



Financial Disclosure Transparency, Gender Equality, and Environmental Performance: Evidence from Energy Sector Companies

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Abstract

Purpose: This study investigates the effect of financial disclosure transparency on environmental performance and examines the moderating role of gender equality in energy sector companies. **Method:** The study employs a quantitative approach using panel data from energy sector companies listed on the Indonesia Stock Exchange (IDX) during the period 2020–2024. Data analysis is conducted using moderated regression analysis with EViews to test the proposed hypotheses. **Findings:** The empirical results indicate that financial disclosure transparency has a positive and significant effect on environmental performance, suggesting that higher transparency improves corporate accountability and environmental outcomes. Gender equality also has a positive effect on environmental performance, implying that gender-diverse leadership supports stronger environmental decision-making. Furthermore, the findings confirm that gender equality significantly moderates the relationship between financial disclosure transparency and environmental performance, strengthening the positive impact of transparency. **Implications:** From a theoretical perspective, this study extends stakeholder and legitimacy theories by incorporating gender equality as a governance mechanism that enhances the effectiveness of transparent disclosure. Practically, the results provide insights for regulators, investors, and corporate managers to improve disclosure quality and promote gender-inclusive governance. The novelty of this study lies in its moderated framework linking financial disclosure transparency, gender equality, and environmental performance in the Indonesian energy sector.

Keywords: environmental performance, financial disclosure transparency, gender equality, PROPER, energy sector companies

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Introduction

Financial disclosure transparency and environmental sustainability have become increasingly critical issues for energy sector companies amid growing global demands for responsible business practices (Chouaibi et al., 2021; Omran et al., 2021). The energy industry is characterized by high emission intensity and substantial environmental risk. Consequently, corporate environmental performance, as reflected by the PROPER rating in

Indonesia, represents a key indicator of firms' commitment to sustainability (Irman et al., 2025). The Indonesia Energy Outlook 2019 projects sustained growth in national energy demand, with average annual increases of 5.0 percent under the Business-as-Usual scenario, 4.7 percent under the sustainable development scenario, and 4.3 percent under the low-carbon scenario. Total energy demand is expected to reach 548.8, 481.1, and 424.2 MTOE by 2050, respectively. This projected increase in energy demand intensifies environmental pressures, thereby heightening expectations for energy companies to enhance transparency and accountability in managing their environmental impacts. Given this trajectory, energy sector companies are regarded as highly strategic, as they play a central role in supplying and distributing energy essential for economic development. One strategic factor widely believed to influence environmental performance is financial disclosure transparency. Firms with higher transparency tend to exhibit stronger governance practices, greater accountability, and increased public scrutiny, which may encourage environmentally responsible operations (Dagestani et al., 2024; Saeed et al., 2025). However, empirical evidence on this relationship remains inconclusive (Doan & Sassen, 2020), highlighting the need for further investigation within the Indonesian energy sector context.

From a theoretical perspective, the relationship between financial disclosure transparency and environmental performance can be explained by legitimacy theory and stakeholder theory. Legitimacy theory suggests that firms seek public approval by openly disclosing relevant information, including financial and non-financial data that demonstrate compliance with environmental standards (Basak & Sana, 2025; Chouaibi et al., 2021). Stakeholder theory emphasizes that information transparency compels firms to respond to pressures from investors, regulators, and society, thereby strengthening their commitment to improved environmental practices (Dagestani et al., 2024; Oncioiu et al., 2020). Together, these theories provide a logical foundation for a positive association between financial disclosure transparency and corporate environmental performance (Omran et al., 2021; Saeed et al., 2025).

Prior studies report mixed findings regarding the effect of transparency on environmental performance. Several studies document a positive relationship (Basak & Sana, 2025; Chouaibi et al., 2021; Dagestani et al., 2024; Omran et al., 2021; Oncioiu et al., 2020; Saeed et al., 2025), suggesting that transparent financial and environmental disclosures enhance sustainability outcomes by reducing information asymmetry, strengthening governance quality, and increasing managerial accountability. In contrast, Doan & Sassen (2020) find no significant relationship, indicating empirical inconsistency. These divergent findings suggest the need for further empirical testing, particularly in emerging market settings such as Indonesia.

Gender equality, particularly female representation on corporate boards, has also emerged as a critical dimension of sustainability research. Legitimacy theory posits that gender-diverse boards offer broader strategic perspectives and are more sensitive to social and environmental concerns. Empirical evidence from Asteria et al. (2020), Dash (2025), Doğan & Kirikkaleli (2021), Gergely et al. (2025), Jeevanasai et al. (2023), Lin & Yin (2022), Rahmania et al. (2025), and Sztojkov & Macher (2025) supports a positive association between gender equality and environmental sustainability or green innovation. Nevertheless, some studies report insignificant effects (Wang et al., 2023), indicating that the role of gender equality in shaping environmental performance remains contested. This inconsistency reinforces the importance of examining gender equality within the specific context of Indonesian energy companies.

Recent literature further suggests that gender equality may function not only as an independent determinant but also as a moderating variable. Studies by Almaqtari et al. (2024), Escamilla-Solano et al. (2022), García-Sánchez et al. (2022), and Herghiligiu et al.

