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Determinants of Carbon Emission Disclosure in the Energy and Transportation Sectors

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Abstract
Purpose: This study aims to analyze the effects of International Organization for Standardization (ISO) 14001 certification, environmental performance, and industry competition on carbon emission disclosure.
Research Methodology: The research data were obtained from the annual and sustainability reports of energy and transportation companies listed on the Indonesia Stock Exchange (IDX) during the period 2021-2024. Data were analyzed using statistical methods, including multiple regression.
Results: The results indicate that ISO 14001 certification, environmental performance, and industry competition positively affect carbon emission disclosure.
Conclusions: This study shows that ISO 14001 certification, environmental performance, and industry competition positively affect carbon emission disclosure.
Limitations: The presence of numerous outliers in the data is a limitation of this study. Another limitation is that more than 50% of the sample companies did not have a Program Penilaian Peringkat Kinerja Perusahaan (PROPER) rating during the observation period.
Contributions: This research is expected to increase companies' commitment to managing the environmental impacts of their operations not just through ISO 14001 certification but also through ongoing efforts to improve environmental performance. Furthermore, increased transparency in carbon emissions disclosure is expected to boost investor confidence and strengthen corporate legitimacy in the capital market.

Keywords: *Carbon Emission Disclosure, Environmental Performance, Industry Competition, ISO 14001 Certification*

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1. Introduction

The rise in carbon emissions resulting from industrial activity has become a global issue that has garnered serious attention from governments, investors and the public. Companies are no longer judged solely on their financial performance but also on their responsibility for the environmental impacts of their operations. The disclosure of carbon emissions is considered a transparency mechanism through which corporations demonstrate accountability in response to societal pressures concerning climate change and sustainability issues. This circumstance supports legitimacy theory Subroto and Endaryati (2024), which asserts that the long-term viability of a company relies on the extent to which its practices conform to socially accepted values.

As carbon emissions disclosure in Indonesia is still conducted on a voluntary basis, there are notable variations in the depth and quality of information reported by companies. These differences indicate that certain factors influence companies' decisions to disclose carbon emissions information. Choi, Lee, and Psaros (2013) argue that carbon emissions disclosure is often driven by reputational and legitimacy considerations, mainly among industries with substantial emission levels. Sukmawati and Henny (2024)

found that carbon emission disclosure in Indonesia is not yet evenly distributed due to the absence of regulatory and binding reporting obligations.

ISO 14001 certification is an indicator of a company's commitment to implementing an internationally standardized environmental management system. In their research on manufacturing, mining, and agricultural companies in Indonesia. Rohmah and Nazir (2022) revealed that ISO 14001 certification contributes positively to carbon emission reporting. These findings suggest that certified firms tend to disclose environmental information more openly, demonstrating the congruence between their operational conduct and environmental communication. Similar findings were also presented by Putri and Yuliandhari (2024), who examined companies within the energy industry and found that ISO 14001 certification drives organizations to be more forthcoming in reporting carbon emissions as a means of reinforcing stakeholder legitimacy.

Corporate environmental performance significantly influences carbon emission reporting. According to the stakeholder theory Subroto and Endaryati (2024), firms have a duty to address the information requirements of stakeholders affected by their business activities. According to Rohmah and Nazir (2022), companies with stronger environmental performance tend to provide more extensive disclosures of carbon emissions. This evidence aligns with the research of Sukmawati and Henny (2024), who emphasized that superior environmental performance ratings illustrate an organization's readiness to communicate environmental information as part of its accountability to the broader community.

Industrial competition also influences companies' strategies for disclosing environmental information. Pranasyahputra, Elen, and Dewi (2020) found in their research on manufacturing companies in Indonesia that the level of industrial competition positively influences carbon emission disclosure. Ramadhan, Ermaya, and Wibawaningsih (2021) corroborate these findings by stating that companies in highly competitive industries tend to increase the transparency of their environmental disclosures to maintain their reputation and market trust. In this context, carbon emission disclosure functions as a non-financial means of differentiation to enhance corporate competitiveness.

