The Effect of Environmental Performance and CEO Gender on Carbon Emission Disclosure in the Basic Materials Sector Listed on the Indonesia Stock Exchange for the 2022 - 2024 Period

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Article Info	Abstract
  	Purpose – *This study aims to obtain empirical evidence on the effect of environmental performance and CEO gender on carbon emission disclosure.* ***Design/methodology/approach –*** *This study uses quantitative research. The sample in this study consists of 66 companies in the basic materials sector listed on the Indonesia Stock Exchange from 2022 - 2024. The analysis technique used to test the hypothesis is multiple regression analysis using Eviews9 software.* ***Findings –****The results of this study indicate that the environmental performance variable has a positive and is statistically insignificant effect on carbon emissions disclosure. The CEO gender variable has a positive and is statistically insignificant effect on carbon emissions disclosure. These findings suggest that improving environmental performance and CEO gender differences are not sufficient to significantly encourage carbon emission conservation practices, which are largely voluntary in Indonesia.* ***Research limitations/implications –*** *his study aims to provide practical empowerment for regulators such as the Financial Services Authority (OJK) and the Indonesia Stock Exchange (IDX), highlighting the need for more standardized and mandatory carbon emission regulations, particularly for environmentally sensitive sectors. It also provides information on carbon emission distribution that can be useful in decision-making and serve as a reference for further research.* ***JEL :*** *Q56, M14, and G34*

INTRODUCTION

The basic materials sector comprises companies that provide products and/or services in the form of raw materials used by other industries to produce final goods. The main activities

of companies in this sector generally include mining, processing, and distribution of raw materials, which include chemicals, construction materials, containers and packaging, metals and minerals, as well as forestry and paper (Kayo, 2023). The continued growth of the basic materials sector contributes positively to the national economy, but on the other hand, it has the potential to negatively impact the environment due to the high use of fossil-based energy, which produces carbon emissions and greenhouse gases that cause climate change.

Compared to other sectors, companies in the basic materials sector have a relatively higher and more consistent level of carbon emission disclosure. Data for the 2022–2024 period shows that the level of carbon emission disclosure in the basic materials sector consistently exceeds that of the financials sector. This reflects the high pressure from regulators, investors, and the public on companies whose operational activities have a direct impact on the environment, as well as increasing awareness among companies of the importance of transparency and the application of Environmental, Social, and Governance (ESG) principles. However, carbon emissions disclosure in Indonesia is still voluntary, meaning that not all companies report adequate carbon emissions information. Several cases show low quality of environmental disclosure, particularly in basic materials companies with high environmental risks (Pramuditya & Budiasih, 2020). Although the government has ratified the Paris Agreement, as stipulated in Presidential Regulation No. 71 of 2011 and Law No. 16 of 2016, with a target of reducing emissions by 41% by 2030, carbon emissions reporting in Indonesia is currently voluntary. This creates a gap in the quality of disclosure between companies. This research is crucial for providing practical input to regulators, such as the Financial Services Authority (OJK), in developing more standardized emissions reporting policies (Septriyawati & Anisah, 2019).

Factors that can influence Carbon Emission Disclosure are Environmental Performance, according to (Meiryani et al., 2023) Environmental Performance is a measure of a company's performance in preserving the environment and creating a good environment. Transparent disclosure information will be fulfilled by businesses that invest in environmental performance management because it is reliable for stakeholders. Companies with good environmental performance will provide information on their environmental performance in the form of carbon emission disclosure. This is consistent with research conducted by (Dani & Harto, 2022; Priliana & Ermaya, 2023), which states that Environmental Performance has a positive effect on Carbon Emission Disclosure. However, this is in contrast to research by (Retnowati & Cahyani Putri, 2024), which states that Environmental Performance has a negative effect on Carbon Emission Disclosure.

Another finding from research conducted by (Harjito & Sutopo, 2024) states that Carbon Emission Disclosure arises due to the influence of leadership roles involving gender. Female CEOs have more dominant power in implementing earnings management practices compared to companies with male CEOs. In addition, compensation and reputation for tenure can also be factors in earnings management practices influenced by CEOs. Companies with boards of directors that have gender and national diversity are expected to successfully implement carbon emission reduction practices and communicate their activities to stakeholders. This is consistent with research conducted by (Harjito & Sutopo, 2024; Meiryani et al., 2023), which states that CEO gender has a positive effect on Carbon Emission Disclosure. However, this

contrasts with research by (Isyiana & Inawati, 2025), which states that CEO gender has a negative effect on carbon emission disclosure. This study aims to review, analyze and obtain empirical evidence regarding 1) The influence of environmental performance on carbon emission disclosure. 2) The influence of CEO gender on carbon emission disclosure in the Basic Materials Sector Listed on the Indonesia Stock Exchange for the 2022 - 2024 Period.