(2023) demonstrate that female participation in corporate governance structures can strengthen the relationship between corporate transparency and sustainability performance. This finding aligns with stakeholder theory, which argues that board diversity enhances monitoring effectiveness, decision-making quality, and access to diverse resources. Accordingly, gender equality is expected to amplify the positive effect of financial disclosure transparency on environmental performance. However, empirical evidence on this moderating role remains absent for Indonesian energy sector firms during the 2020–2024 period.

Several research gaps are identified. First, studies on financial disclosure transparency predominantly focus on financial reporting quality and governance outcomes, while limited attention is given to its implications for environmental performance in emerging markets. Second, research examining gender equality as a moderating variable remains scarce, particularly within high environmental risk industries such as the energy sector. Third, no prior study has integrated financial disclosure transparency, gender equality, and environmental performance measured by the PROPER rating into a single moderated framework for Indonesian energy companies during the 2020–2024 period. The 2020–2024 period is critical as it captures the global impact of the COVID-19 pandemic, which heightened demands for transparent financial disclosure and exposed vulnerabilities in corporate governance. It also aligns with accelerated commitments to sustainability and gender equality under frameworks like the SDGs, pushing energy companies to improve environmental performance and inclusivity. Furthermore, this period reflects increasing regulatory pressure and investor scrutiny on ESG practices, making it highly relevant for examining the interplay between transparency, gender equality, and environmental outcomes. These gaps indicate that existing empirical evidence does not adequately capture the institutional and industrial dynamics of Indonesia's energy sector.

Based on the observed phenomena, theoretical foundations, and identified research gaps, this study aims to examine the effect of financial disclosure transparency on environmental performance in Indonesian energy companies, analyze the impact of gender equality on environmental performance, and evaluate whether gender equality moderates the relationship between financial disclosure transparency and environmental performance. This study differs from prior research by employing a financial disclosure transparency measure based on Torchia & Calabrò (2016), utilizing the Indonesia-specific PROPER rating as an indicator of environmental performance, and testing the moderating role of the gender equality index using moderated regression analysis with data from 2020 to 2024. Overall, these findings advance environmental accounting theory by emphasizing the integration of economic, social, and environmental dimensions in corporate reporting, while highlighting the need for firms, managers, regulators, and governments to strengthen ESG reporting, promote gender equality, enhance internal oversight, and implement supportive policies to foster a transparent, inclusive, and sustainability oriented business environment.

Literature review

Legitimacy theory

Legitimacy theory posits that firms seek to maintain social legitimacy among stakeholders by aligning their activities and disclosures with prevailing societal values, norms, and expectations (Escamilla-Solano et al., 2022; García-Sánchez et al., 2022). In the energy sector, which is characterized by a high environmental footprint, firms are expected to demonstrate strong environmental performance to be perceived as operating responsibly (Irman et al., 2025). Transparency, including comprehensive financial disclosure, serves as a legitimacy mechanism through which firms respond to social pressure, meet public expectations, and project an image consistent with sustainability principles (Basak & Sana,

2025; Omran et al., 2021). Greater openness and accountability enhance social acceptance while reducing the risk of conflict with regulators and the public (Chouaibi et al., 2021; Saeed et al., 2025).

Stakeholder theory

Stakeholder theory asserts that firms are accountable not only to shareholders but also to a wide range of stakeholders affected by organizational activities, including governments, local communities, investors, consumers, and environmental institutions (Almaqtari et al., 2024; Oncioiu et al., 2020). Environmental performance represents a key corporate response to stakeholder expectations for cleaner and more sustainable operations (Dagestani et al., 2024; Herghiligiu et al., 2023). Information transparency and female representation on corporate boards play an important role in enhancing oversight and accountability, as they improve decision-making quality and strengthen stakeholder trust in firms' sustainability commitments (Dash, 2025; Gergely et al., 2025).

Financial disclosure transparency

Financial disclosure transparency refers to the completeness, openness, and quality of financial information communicated by firms to the public (Chouaibi et al., 2021; Saeed et al., 2025). Its indicators include stock performance, profitability analysis, business segment reporting, litigation disclosure, intangible assets, productivity, and research and development activities (Torchia & Calabrò, 2016). A high level of transparency provides a more accurate representation of a firm's condition and reflects strong corporate governance practices (Dagestani et al., 2024; Oncioiu et al., 2020). In a sustainability context, financial transparency enhances corporate credibility in disclosing non-financial outcomes, including environmental performance, as stakeholders assess the consistency between financial results and ecological responsibility (Basak & Sana, 2025; Chouaibi et al., 2021; Saeed et al., 2025).

Environmental performance

Environmental performance refers to the extent to which a firm successfully manages the environmental impacts arising from its operational activities (Almaqtari et al., 2024; Jeevanasai et al., 2023). In the Indonesian context, environmental performance is measured using the PROPER rating system, which classifies firms into gold, green, blue, red, and black categories based on standards related to waste management, energy efficiency, resource conservation, and compliance with environmental regulations (Ulupui et al., 2020). Strong environmental performance signals a firm's commitment to sustainable practices and serves as an important benchmark for regulators and the public in assessing responsible operations and long-term sustainability (Chouaibi et al., 2021; Omran et al., 2021).