Previous research has shown inconsistencies in the findings regarding the relationship between ISO 14001 certification, environmental performance, industry-level competition, and carbon emissions disclosure. Maqfirah and Fahrianta (2022) found that ISO 14001 certification does not always encourage carbon emission disclosure because of differences in reporting strategies between companies. Angelina and Handoko (2023) indicate that organizations with poor environmental performance are more motivated to engage in carbon emission reporting in response to intensified external demands. These inconsistent research findings indicate a gap in the literature that requires further investigation.

This study investigates how ISO 14001 certification, environmental performance, and competitive intensity influence carbon emission reporting in energy and transportation firms listed on the Indonesia Stock Exchange. These sectors were selected based on their relatively high carbon emission contributions compared to other sectors, making them relevant for environmental accounting studies. This study contributes to the global sustainability accounting literature by providing empirical evidence from Indonesia, an emerging market where carbon emissions disclosure practices are still developing. The findings also have practical implications for regulators and industry practitioners seeking to improve transparency in corporate carbon emissions reporting.

2. Literature Review and Hypotheses Development

2.1 Legitimacy Theory

Legitimacy theory explains that a company's sustainability is heavily influenced by the public acceptance of its activities and performance. Companies strive to align their operational activities and reporting practices with generally recognized social norms and values to attain and maintain legitimacy (Subroto & Endaryati, 2024). In line with this perspective, legitimacy is obtained when corporate actions are perceived as consistent with societal expectations, and failure to meet these expectations may threaten corporate survival (Melawati & Rahmati, 2022). As explained by Wahyuningrum, Ihlashul'amal, Utami, Djajadikerta, and Sriningsih (2024), legitimacy theory emphasizes that

organizations operate within a broader social system and must conform to the prevailing norms and values to secure continued support from society. Therefore, companies must continuously adapt their strategies and disclosures to ensure that their operations remain socially acceptable and are aligned with environmental and regulatory standards. A company's legitimacy is granted by external stakeholders and represents the shared perceptions and beliefs about the organization (Fransisca, Robiani, Meutia, & Yusnaini, 2024).

2.2 Stakeholder Theory

According to stakeholder theory, firms are accountable not only to their shareholders but also to every stakeholder with a vested interest in their activities (Subroto & Endaryati, 2024). Pressure from investors, governments, consumers, and community expectations encourages companies to enhance transparency in environmental reporting as part of their accountability practices. The disclosure of carbon emissions is a corporate communication tool aimed at satisfying stakeholders' information requirements. Good environmental performance and high levels of industry competition reinforce companies' drive to increase disclosure transparency to maintain their stakeholder support.

Stakeholder theory emphasizes that a company does not operate solely for the benefit of its shareholders, as well as for various parties that can affect or are affected by the achievement of corporate objectives. Stakeholders include not only investors and shareholders but also creditors, the workforce, consumers, suppliers, community representatives, civil society groups, and the government. Each of these groups has certain interests and expectations regarding the company's activities. As explained in this study, stakeholders can affect organizational decisions, including the extent of information disclosure, because they control or influence critical resources required for a company's operations (Palupi & Nariman, 2025).

Furthermore, stakeholder power may arise in different forms, such as authority over economic assets, including financial capital and human resources, access to powerful media channels, authority in corporate governance, and the ability to affect the consumption of a company's products or services (Palupi & Nariman, 2025). This implies that companies must continuously adapt their strategies and policies to align with their stakeholders' expectations. An increase in stakeholder influence leads to heightened efforts by the company to accommodate their demands to secure continued support and legitimacy. Therefore, corporate transparency, including environmental disclosure, can be understood as a strategic response to the pressure exerted by stakeholders. Jaya and Nugraheni (2024) state that the power or influence held by stakeholders can appear in various forms, such as authority over economic assets, including financial capital and workforce, access to prominent media outlets, authority in company management, and competence in influencing the use of products and/or services offered by the company. Thus, as stakeholder influence grows, companies are more likely to adapt their strategies to satisfy stakeholder expectations.

