement, structural mechanisms dominate behavioral drivers, thus reducing the practical effect of gender diversity.

This section examines the role of ethical regional context by splitting the sample into high-ethics and low-ethics regions. Ethical context reflects the social norms and legal enforcement that influence corporate behavior. According to legitimacy theory, firms operating in ethically sensitive regions face greater societal pressure to act responsibly and disclose environmental impacts accurately (Dowling & Pfeffer, 1975; Suchman, 1995). To operationalize this construct, provincial crime counts from Statistics Indonesia (2024) are normalized by provincial land area to obtain crime density (incidents per km²), following crime-mapping normalization principles that adjust for spatial scale (Ratcliffe, 2010). Provinces with crime density below the sample median are classified as high-ethics regions, while those above the median are classified as low-ethics regions, reflecting the notion that lower ambient criminality correlates with stronger social norms and more effective enforcement.

Tabel 2. Subsample: High-ethics regions

Variable	t-Statistic	Prob.
CE	2.904671	0.0048
GP	1.470324	0.1455
CE*GP	-1.281916	0.2037
SIZE	0.83288	0.4075
C	-1.352698	0.1801

In high-ethics regions (Table 2), CE is positive and statistically significant ($t = 2.904671$, $p = 0.0048$), indicating higher discretionary accruals and thus lower earnings quality. This pattern aligns with legitimacy pressures that foster accrual-based earnings management rather than enhanced transparency (Perera & Jubb, 2024). The interaction term CE*GP is insignificant ($t = -1.281916$, $p = 0.2037$), indicating that gender proportion does not moderate the emissions–earnings management relationship in this context. In strong ethical and regulatory environments, all board members—regardless of gender—are equally pressured to maintain legitimacy. Therefore, the relative monitoring advantage traditionally associated with female directors becomes less relevant (Adams & Ferreira, 2009; Wahid, 2019).

Table 3. Subsample: Low-ethics regions

Variable	t-Statistic	Prob.
CE	-2.2649	0.0248
GP	0.377643	0.7062
CE*GP	-0.053383	0.9575
SIZE	4.800389	0
C	**2.188153**	**0.0301**

Conversely, in low-ethics regions (Table 3), CE exhibit a negative significant effect on earnings management ($t = -2.2649$, $p = 0.0248$). This supports the findings of Choi & Lai (2025), who reported that in contexts with weak regulatory monitoring, increases in carbon emissions do not prompt greater accrual manipulation. This result highlights that firms operating in environments with weaker ethical norms may exhibit lower tendencies toward earnings management when facing environmental pressures, potentially due to inadequate oversight mechanisms and lower societal expectations. Prior to the implementation of emissions monitoring in China, discretionary accruals in polluting firms were lower, suggesting that without the threat of sanctions, firms had no motivation to conceal emissions via earnings manipulation. This is consistent with prior work (Salihi et al., 2024; Velte, 2021) that weak environmental enforcement is associated with a decline in discretionary accruals, as reputational threats are minimized. Geraldina et al. (2023) confirmed similar patterns across ASEAN countries.

The interaction between carbon emissions and board gender proportion (CE*GP) yields a t of -0.008180 with a p-value of 0.6063, indicating no statistically significant moderating effect. This suggests that the presence of female directors does not significantly influence the relationship between carbon emissions and earnings management practices.

In conclusion, the findings highlight the importance of institutional and ethical environments in shaping the link between carbon emissions and earnings management, while revealing the limitations of gender diversity as a moderating factor in the absence of regulatory enforcement.The moderation effect of gender diversity remained insignificant across both high and low ethical contexts. This consistency suggests that board gender diversity alone does not effectively moderate the relationship between carbon emissions and earnings quality, irrespective of the ethical setting. These results imply that other governance mechanisms, complementary to gender diversity, may be essential to achieve meaningful improvements in corporate reporting transparency and practices.

Overall, these findings emphasize the complexity inherent in the relationship between environmental pressures, internal corporate governance mechanisms, and regional ethical standards. Future research should explore additional governance and contextual variables, such as regulatory strictness, comprehensive governance frameworks, and corporate ethical cultures, to further elucidate the conditions under which firms’ financial reporting behaviors respond significantly to environmental scrutiny.