Gender equality

Gender equality in corporate governance refers to the proportion of female representation within management structures, particularly on corporate boards (Doğan & Kirikkaleli, 2021; Sztojkov & Macher, 2025). Female participation in strategic decision-making is associated with greater diversity of perspectives, stronger ethical sensitivity, and more effective oversight of corporate sustainability policies (Gergely et al., 2025; Lin & Yin, 2022). A higher gender equality index indicates greater opportunities for women to contribute to strategic processes, which in turn positively influences environmental performance, governance effectiveness, and the achievement of sustainability objectives (Asteria et al., 2020; Dash, 2025; Rahmania et al., 2025).

Hypothesis development

Financial disclosure transparency reflects the extent to which firms provide relevant, accurate, and verifiable financial information to the public (Dagestani et al., 2024; Oncioiu et al., 2020). From the perspectives of legitimacy theory and stakeholder theory, transparent firms are more likely to demonstrate accountability and conformity with social norms, including commitments to environmental responsibility (Basak & Sana, 2025; Omran et al., 2021). Transparent financial disclosure signals a firm's willingness to be monitored by investors, regulators, and society, which encourages alignment between environmental performance and the corporate image and legitimacy the firm seeks to maintain (Chouaibi et al., 2021; Saeed et al., 2025). Accordingly, firms with higher levels of information openness are more strongly motivated to manage sustainability issues responsibly, leading to operational strategies that enhance environmental performance (Basak & Sana, 2025; Chouaibi et al., 2021; Saeed et al., 2025).

Prior empirical studies consistently report a positive association between financial disclosure transparency and environmental performance (Basak & Sana, 2025; Chouaibi et al., 2021; Dagestani et al., 2024; Omran et al., 2021; Oncioiu et al., 2020; Saeed et al., 2025). Chouaibi et al. (2021), Omran et al. (2021), and Oncioiu et al. (2020) show that high-quality disclosure in financial and sustainability reports enhances corporate accountability in managing environmental issues. Dagestani et al. (2024) further demonstrate that third-party transparency in environmental disclosure increases financial pressure on firms to maintain stronger environmental practices. Saeed et al. (2025) and Basak & Sana (2025) argue that transparent reporting strengthens incentives to improve environmental performance by fostering investor trust and protecting corporate reputation. With the consistency of these findings, then:

H1: Financial disclosure transparency has a positive effect on environmental performance.

Gender equality in corporate governance, particularly female representation on boards of directors, plays an important role in enhancing firms' sensitivity to social and environmental issues (Dash, 2025; Rahmania et al., 2025). From the perspective of stakeholder theory, female participation introduces more inclusive viewpoints and strengthens corporate accountability toward diverse stakeholder groups, including communities and governments that demand sustainable practices (Lin & Yin, 2022; Sztojckov & Macher, 2025). Legitimacy theory further suggests that firms with higher levels of gender equality have stronger incentives to demonstrate sustainability commitments as part of efforts to secure social legitimacy (Doğan & Kirikkaleli, 2021; Gergely et al., 2025). Female directors are frequently associated with preferences for environmentally responsible policies, more ethical decision-making, and stronger commitment to sustainable development goals (Asteria et al., 2020; Rahmania et al., 2025). Accordingly, greater gender equality is expected to encourage firms to prioritize environmental management (Dash, 2025; Jeevanasai et al., 2023).

Empirical evidence consistently supports a positive relationship between gender equality and environmental performance (Asteria et al., 2020; Dash, 2025; Doğan & Kirikkaleli, 2021; Gergely et al., 2025; Jeevanasai et al., 2023; Lin & Yin, 2022; Rahmania et al., 2025; Sztojckov & Macher, 2025). Asteria et al. (2020) show that female involvement enhances the effectiveness of environmental conservation programs in urban settings. Doğan & Kirikkaleli (2021) and Jeevanasai et al. (2023) demonstrate that gender equality in education and participation significantly contributes to environmental sustainability across countries. Lin & Yin (2022) further argue that gender equality strengthens green innovation, which in turn improves environmental performance. Findings from Gergely et al. (2025) and Sztojckov & Macher (2025) indicate that firms and countries with higher gender equality

achieve superior ESG performance, including environmental outcomes. With the consistency of these findings, then:

H2: Gender equality has a positive effect on environmental performance.

Higher financial disclosure transparency enables firms to present more accurate, relevant, and auditable information regarding their financial activities and sustainability practices (Herghiligi et al., 2023). Such transparency generates legitimacy pressure from stakeholders, requiring firms to demonstrate not only financial performance but also a credible commitment to environmental performance (García-Sánchez et al., 2022). However, the effectiveness of transparency is often shaped by internal firm characteristics, including gender equality policies and practices (Escamilla-Solano et al., 2022). Firms with stronger commitments to gender equality tend to adopt more inclusive, accountable, and sustainability-oriented governance cultures (Almaqtari et al., 2024). In this context, gender equality strengthens the relationship between financial disclosure transparency and environmental performance by fostering broader perspectives, ethical judgment, and more responsible decision-making on environmental issues (Almaqtari et al., 2024; Herghiligi et al., 2023).