LITERATUR REVIEW

Legitimacy Theory

(Dowling & Pfeffer, 1975) created the theory of organizational legitimacy, focusing on the interaction between companies and society. According to this theory, society is considered a key element in the long-term development of a company. Companies strive to gain legitimacy and strengthen their relationships with the social environment in which they operate. If society does not accept the legitimacy of a company due to violations of previously established rules, the company is required to comply with these rules in order to maintain its legitimacy. Therefore, compliance with regulations is essential to maintain the smooth operation of the company.

Upper Echelon Theory

(Hambrick & Mason, 1984) created the Upper Echelon Theory to explain that the strategies adopted by companies are entirely determined by top management. Their role in company performance and the results achieved by the company are also determined by top management. This theory emphasizes that the characteristics and experiences of executives influence how they view situations, make strategic decisions, and take action within the organization (Bromiley & Rau, 2016). CEO gender reflects differences in risk preferences, ethical orientation, and decision-making styles, which may influence corporate policies regarding environmental transparency.

Stakeholder Theory

(Freeman, 1984) created Stakeholder Theory to explain the relationship between organizations and various groups that have an interest in them. This theory states that employee contributions to the company can be influenced by company activities. The main objective of stakeholder theory is to assist management in increasing company value as a result of various activities and minimizing any negative consequences that may arise for stakeholders.

Environmental Performance

(Sudarmanto et al., 2024) states that Environmental Performance refers to a company's operational activities that incorporate elements of control and monitoring to ensure that the environment remains clean and sustainable. Environmental Performance refers to how effectively a company or organization manages and reduces the negative impact of its operations on the environment. This includes various measures, strategies, and practices adopted by companies to ensure that their business activities not only comply with applicable environmental regulations but also contribute positively to overall environmental sustainability (Aurora et al., 2024).

CEO Gender

(Suharnanik, 2023) states that gender is a social construct that encompasses roles, behaviors, identities, and expectations associated with a particular sex in a society. Each society has different norms and values in defining gender, but generally gender is used to divide humans into male or female, and to define different roles and expectations for each sex. The Chief Executive Officer (CEO) plays an important role in corporate governance and influences investor investment decisions. In general, men and women have different positions in decision-making related to social responsibility, especially regarding sustainability (Isyiana & Inawati, 2025).

Carbon Emission Disclosure

(Widarjo et al., 2024) state that the distribution of carbon emissions is information that can be disclosed and can serve as a reference for investors, where a company's low investment risk will result in a relatively low cost of equity. In Indonesia, the distribution of carbon emissions by companies is still voluntary. In facing the challenges of climate change, companies are required to report information related to activities that impact climate conditions, including reporting carbon emissions. One of the main sources of carbon emissions comes from company operations. Therefore, disclosing carbon emissions is an important means for companies to demonstrate transparency, accountability, and commitment to sustainable business practices, while also gaining legitimacy from stakeholders amid increasing demands for corporate environmental responsibility.

Hypotheses development

Environmental Performance reflects a company's responsibility in managing the impact of its operational activities on the environment. Companies with good environmental performance tend to be more proactive in disclosing carbon emission information as a form of accountability to stakeholders. Based on legitimacy theory, carbon emission disclosure is used by companies to gain social legitimacy by demonstrating compliance with applicable environmental values, norms, and regulations. This is in line with research showing that Environmental Performance has a positive effect on Carbon Emission Disclosure (Dani & Harto, 2022; Priliana & Ermaya, 2023). Based on the above explanation, the researchers formulated the following hypothesis:

H$_1$: Environmental Performance has a positive effect on Carbon Emission Disclosure.