CONCLUSION

This study concludes that carbon emissions do not significantly impact earnings quality, indicating that higher environmental pressures alone might not lead to increased earnings management practices within Indonesian firms. Additionally, board gender diversity was found to have no significant moderating effect on this relationship, suggesting the need for more comprehensive corporate governance mechanisms to enhance financial transparency and reporting integrity. Subgroup analyses reveal that in high-ethics regions, higher emissions are associated with lower earnings quality (greater accrual-based earnings management), whereas in low-ethics regions, higher emissions are associated with improved earnings quality (lower discretionary accruals). Therefore, policymakers and corporate leaders should consider strengthening ethical frameworks and governance practices at regional and national levels to enhance corporate reporting transparency. Future research should investigate additional moderating and mediating variables, such as regulatory strictness, corporate ethical cultures, and other governance frameworks, to provide a deeper understanding of the factors influencing corporate earnings management in environmentally sensitive industries.

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REFERENCE

Adams, R. B., & Ferreira, D. (2009). Women in the boardroom and their impact on governance and performance. Journal of Financial Economics, 94(2), 291–309. https://doi.org/10.1016/j.jfineco.2008.10.007

Ardhaoui, R., Ben Amar, A., & Fakhfakh, I. (2024). Does corporate environmental disclosure affect earnings management? The moderating effect of female board representation. EuroMed Journal of Business. https://doi.org/10.1108/EMJB-10-2023-0275

Bear, S., Rahman, N., & Post, C. (2010). The impact of board diversity and gender composition on corporate social responsibility and firm reputation. Journal of Business Ethics, 97(2), 207–221. https://doi.org/10.1007/s10551-010-0505-2

Bilal, A. R., Tan, D., Komal, B., Ezeani, E., Usman, M., & Salem, R. (2022). Carbon emission disclosures and financial reporting quality: Does ownership structure and economic development matter? Environmental Science & Policy, 137, 109–119. https://doi.org/10.1016/j.envsci.2022.08.004

Choi, D., & Lai, F. (2025, March). E vs. G: Environmental policy and earnings management in China. SSRN. https://ssrn.com/abstract=4995886

CountryEconomy. (2023). Indonesia — CO_2 emissions. Retrieved June 30, 2025, from https://countryeconomy.com/energy-and-environment/co2-emissions/indonesia

Dechow, P. M., Ge, W., & Schrand, C. (2010). Understanding earnings quality: A review of the proxies, their determinants and their consequences. Journal of Accounting and Economics, 50(2–3), 344–401. https://doi.org/10.1016/j.jacceco.2010.09.001

Deegan, C. (2002). Introduction: The legitimising effect of social and environmental disclosures—A theoretical foundation. Accounting, Auditing & Accountability Journal, 15(3), 282–311. https://doi.org/10.1108/09513570210435852

Dowling, J., & Pfeffer, J. (1975). Organizational legitimacy: Social values and organizational behavior. Pacific Sociological Review, 18(1), 122–136. https://doi.org/10.2307/1388226

Febriansyah, M., Adam, M., & Meutia, I. (2019). Carbon emission disclosure: Analysis of manufacturing companies in Indonesia. Saudi Journal of Business and Management Studies, 4(1), 8–14. https://doi.org/10.36348/sjbms.2019.v04i01.002

Geraldina, I., Meini, Z., Arieftiara, D., Muktiyanto, A., & Sahudin, Z. (2023, November 26–28). Greenwashing and earnings quality of family firms in Indonesia and Singapore. In Proceedings of the 20th Asian Academic Accounting Association (FourA) Annual Conference 2023 (pp. 140–146). Khon Kaen, Thailand. https://www.foura.org

Gneezy, U., & Croson, R. (2009). Gender differences in preferences. Journal of Economic Literature, 47(2), 448–474. https://doi.org/10.1257/jel.47.2.448

Houten, E. S., & Wedari, L. K. (2023). Carbon disclosure, carbon performance, and market value: Evidence from Indonesia polluting industries. International Journal of Sustainable Development and Planning, 18(6), 1973–1981. https://doi.org/10.18280/ijsdp.180634

Houqe, M. N., Opare, S., & Zahir-Ul-Hassan, M. K. (2024). Carbon emissions, female CEOs and earnings management. International Journal of Accounting and Information Management, 32(4), 593–621. https://doi.org/10.1108/IJAIM-11-2023-0296

International Energy Agency. (n.d.). Indonesia. IEA. Retrieved June 30, 2025, from https://www.iea.org/countries/indonesia

Kothari, S. P., Leone, A. J., & Wasley, C. E. (2005). Performance matched discretionary accrual measures. Journal of Accounting and Economics, 39(1), 163–197. https://doi.org/10.1016/j.jacceco.2004.11.002