Prior empirical studies provide evidence that gender equality moderates the relationship between financial disclosure transparency and environmental performance (Almaqtari et al., 2024; Escamilla-Solano et al., 2022; García-Sánchez et al., 2022; Herghiligi et al., 2023). Almaqtari et al. (2024) show that gender diversity, particularly at the board level, enhances the effectiveness of sustainability governance and strengthens the link between environmental practices and firm performance. Herghiligi et al. (2023) further demonstrate that financial transparency and gender equality jointly improve corporate sustainability outcomes, including environmental performance. Similarly, Escamilla-Solano et al. (2022) and García-Sánchez et al. (2022) find that firms with stronger gender equality commitments exhibit higher disclosure quality and greater responsiveness to stakeholder demands. Collectively, this evidence suggests that gender equality amplifies the positive effect of financial disclosure transparency on environmental performance through more participatory, ethical, and sustainability-oriented governance mechanisms (Almaqtari et al., 2024; Escamilla-Solano et al., 2022). With the consistency of these findings, then:

H3: Gender equality moderates the relationship between financial disclosure transparency and environmental performance.

Based on theoretical foundations and prior empirical studies, the relationships among financial disclosure transparency, environmental performance, and gender equality are illustrated in Figure 1:

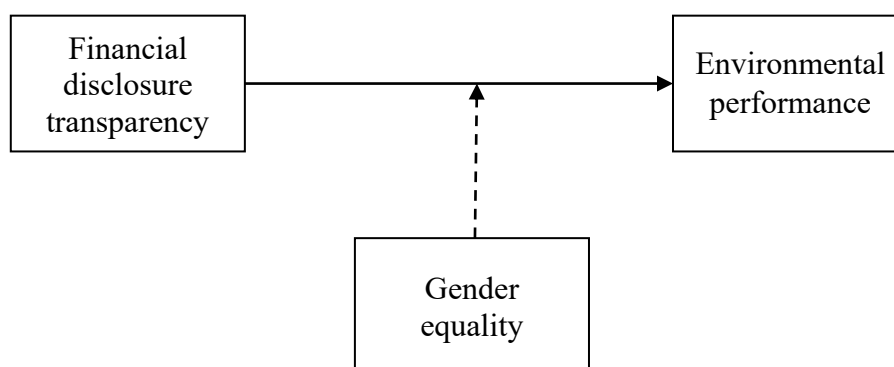


Figure 1. Research framework

Method

This study adopts a quantitative approach to examine the causal relationships among financial disclosure transparency, gender equality, and environmental performance in Indonesian energy sector companies. The sample includes energy companies listed on the Indonesia Stock Exchange during the 2020 to 2024 period, selected using purposive sampling based on the availability of annual reports, sustainability reports, and complete data on financial disclosure transparency, board gender composition, and environmental performance measured by the PROPER rating. A quantitative research design is employed to test hypotheses using numerical data and to assess interaction effects through a moderated regression analysis model. The empirical equations used to test the hypotheses are presented below.

$$EP = \alpha + \beta_1 FDT \dots\dots\dots(1)$$

$$EP = \alpha + \beta_1 FDT + \beta_2 GE + \beta_3 FDT * GE \dots\dots\dots(2)$$

The energy sector is selected due to its high emission intensity and significant environmental impact, which necessitate strong financial disclosure transparency and effective corporate governance to improve environmental performance. This sector is also a primary target of the PROPER evaluation conducted by the Ministry of Environment and Forestry. Data are obtained from annual reports, sustainability reports, and official PROPER publications. The study variables include financial disclosure transparency, gender equality, and environmental performance, with observations structured as firm-level panel data over a five-year period.

Table 1. Research sample selection

Research Sample Selection	Amount
Companies classified in the energy sector based on IDX classification (2020–2024)	75
Energy sector companies conducting IPOs after 1 January 2020	(18)
Energy sector companies under IDX suspension (2020–2024)	(21)
Energy sector companies lacking complete financial and environmental records (2020–2024)	(2)
Number of sampled firms	34
Study period (2020–2024)	5 years
Observation count (34 × 5)	170

Source: Data processed, 2025

This study uses secondary panel data obtained from official sources, including the Indonesia Stock Exchange, corporate annual and sustainability reports, and PROPER assessments issued by the Ministry of Environment and Forestry. Environmental performance (EP) serves as the dependent variable and is measured using the PROPER score, converted into a numerical scale ranging from 1 to 5, where gold equals 5, green equals 4, blue equals 3, red equals 2, and black equals 1 (Ulupui et al., 2020). The independent variable is financial disclosure transparency (FDT), measured using thirteen financial transparency indicators developed by Torchia & Calabrò (2016), covering stock performance, disclosure of strategic actions, non-mandatory profitability analysis, business unit information, intangible assets, economic value added, productivity, litigation, research and development activities, market share, brand or patent information, supplier cost calculations, and project costs. Gender equality (GE) is included as a moderating variable and is measured as the percentage of female directors on the board, calculated as the number of female directors divided by the total number of directors multiplied by 100 percent (Blommaert & van den Brink, 2020).