CEOs play a strategic role in managing companies, including in decision-making related to environmental issues. One characteristic of CEOs that has an influence is gender. Gender diversity in company management can affect information disclosure, particularly related to carbon emissions. Based on Upper Echelon Theory, it shows that a company's board of directors plays an important role because it influences the choices and decisions made by the company. This theory considers gender to be an important construct to explore in the context of carbon emission disclosure. This is in line with research showing that CEO gender has a positive effect on carbon emission disclosure (Harjito & Sutopo, 2024; Meiryani et al., 2023). Based on the above explanation, the researchers formulated the following hypothesis:

H$_2$: CEO gender has a positive effect on carbon emission disclosure.

RESEARCH METHOD

This study aims to examine the relationship between the independent variables, namely Environmental Performance and CEO Gender, and the dependent variable Carbon Emission Disclosure. This study uses panel data regression testing. There are three models that can be used to estimate model parameters with panel data, namely the Common Effect Model (CEM), Fixed Effect Model (FEM-Covariance Model), and Random Effect Model (REM). Model selection tests are used to determine the best model among the three regression models, namely the Common Effect Model, Fixed Effect Model, and Random Effect Model. The tests used include the Chow test and Lagrange Multiplier test. To test the hypothesis, this study uses the coefficient of determination test and the t-test.

Table 1. Variable measuring instruments and sources of measurement

No	Type	Variable	Measurement	Source
1	Independent Variables	Environmental Performance	$GRI\ 300 = \dfrac{n}{k}$ Description: n: number of items disclosed by the company k: number of items required by GRI 300	(Retnowati & Cahyani Putri, 2024)
2		CEO Gender	Dummy Variable, with the following criteria: Score 1: if the CEO is female Score 0: if the CEO is male	(Isyiana & Inawati, 2025)
3	Dependent Variable	Carbon Emission Disclosure	$CED = \dfrac{\Sigma di}{M}\ x\ 100\%$ Description: CED = Carbon Emission Disclosure Σdi = Total overall score 1 obtained by the company M = Maximum total items that can be disclosed	(Almuaromah & Wahyono, 2022)

Source: Data processed by the author (2025)

Based on the established criteria, 66 companies out of 114 companies in the industrial sector were eligible for this study over a period of 3 years and the number of observations was obtained as many as 198 data observations. The technique used in this study was non-probability sampling. Non-probability sampling is a sampling method that basically uses certain considerations used by researchers. The type of non-probability sampling used was purposive sampling. Purposive sampling is a sampling method that selects sample members from a population determined subjectively by the researcher.

This study used secondary data, with the data sources used in this study obtained from the financial reports of industrial sector companies listed on the Indonesia Stock Exchange for the period 2022–2024, obtained from www.idx.co.id. In obtaining data for this study, two techniques were used, namely literature research and field research. 1) Literature Research, the researcher obtained data related to the issue being studied through previous research journals, books, and the internet related to the research theme. 2) Field Research, the type of data used

in this study was secondary data. The research was conducted on basic materials sector companies listed on the Indonesia Stock Exchange for the period 2022–2024, whose financial data had been published and audited by public accountants and published in full on the Indonesia Stock Exchange.

RESULTS

Table 2. Descriptive Test Results

	EP	GENDER	CED
Mean	0.553131	0.398990	0.630303
Median	0.560000	0.000000	0.610000
Maximum	0.930000	1.000000	0.940000
Minimum	0.070000	0.000000	0.330000
Std. Dev.	0.190514	0.490932	0.130858
Skewness	-0.235188	0.412547	0.086036
Kurtosis	2.740286	1.170195	2.497285
Jarque-Bera	2.381812	33.23897	2.329237
Probability	0.303946	0.000000	0.312042
Sum	109.5200	79.00000	124.8000
Sum Sq. Dev.	7.150259	47.47980	3.373382
Observations	198	198	198

EP: Environmental Performance, GENDER: CEO Gender,
CED: Carbon Emission Disclosure
Source : Output Eviews9 (2025)

Selection of the Best Panel Data Model

Chow Test
The criteria for making Chow test decisions are as follows:
1. If the probability (Prob) on Cross Section F < 0.05 then a better model is Fixed effect.
2. If the probability (Prob) on Cross Section F > 0.05 then a better model is Common effect.

Table 3. Chow Test

Effects Test	Statistic	d.f.	Prob.
Cross-section F	1.138709	(65,129)	0.2643
Cross-section Chi-square	89.787590	65	0.0226

Source : Output Eviews9 (2025)

Based on the results of the Chow test using Eviews9, the cross-section probability value F is 0.2643, which is greater than the significance level ($\alpha = 0.05$). This means that the best model to use is the Common Effect Model (CEM). Data testing then continues to the Lagrange Multiplier test.