2.3 Carbon Emission Disclosure

The disclosure of carbon emissions entails reporting the number of emissions produced, identifying their sources, and outlining a company's efforts to manage and minimize carbon emissions. This disclosure is voluntary in Indonesia and is generally made through annual reports or sustainability reports (Amira, Ermaya, & Miftah, 2024). This practice of disclosing carbon emissions accords with legitimacy theory, whereby firms attempt to secure legitimacy within their operating environment by adjusting their actions to conform to the existing societal norms and values (Alfayerds & Setiawan, 2021). From the perspective of carbon emissions disclosure, companies use environmental reports to demonstrate their concern for the environmental impact of their operational activities.

Wahyuningrum et al. (2024) argue that carbon disclosure demonstrates a firm's commitment to mitigating greenhouse gas emissions and responding to climate change. Environmental transparency functions as a mechanism for maintaining public trust and social approval, particularly amid increasing global awareness of climate change and sustainability issues. As stated by Manan, Wuryanti, and Mufahamah (2025), companies tend to voluntarily disclose environmental information when management believes that such actions are consistent with societal expectations and contribute to

strengthening social legitimacy. Thus, carbon emission disclosure can be viewed as a calculated organizational response to public pressure aimed at maintaining reputation capital and securing long-term business sustainability.

Furthermore, holding an ISO 14001 certification and demonstrating robust environmental performance indicate a company's commitment to responsible environmental management practices, which supports its legitimacy in the eyes of stakeholders. Effective risk and environmental management practices help firms mitigate reputational risks and comply with regulatory requirements, thereby strengthening their social status (Santoso & Husaini, 2025). Consistent with legitimacy theory Suchman (1995), companies that actively demonstrate accountability through certifications and transparent carbon disclosure are more likely to gain stakeholder support, enhance credibility, and secure long-term operational continuity.

2.4 ISO 14001 Certification

As an international environmental management system standard that firms use to systematically manage the environmental consequences of their business activities (Setiadi, 2021). ISO 14001 certification demonstrates a structured and sustainable environmental management system. Companies certified under ISO 14001 tend to disclose more extensive environmental information, such as carbon emissions data, to maintain consistency between internal environmental practices and external reporting (Rohmah & Nazir, 2022).

ISO 14001 certification is granted to organizations that have developed and applied an Environmental Management System (EMS) consistent with the standard's requirements and have successfully completed an external assessment by an accredited certifying institution. The certification process evaluates the conformity between documented procedures and actual practices within the company, ensuring that environmental aspects, legal compliance, risk management, and continuous improvement mechanisms are effectively implemented. Certification not only signifies compliance with international environmental standards but also confirms that an organization has established systematic planning, implementation, monitoring, and evaluation processes related to environmental performance (Muktiono & Soediantono, 2022).

Furthermore, ISO 14001 certification provides multidimensional benefits, including environmental, social, market, and economic advantages. Certified companies generally experience improvements in corporate image, regulatory compliance, stakeholder trust, and competitiveness, while also strengthening internal environmental governance structures Alnavis, Martono, and Hamzah (2021) to adopt a structured Plan Do Check Act (PDCA) cycle, supporting sustained progress in environmental performance and contributing to the achievement of long-term sustainability targets (Agustiana & Elvania, 2024).

2.5 Environmental Performance

Environmental performance refers to the voluntary initiatives undertaken by a company as a form of corporate responsibility to reduce the negative impacts generated by its operational activities, which may subsequently influence the level of stakeholder perception (Ramadhan et al., 2021). In a wider context, environmental performance indicates a firm's commitment to environmental protection by ensuring the preservation of water, air, and soil quality, as well as to reduce pollution and waste generation (Nguyen, Elmagrhi, Ntim, & Wu, 2021). Environmental performance can be measured using both direct and indirect approaches, which measure the ecological consequences of corporate operations and products on the natural environment (Nguyen et al., 2021). In Indonesia, environmental performance is evaluated through the Corporate Performance Rating Program in Environmental Management (PROPER), which utilizes a tiered color rating system from black to gold to determine the quality of firms' environmental management practices (Azzahra, Damayanti, & Dewi, 2025).