Data analysis is conducted using moderated regression analysis to examine the moderating role of gender equality in the relationship between financial disclosure transparency and environmental performance. The analysis is performed using EViews and begins with descriptive statistics to assess data characteristics and variable distributions. The most appropriate panel data regression model is selected through a series of tests, including the Chow test to compare the common effects and fixed effects models, the Hausman test to distinguish between fixed effects and random effects models, and the Breusch–Pagan Lagrange Multiplier test to determine whether the random effects model is preferable to the common effects model. After selecting the optimal model, classical assumption tests are conducted, including multicollinearity, heteroskedasticity, and autocorrelation tests, to ensure model robustness.

The moderated regression model is estimated by including the interaction term between financial disclosure transparency and gender equality ($FDT \times GE$) to test the third hypothesis. Two regression specifications are employed in EViews: a baseline model without the interaction term to test H1 and H2, and a moderated regression analysis model to test H3. Regression results are evaluated using coefficient estimates and p-value at a 5 percent significance level. A statistically significant interaction coefficient indicates that gender equality strengthens or weakens the effect of financial disclosure transparency on environmental performance.

Results and discussion

In Table 2, financial disclosure transparency, measured using thirteen indicators following Torchia & Calabrò (2016), has a mean value of 7.45, indicating that firms disclose approximately 57 percent of the total financial transparency indicators on average. The minimum value of 3.00 reflects firms with relatively low disclosure levels, while the maximum value of 12.00 indicates highly comprehensive financial disclosure practices. A standard deviation of 2.10 suggests substantial variation in transparency levels across firms.

Environmental performance has a mean score of 3.12, indicating that firms on average fall within the blue PROPER category, which reflects compliance with minimum environmental management standards. The maximum score of 5.00 corresponds to firms achieving the gold rating. The standard deviation of 0.84 indicates a moderate level of variation in environmental performance among energy sector firms.

Gender equality, measured as the percentage of female directors on corporate boards, has a mean value of 18.35 percent, suggesting that female representation in leadership positions remains relatively low in the energy sector. However, this level of representation appears to be sufficient to significantly moderate the impact of financial disclosure transparency on environmental performance. The minimum value of 0 percent indicates firms with no female board representation, while the maximum value of 25 percent reflects relatively high female participation in a small number of firms. A standard deviation of 12.80 highlights considerable variation in gender equality across firms.

Table 2. Descriptive statistics

Variable	N	Mean	Minimum	Maximum	Std. Dev.
Financial disclosure transparency	170	7.450	3.000	12.000	2.100
Environmental performance	170	3.120	0.000	5.000	0.840
Gender equality	170	18.350	0.000	25.000	12.800

Source: Data processed, 2025

In Table 3, the Chow and Hausman tests were conducted to identify the most appropriate panel data model. The Chow test indicates that the Fixed Effects Model outperforms the Common Effects Model. The Hausman test further shows that the Random Effects Model is inferior to the Fixed Effects Model, with a p-value below 0.05. Accordingly, the Fixed Effects Model is selected for subsequent analysis, as it effectively captures unobserved firm specific characteristics that remain constant over time. The coefficient of financial disclosure transparency is positive and significant at 0.158, indicating that higher disclosure transparency is associated with improved environmental performance. Gender equality also exhibits a positive and significant coefficient of 0.061, suggesting that greater female representation on corporate boards enhances environmental performance. Moreover, the interaction term between financial disclosure transparency and gender equality is positive and significant at 0.013, indicating that gender equality strengthens the effect of financial disclosure transparency on environmental performance.

Table 3. Empirical results of panel regression model

DV: EP	CEM		FEM*		REM	
	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
FDT	0.124**	(0.028)	0.158**	(0.022)	0.137**	(0.026)
GE	0.042*	(0.017)	0.061**	(0.014)	0.049*	(0.016)
FDT × GE	0.009*	(0.004)	0.013**	(0.003)	0.011**	(0.004)
R Square	0.612		0.884		0.701	
Adjusted R ²	0.594		0.867		0.683	
F-statistic	4.982		11.532		6.214	
Prob(F-statistic)	0.003		0.000		0.001	

Note: (*)The Fixed Effects Model (FEM) is selected as the optimal empirical specification according to the results of the model selection procedures. Significance thresholds are indicated as **p < 0.05 and *p < 0.10.

Source: Data processed, 2025

In Table 4, the Chow test yields an F statistic of 7.42 with a p-value of 0.000, leading to the rejection of the null hypothesis and indicating that the Fixed Effects Model is more appropriate than the Common Effects Model. This result confirms that firm specific heterogeneity is statistically significant and should be accounted for in the estimation. The Hausman test reports a chi square value of 9.85 with a p-value of 0.002, resulting in the rejection of the null hypothesis and indicating a significant correlation between the individual effects and the explanatory variables. Accordingly, the Fixed Effects Model is preferred over the Random Effects Model. The Lagrange Multiplier test produces a chi square value of 5.62 with a p-value of 0.018, suggesting that the Random Effects Model is superior to the Common Effects Model. However, because the Hausman test favors the Fixed Effects Model, it is retained as the final specification. Although the Lagrange Multiplier test indicates the presence of random effects, the significant correlation identified by the Hausman test supports the Fixed Effects Model as the most appropriate specification for this study.