Lagrange Multiplier Test

The decision-making criteria for the Lagrange Multiplier test are as follows:
1. If the Significance on Both < 0.05 then a better model is the Random effect.
2. If the Significance on Both > 0.05 then a better model is Common effect.

Table 4. Lagrange Multiplier

| | Test Hypothesis | | |
	Cross-section	Time	Both
Breusch-Pagan	0.064569	1.052746	1.117315
	(0.7994)	(0.3049)	(0.2905)
Honda	0.254104	-1.026034	-0.545837
	(0.3997)	--	--
King-Wu	0.254104	-1.026034	-0.966702
	(0.3997)	--	--
Standardized Honda	0.530720	-0.757510	-6.714752
	(0.2978)	--	--
Standardized King-Wu	0.530720	-0.757510	-3.615156
	(0.2978)	--	--
Gourierioux, et al.*	--	--	0.064569
			(>= 0.10)

*Mixed chi-square asymptotic critical values:

1%	7.289
5%	4.321
10%	2.952

Source : Output Eviews9 (2025)

Based on the results of the Lagrange multiplier test, the Breusch-Pagan probability value is 0.7994, which is greater than the significance level (α= 0.05). In this case, it means that the best model is the Common Effect Model (CEM).

Multiple Regression Analysis

Table 5. Panel Data Regression Analysis

Variable	Prediction	Coefficient	T-Statistic	Prob.
C		0.583	17.686	0.000*
EP	+	0.017	0.353	0.362
GENDER	+	0.002	0.148	0.441
R-Square				0.027
Adjusted R-Square				0.012
F-Statistic				1.799
Prob (F-statistic)				0.148**

*=Significance 0,05, **=Significance 0,25
EP: Environmental Performance, GENDER: CEO Gender
Source : Output Eviews9 (2025)

The results of panel data regression estimation using the Common Effect Model (CEM) show the results of testing with panel data regression, so from these results the following model equation is obtained:

$$CED = 0{,}58 + 0{,}017{*}EP + 0{,}002{*}GENDER + \varepsilon$$

Coefficient of Determination Test

Table 6. Coefficient of Determination Test

R-squared	0.027075	Mean dependent var	0.630303
Adjusted R-squared	0.012030	S.D. dependent var	0.130858
S.E. of regression	0.130068	Akaike info criterion	-1.221519
Sum squared resid	3.282046	Schwarz criterion	-1.155089
Log likelihood	124.9304	Hannan-Quinn criter.	-1.194630
F-statistic	1.799604	Durbin-Watson stat	1.947410
Prob(F-statistic)	0.148610*		

Source : Output Eviews9 (2025)

R-Squared shows a value of 0,027075 which means that 2,7% of the variables Environmental Performance and CEO gender can explain the Carbon emission disclosure variable. This relatively low explanatory power suggests that carbon emission disclosure practices in Indonesia are influenced by many other factors beyond internal company characteristics, such as regulatory pressure, industry norms, media exposure, and stakeholder activism.

Partial Test (T-Test)

Table 7. Partial Test (T-Test)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.583490	0.032990	17.68677	0.0000
EP	0.017232	0.048781	0.353255	0.7243
GENDER	0.002812	0.018924	0.148593	0.8820

EP: Environmental Performance, GENDER: CEO Gender
Source : Output Eviews9 (2025)

The results of the test using the Common Effect Model (CEM) can be concluded as follows:
1. Environmental performance with a probability value of 0,7243/2 = 0,36215 > 0.05, can be interpreted that the Environmental performance has a positive effect and is statistically insignificant on Carbon emission disclosure.
2. CEO gender with a probability value of 0,8820/2 = 0,441 > 0.05, can be interpreted that

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the CEO gender has a positive effect and is statistically insignificant on Carbon emission disclosure.