Liao, L., Luo, L., & Tang, Q. (2015). Gender diversity, board independence, environmental committee and greenhouse gas disclosure. The British Accounting Review, 47(4), 409–424. https://doi.org/10.1016/j.bar.2014.01.002

OECD. (2024). Greenhouse gas emissions data: Concepts and data availability. Retrieved March 9, 2025, from https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/06/greenhouse-gas-emissions-data_57bb38a1/b3e6c074-en.pdf

Perera, L., & Jubb, C. (2024). Greenhouse gas emissions, political visibility and earnings quality. Australasian Accounting, Business and Finance Journal, 18(4), 22–50. https://doi.org/10.14453/aabfj.v18i4.03

Republic of Indonesia. (2021). Presidential Regulation No. 98 of 2021 onthe Implementation of the Economic Value of Carbon for Achieving Nationally Determined Contribution Targets and the Control of Greenhouse Gas Emissions in National Development [Peraturan Presiden Nomor 98 Tahun 2021 tentang Penyelenggaraan Nilai Ekonomi Karbon …]. State Gazette of the Republic of Indonesia No. 249/2021. Retrieved May 15, 2025, from https://jdih.kemenkeu.go.id/in/dokumen/peraturan/7c32c485-2167-4ce9-9820-cfddfdd7293f

Ratcliffe, J. H. (2010). Crime mapping: Spatial and temporal challenges. In A. R. Piquero & D. Weisburd (Eds.), Handbook of quantitative criminology (pp. 5–24). Springer. https://doi.org/10.1007/978-0-387-77650-7

Ratmono, D., Darsono, D., Cahyonowati, N., & Niza, T. C. (2022). Greenhouse gas emission accounting disclosure, corporate characteristics and governance: An empirical investigation on Indonesian firms. International Journal of Energy Economics and Policy, 12(6), 86–95. https://doi.org/10.32479/ijeep.13487

Rifha, I. (2022, June 27). Kasus korupsi Garuda Indonesia rugikan negara hingga Rp 8,8 triliun [Corruption case at Garuda Indonesia costs the state up to IDR 8.8 trillion]. Kompas.com. Retrieved September 19, 2025, from https://money.kompas.com/read/2022/06/27/141500526/kasus-korupsi-garuda-indonesia-rugikan-negara-hingga-rp-8-8-triliun

Salihi, A. A., Ibrahim, H., & Baharudin, D. M. (2024). Gender diversity, corporate social responsibility and real earnings management for policy management decision: Evidence from emerging market. Journal of Science and Technology Policy Management, 15(6), 1247–1265. https://doi.org/10.1108/JSTPM-09-2022-0142

Statistics Indonesia (BPS). (2024). Criminal statistics 2024 [Statistik kriminal 2024]. Retrieved March 12, 2025, from https://www.bps.go.id/id/publication/2024/12/12/13317138a55b2f7096589536/statistik-kriminal-2024.html

Suchman, M. C. (1995). Managing legitimacy: Strategic and institutional approaches. Academy of Management Review, 20(3), 571–610. https://doi.org/10.5465/amr.1995.9508080331

Tohang, V., Hutagaol-Martowidjojo, Y., & Pirzada, K. (2024). The link between ESG performance and earnings quality. Australasian Accounting, Business and Finance Journal, 18(1), 187–204. https://doi.org/10.14453/aabfj.v18i1.12

Velte, P. (2021). Environmental performance, carbon performance and earnings management: Empirical evidence for the European capital market. Corporate Social Responsibility and Environmental Management, 28(1), 42–53. https://doi.org/10.1002/csr.2030

Wahid, A. S. (2019). The effects and the mechanisms of board gender diversity: Evidence from financial manipulation. Journal of Business Ethics, 159(3), 705–725. https://doi.org/10.1007/s10551-018-3785-6

Wang, X., Xu, L., Zhang, Q., Zhang, D., & Zhang, X. (2022). Evaluating the data quality of continuous emissions monitoring systems in China. Journal of Environmental Management, 314, 115081. https://doi.org/10.1016/j.jenvman.2022.115081

WRI Indonesia. (2023). Annual report 2023. Retrieved March 11, 2025, from https://wri-indonesia.org/sites/default/files/2024-11/Annual%20Report%202023_EN.pdf

Xu, S. G., & Andrew, B. (2021). Competing for the leading role: Trials in categorizing greenhouse and energy auditors. Critical Perspectives on Accounting, 77, 102180. https://doi.org/10.1016/j.cpa.2020.102180