Table 4. Panel data model comparison and selection results

Comparison Objective	Test Applied	Statistic	p-value	Preferred Model
Common Effect vs Fixed Effect	Chow Test	F = 7.42	0.000	Fixed Effect Model

Fixed Effect vs Random Effect	Hausman Test	Chi-Square = 9.85	0.002	Fixed Effect Model
Common Effect vs Random Effect	Lagrange Multiplier Test	Chi-Square = 5.62	0.018	Random Effect Model

Source: Data processed, 2025

In Table 5, multicollinearity was assessed using the Variance Inflation Factor. All variables exhibit VIF values ranging from 1.411 to 1.964, well below the threshold of 10, indicating the absence of multicollinearity. Financial disclosure transparency, gender equality, the interaction term, and environmental performance are not excessively correlated. Heteroskedasticity was examined using the Glejser test. The results show p-value of 0.217 for all variables, exceeding the 0.05 significance level, which indicates homoskedastic residuals. Autocorrelation was evaluated using the Durbin Watson statistic. The value of 2.068 is close to the ideal value of 2, suggesting no serial correlation in the regression residuals.

Table 5. Classical assumption test results

Test Type	Variable	Test Statistic	Decision Criterion	Conclusion
Multicollinearity (VIF)	Financial Disclosure Transparency	1.842	VIF < 10	No multicollinearity
	Gender Equality	1.527	VIF < 10	No multicollinearity
	Interaction Term (FDT × GE)	1.964	VIF < 10	No multicollinearity
	Environmental Performance	1.411	VIF < 10	No multicollinearity
Heteroskedasticity (Glejser Test)	All variables	p = 0.217	p-value > 0.05	No heteroskedasticity
Autocorrelation (Durbin-Watson)	All variables	2.068	DW ≈ 2	No autocorrelation

Source: Data processed, 2025

The results of Model 1 indicate that financial disclosure transparency has a positive and significant effect on environmental performance. Gender equality also exhibits a positive and significant effect on environmental performance. In Model 2, the interaction term between financial disclosure transparency and gender equality is significant, indicating that gender equality strengthens the effect of financial disclosure transparency on environmental performance.

Table 6. Regression output

DV: EP	Fixed Effects Regression Results (Robust Standard Errors)
FDT	0.158** (0.022)
GE	0.061** (0.014)
FDT × GE	0.013** (0.003)

R Square	0.884
Adjusted R ²	0.867
F-statistic	11.532
Prob(F-statistic)	0.000

**p < 0.05

Source: Data processed, 2025

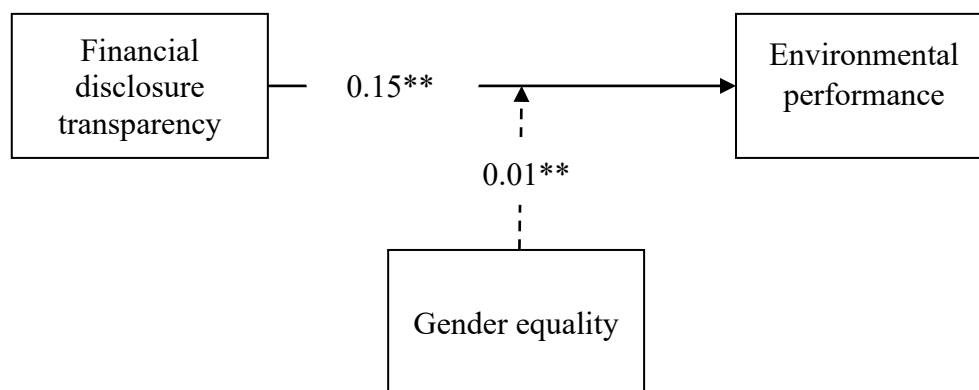


Figure 2. Research model
Source: Data processed, 2025

The Effect of Financial Disclosure Transparency on Environmental Performance

Table 6 show that financial disclosure transparency has a positive and statistically significant effect on environmental performance ($p < 0.05$), indicating that energy companies with higher levels of financial transparency tend to achieve superior environmental performance as reflected in higher PROPER scores. This finding is consistent with prior studies by Basak & Sana (2025), Chouaibi et al. (2021), Dagestani et al. (2024), Omran et al. (2021), Oncioiu et al. (2020), and Saeed et al. (2025). Comprehensive financial disclosures covering stock performance, profitability structure, productivity, litigation risk, and R&D activities signal stronger corporate governance and facilitate more effective sustainability strategies and environmental management. From the perspective of legitimacy theory, enhanced financial transparency helps energy firms demonstrate accountability and ethical conduct, thereby strengthening social legitimacy in an industry characterized by high environmental risk. In line with stakeholder theory, transparent financial reporting increases external scrutiny by investors, regulators, communities, and environmental groups, intensifying pressure to manage environmental risks responsibly. Consequently, financial disclosure transparency functions as a governance mechanism that reinforces accountability and motivates firms to improve environmental performance.