DISCUSSIONS

Environmental performance on Carbon emission disclosure

Based on the partial test (t-test) using the Common Effect Model (CEM), the results show a coefficient of 0,017232 with a probability of 0,7243/2 = 0,36215, which is greater than the significance level α = 5% (0.05). From the statistical results, it can be concluded that the first hypothesis (H1) is rejected and it can be concluded that environmental performance has a positive effect and is statistically insignificant on carbon emission disclosure. Although the direction is positive, the effect is not significant. Disclosure of carbon emissions serves not only as a reporting obligation but also as a means to legitimize companies to gain the trust of investors, regulators, and the public. Despite companies' superior environmental performance, they do not aggressively use carbon emissions as a means of legitimacy. This is likely due to the voluntary nature of environmental reporting in Indonesia. Legitimacy theory ensures that companies continuously strive to operate within norms and boundaries accepted by society. However, this insignificant result indicates a legitimacy gap in the Basic Materials Sector in Indonesia. Companies tend to perceive legitimacy as achieved through providing basic environmental standards or other social responsibility programs, without feeling the need to include detailed carbon statistics. Thus, public pressure is not yet strong enough to compel companies to make environmental performance a primary driver of carbon emissions transparency. The results of this study are in line with research by (Priliana & Ermaya, 2023) on non-financial companies traded on the Indonesia Stock Exchange in 2018-2020, which states that environmental performance has a positive effect on carbon emission disclosure, and by (Dani & Harto, 2022) on companies listed on the SRI-KEHATI index in 2016-2020, which states that there is a positive relationship between environmental performance and carbon emission disclosure. This differs from the research by (Retnowati & Cahyani Putri, 2024) on basic materials manufacturing companies listed on the Indonesia Stock Exchange (IDX) during the 2018-2022 research period, which states that environmental performance has a negative effect on carbon emission disclosure.

CEO gender on Carbon emission disclosure

Based on the partial test (t-test) using the Common Effect Model (CEM), the results show a coefficient of 0,002812 with a probability of 0,8820/2 = 0,441, which is greater than the significance level α = 5% (0.05). From the statistical results, it can be concluded that the second hypothesis (H2) is rejected and that CEO gender has a positive effect and is statistically insignificant on carbon emission disclosure. CEO gender characteristics do not provide a significant increase in emission levels in Indonesia, which may be due to the dominance of compliance with existing market rules compared to personal leader initiatives, institutional and regulatory factors play a more important role than individual CEO characteristics in shaping decisions in Indonesian companies. In addition, the collective and hierarchical context of corporate governance in Indonesia can limit the CEO's discretionary space in making strategic decisions related to environmental disclosure. This condition causes the CEO's personal characteristics, as explained in the Upper Echelon Theory, not to be fully reflected in

carbon emission disclosure policies, so that the influence of CEO gender is statistically insignificant. The results of this study are in line with research by (Harjito & Sutopo, 2024) on mining sector companies listed on the Indonesia Stock Exchange from 2019 to 2023. Then by (Meiryani et al., 2023) on LQ45 index companies listed on the Indonesia Stock Exchange in 2016-2020, stating that CEO gender has a positive effect on carbon emission disclosure. In contrast, research by (Isyiana & Inawati, 2025) on companies listed in the IDX ESG Leaders from 2020 to 2023 states that CEO gender has a negative effect on carbon emission disclosure.

CONCLUSIONS

1. Environmental performance has a positive effect and is statistically insignificant on Carbon emission disclosure. This means that improvements in a company's environmental performance tend to be followed by an increase in carbon emissions disclosure, but the effect is not statistically significant.
2. CEO gender has a positive effect and is statistically insignificant on Carbon emission disclosure. This means that companies led by CEOs of a certain gender tend to show an increase in carbon emissions disclosure, but the effect is not statistically significant.

SUGGESTION

1. Future research may consider other variables such as environmental governance, green accounting, media exposure, or environmental sensitivity. The addition of these variables is expected to provide a more comprehensive picture of the factors that influence carbon emission disclosure.
2. Further research is recommended to use different measurements in assessing carbon emission disclosure and environmental performance. For example, carbon emission disclosure can be measured using the latest GRI-based index or other international standards and while environmental performance can be measured using PROPER.
3. Further research could compare the basic materials sector with other sectors such as transportation and logistics, energy, or infrastructure to see whether the variables affecting carbon emission disclosure show different trends in each sector, either positively or negatively.
4. Future research should use a longer observation period in order to capture carbon emission disclosure trends more accurately and reflect the long-term sustainability of companies. In addition, expanding the number of companies sampled is also expected to improve the generalization of research results.

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