Environmental performance in this research is linked to stakeholder theory, which asserts that companies are accountable not only to shareholders but also to a wider set of stakeholders, including society and governmental institutions (Harahap, Juliana, & Lindayani, 2019). Companies that

demonstrate strong environmental performance tend to receive positive evaluations from stakeholders because they are perceived as responsible and compliant with environmental regulations. According to legitimacy theory, organizations that align their operational practices with prevailing social norms and environmental standards are more likely to obtain public approval and sustain a favorable corporate reputation (Azzahra et al., 2025). Consequently, environmental performance is considered an essential independent variable that reflects a company's ability to manage its environmental responsibilities in accordance with societal standards and stakeholder expectations.

As an independent variable, environmental performance represents a firm's effectiveness in managing the environmental impacts arising from its operations. Azzahra et al. (2025) argue that environmental performance demonstrates a company's ability to manage the environmental effects associated with its operational processes and that companies with higher PROPER ratings (gold and green) indicate better compliance with environmental standards and regulations. Similarly, Nelson, Junaidi, and Sentoso (2025) conceptualizes environmental performance as the extent to which an organization demonstrates responsibility for conserving the natural environment, including actions aimed at preserving water, air, and soil conditions and classify its measurement into direct and indirect approaches to assess environmental impacts. These definitions emphasize that environmental performance is a measurable construct that reflects the extent to which companies implement environmentally responsible practices in their operations.

2.6 Industrial Competition

Industrial competition is the rivalry between companies to attract consumers by demonstrating their respective advantages or added value (Ramadhan et al., 2021). Competition can arise from pressure from companies in the same industry or sector (Pranasyahputra et al., 2020). In the literature, industrial competition is commonly conceptualized as the degree of market concentration and intensity of product market rivalry within an industry. Beyond concentration, competition is also viewed as a multidimensional construct that includes product substitutability, market size, and entry costs, all of which shape the extent of price rivalry and strategic interaction among firms (Wang, Jou, Chang, & Wu, 2014).

From a theoretical perspective, economic theory suggests that the level of industry competition influences corporate profit persistence and volatility (Safdar, 2016). In highly competitive industries, abnormal profits tend to be eroded more quickly due to entry and rivalry, whereas firms operating in less competitive or more concentrated industries are more likely to sustain their profitability over time. This distinction reflects the idea that competition disciplines firms by limiting economic rents, thereby increasing uncertainty and reducing return stability. Consequently, industry competition is an important contextual factor that shapes managerial behavior, strategic decisions, and corporate policies.

The industrial competition variable in this study is linked to stakeholder theory because carbon emission disclosure is a form of pressure on companies arising from ratcheting and herding effects, which trigger a competitive response from other companies that will also disclose carbon emissions (Peng & Yang, 2014). In competitive environments, firms face stronger external monitoring and benchmarking pressures as stakeholders can more easily compare performance across similar firms, increasing accountability and transparency. Moreover, competition affects how firms respond to external pressures, as firms operating in industries with different levels of concentration may experience varying degrees of market discipline and strategic interdependence. Therefore, industry competition reflects structural market conditions and represents an external governance mechanism that intensifies stakeholder scrutiny and motivates firms to adjust their disclosure practices.

2.7 Conceptual Framework

The following is the conceptual framework of this study, which examines ISO 14001 certification ownership, environmental performance, and industrial competition as independent variables and carbon emission disclosure as the dependent variable.