The Effect of Gender Equality on Environmental Performance

Table 6 indicates that gender equality has a positive and statistically significant effect on environmental performance ($p < 0.05$), suggesting that firms with a higher proportion of female directors achieve superior environmental outcomes. This finding is consistent with prior studies (Asteria et al., 2020; Dash, 2025; Doğan & Kirikkaleli, 2021; Gergely et al., 2025; Jeevanasai et al., 2023; Lin & Yin, 2022; Rahmania et al., 2025; Sztojkov & Macher, 2025). From the perspective of legitimacy theory, greater female representation enhances corporate legitimacy by signaling inclusive, ethical, and socially responsible governance, which encourages firms to strengthen environmental protection efforts to maintain social approval. From a stakeholder theory perspective, gender diverse boards are more attentive to

the expectations of multiple stakeholder groups and more sensitive to long term environmental risks, leading to stronger oversight, more responsible decision making, and improved compliance with environmental responsibilities.

The Moderating Effect of Gender Equality on the Relationship between Financial Disclosure Transparency and Environmental Performance

Table 6 shows that the interaction between financial disclosure transparency and gender equality has a positive and statistically significant effect on environmental performance ($p < 0.05$), indicating that gender equality functions as a strengthening moderator. This result supports prior evidence that board gender diversity enhances the effectiveness of transparency in driving sustainability outcomes (Almaqtari et al., 2024; Escamilla-Solano et al., 2022; García-Sánchez et al., 2022; Herghiligiu et al., 2023). From a legitimacy theory perspective, financial transparency signals corporate accountability, while gender diverse boards enhance the credibility of this signal by ensuring that disclosed commitments are translated into substantive environmental actions, thereby strengthening social legitimacy. Consistent with stakeholder theory, female representation on boards improves governance oversight and increases firms' responsiveness to stakeholder demands related to environmental protection, including those of regulators, local communities, and the public. Accordingly, the combined presence of high financial disclosure transparency and gender equality promotes more effective governance and leads to superior environmental performance.

Conclusions

The empirical results show that financial disclosure transparency positively and significantly influences environmental performance, indicating that greater transparency enhances corporate accountability and environmental outcomes. Gender equality also positively affects environmental performance, suggesting that gender-diverse leadership fosters more effective environmental decision-making. Moreover, gender equality significantly moderates the relationship between financial disclosure transparency and environmental performance, strengthening the beneficial impact of transparency. These findings highlight that companies with higher transparency and a commitment to social and environmental sustainability gain greater stakeholder trust. Integrating gender and environmental governance further enhances corporate governance mechanisms and reduces the potential for opportunistic managerial practices, demonstrating that modern sustainability and governance practices are critical determinants of firm performance and competitiveness in the energy sector.

Policy implications emphasize the role of regulators, such as the Financial Services Authority and the Indonesia Stock Exchange, in expanding sustainability reporting standards, enforcing ESG disclosure requirements, and promoting gender equality programs at the managerial level. Governments can also incentivize environmentally responsible practices through tax relief or preferential access to green financing. Stronger, measurable policies can foster a more transparent, inclusive, and sustainability-oriented business ecosystem. This study is limited by its focus on the energy sector, which may constrain the generalizability of the findings to other industries. Future research should expand the scope by including moderators such as audit quality, ownership structure, or digital environmental reporting to examine inter-variable relationships more comprehensively. Extending the observation period, including additional industry sectors, or applying dynamic panel and variance-based SEM methods could further capture complex causal relationships between governance and sustainability performance.

References

- Almaqtari, F. A., Elmashtawy, A., Farhan, N. H. S., Almasria, N. A., & Alhajri, A. (2024). The Moderating Effect of Board Gender Diversity in the Environmental Sustainability and Financial Performance Nexus. *Discover Sustainability*, 5(1), 1–29. <https://doi.org/10.1007/s43621-024-00517-7>
- Asteria, D., Negoro, H., & Soedrajad, M. (2020). Gender Equality for Women Involvement in Urban Environmental Preservation. *E3S Web of Conferences*, 211, 1–9. <https://doi.org/10.1051/e3sconf/202021101020>
- Basak, S., & Sana, A. (2025). Relationship Between Environmental Reporting Practices and Financial Performance of Some Select Companies in the USA: An Empirical Study. *International Journal of Management and Human Sciences*, 9(1), 38–50. <https://doi.org/10.31674/ijmhs.2025.v09i01.004>
- Blommaert, L., & van den Brink, M. (2020). Gender Equality in Appointments of Board Members: The Role of Multiple Actors and their Dynamics. *European Management Review*, 17(3), 633–647. <https://doi.org/10.1111/emre.12381>
- Chouaibi, S., Rossi, M., Siggia, D., & Chouaibi, J. (2021). Exploring the Moderating Role of Social and Ethical Practices in the Relationship Between Environmental Disclosure and Financial Performance: Evidence from ESG Companies. *Sustainability*, 14, 1–18. <https://doi.org/10.3390/su14010209>
- Dagestani, A. A., Alnafrah, I., Ding, C. J., & Qing, L. (2024). Beyond Transparency: Unpacking the Financial Effects of Third-Party Environmental Disclosure in China's Semiconductor Sector. *Journal of Environmental Management*, 360, 1–15. <https://doi.org/10.1016/j.jenvman.2024.121237>
- Dash, P. (2025). The Role of Gender Equality in Advancing Sustainable Development: Intersections of Equity and Diversity in Building Inclusive Societies. *Communications on Applied Nonlinear Analysis*, 32(1), 1466–1474. <https://doi.org/10.52783/cana.v32.5171>
- Doan, M. H., & Sassen, R. (2020). The Relationship Between Environmental Performance and Environmental Disclosure: A Meta-Analysis. *Journal of Industrial Ecology*, 24(5), 1140–1157. <https://doi.org/10.1111/jiec.13002>
- Doğan, N., & Kirikkaleli, D. (2021). Does Gender Equality in Education Matter for Environmental Sustainability in Sub-Saharan Africa? *Environmental Science and Pollution Research*, 28(29), 39853–39865. <https://doi.org/10.1007/s11356-021-13452-1>
- Escamilla-Solano, S., Paule-Vianez, J., & Blanco-González, A. (2022). Disclosure of Gender Policies: Do They Affect Business Performance? *Heliyon*, 8, 1–8. <https://doi.org/10.1016/j.heliyon.2022.e08791>
- García-Sánchez, I.-M., Minutiello, V., & Tettamanzi, P. (2022). Gender Disclosure: The Impact of Peer Behaviour and the Firm's Equality Policies. *Corporate Social Responsibility and Environmental Management*, 29(2), 385–405. <https://doi.org/10.1002/csr.2207>
- Gergely, B. K., Sipos, D., & Zseni, A. (2025). Comparative Analysis of the Role of Gender Equality in Environmental, Social, and Governance Performance Across Belgium, Denmark, Luxembourg, and Hungary. *9th FEB International Scientific Conference: Sustainable Management in the Age of ESG and AI: Navigating Challenges and Opportunities*, 9, 489–498. <https://doi.org/10.18690/um.epf.5.2025.45>
- Herghiligiu, I. V., Robu, I.-B., Istrate, M., Grosu, M., Mihalcu, C. C., & Vilcu, A. (2023). Sustainable Corporate Performance Based on Audit Report Influence: An Empirical Approach through Financial Transparency and Gender Equality Dimensions. *Sustainability*, 15(18), 1–29. <https://doi.org/10.3390/su151814033>

- Irman, M., Rahman, S., & Wati, Y. (2025). Do Macroeconomic and Green Factors Influence Stock Returns in Indonesia? *Etikonomi*, 24(2), 441–458. <https://doi.org/10.15408/etk.v24i2.43614>
- Jeevanasai, A. S., Saole, P., Rath, A. G., Singh, S., Rai, S., & Kumar, M. (2023). Shades & Shines of Gender Equality with Respect to Sustainable Development Goals (SDGs): The Environmental Performance Perspectives. *Total Environment Research Themes*, 8, 1–16. <https://doi.org/10.1016/j.totert.2023.100082>
- Lin, X., & Yin, H. (2022). The Impact of Gender Equality on Green Innovation. *Energy Research Letters*, 4(3), 1–5. <https://doi.org/10.46557/001c.36536>
- Omran, M. S. Y., Zaid, M. A. A., & Dwekat, A. (2021). The Relationship Between Integrated Reporting and Corporate Environmental Performance: A Green Trial. *Corporate Social Responsibility and Environmental Management*, 28(1), 427–445. <https://doi.org/10.1002/csr.2059>
- Oncioiu, I., Popescu, D., Aviana, A.-E., Șerban, A., Rotaru, F., Petrescu, M., & Marin-Pantelescu, A. (2020). The Role of Environmental, Social, and Governance Disclosure in Financial Transparency. *Sustainability*, 12, 1–16. <https://doi.org/10.3390/su12176757>
- Rahmania, T., Kertamuda, F., & Wulandari, S. S. (2025). Analysis of the Relationship Between Gender Equality, Energy Consumption Patterns, and Environmental Sustainability Impact in Indonesia. *Journal of Information Systems Engineering and Management*, 10(17), 413–435. <https://doi.org/10.52783/jisem.v10i17s.2747>
- Saeed, M. M., Mohammed, S. S., Kumari, M., & Pandey, G. (2025). The Impact of Corporate Environmental Reporting on the Financial Performance of Listed Manufacturing Firms in Ghana (Csr-24-2036). *Corporate Social Responsibility and Environmental Management*, 32(1), 1230–1244. <https://doi.org/10.1002/csr.3015>
- Sztojkov, D., & Macher, G. (2025). Gender Equality and the ESG Performance: An Index-Based Comparative Analysis of Hungary, Czechia, Poland, and Spain With a Focus on the Gender Pay Gap. *9th FEB International Scientific Conference: Sustainable Management in the Age of ESG and AI: Navigating Challenges and Opportunities*, 9, 385–394. <https://doi.org/10.18690/um.epf.5.2025.36>
- Torchia, M., & Calabrò, A. (2016). Board of Directors and Financial Transparency and Disclosure. Evidence from Italy. *Corporate Governance*, 16(3), 593–608. <https://doi.org/10.1108/CG-01-2016-0019>
- Ulupui, I. G. K. A., Murdayanti, Y., Marini, A. C., Purwohedi, U., Mardia, M., & Yanto, H. (2020). Green Accounting, Material Flow Cost Accounting and Environmental Performance. *Accounting*, 6, 743–752. <https://doi.org/10.5267/j.ac.2020.6.009>