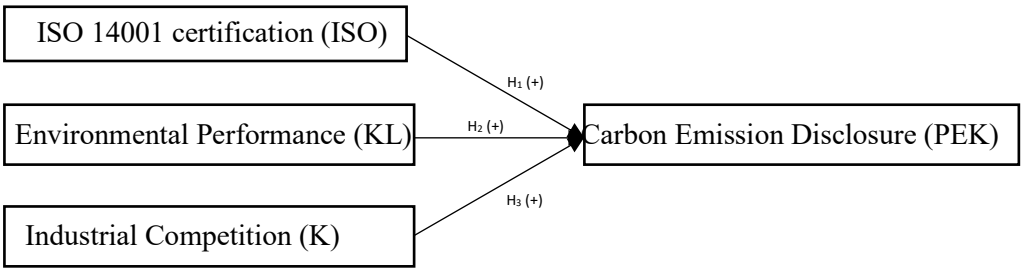

Figure 1. Conceptual framework

2.8 Hypotheses Development

2.8.1 The Impact of ISO 14001 Certification on Carbon Emission Disclosure

Holding an ISO 14001 certification reflects a company's commitment to implementing an internationally standardized environmental management system. Holding this certification encourages companies to increase the transparency of environmental information, including carbon emission disclosures, as a form of consistency between environmental management practices and public reporting. Rohmah and Nazir (2022) results, in line with Putri and Yuliandhari (2024), show that ownership of ISO 14001 certification has a positive effect on carbon emission disclosure because ISO 14001 encourages companies to be more transparent in reporting their environmental impacts. Therefore, companies holding an ISO 14001 certification are expected to make broader carbon emission disclosures.

H_1: ISO 14001 certification ownership positively impacts carbon emission disclosure

2.8.2 The Influence of Environmental Performance on Carbon Emission Disclosure

Environmental performance indicates a company's success in managing and minimizing the environmental impact of its operational activities. Based on legitimacy and stakeholder theories, companies with good environmental performance are more likely to disclose environmental information as a form of accountability to the public and stakeholders. Disclosure of carbon emissions is used to demonstrate transparency and a company's commitment to environmental sustainability. Rohmah and Nazir (2022) are in line with Sukmawati and Henny (2024), who stated that companies with high environmental performance are more open to disclosing carbon emissions. Therefore, the better a company's environmental performance, the more likely it is to disclose its carbon emission.

H_2: Environmental performance positively affects carbon emission disclosure

2.8.3 The Impact of Industrial Competition on Carbon Emission Disclosure

The level of industry competition reflects the intensity of competition among companies in the same sector. Based on stakeholder theory, companies in a highly competitive environment are driven to improve the quality of information disclosure to maintain stakeholder trust and their support. Disclosure of carbon emissions is a non-financial strategy used by companies to build their reputation and competitive advantage. Ramadhan et al. (2021) and Pranasyahputra et al. (2020) showed that the higher the level of competition, the greater the incentive for companies to be more open in disclosing carbon emissions to maintain their image and market trust. Therefore, the higher the level of industry competition, the greater the tendency for companies to disclose carbon emission information more widely.

H_3: Industrial competition positively affects carbon emission disclosure

3. Methodology

A quantitative approach with a causal research method was employed in this study to investigate the influence of ISO 14001 certification, environmental performance, and industry competition on carbon emission disclosure. This study uses secondary data collected from companies' annual and sustainability reports. The research data consist of secondary data obtained from annual reports and corporate sustainability reports published on the companies' official websites and the Indonesia Stock Exchange (IDX). These data include information on ISO 14001 certification, environmental performance, industry competitiveness, and carbon emission disclosures during the observation period. This study considered all energy and transportation companies listed on the Indonesia Stock Exchange as the study population. Samples were selected using a purposive sampling approach, focusing on companies that continuously published annual and/or sustainability reports during the study period and made the required data available. Companies that did not provide information related to the study variables were excluded from the sample.

The independent variable in this study is carbon emission disclosure, and ISO 14001 certification ownership, environmental performance, and industry competition are the dependent variables. Carbon emissions disclosure is measured using a disclosure index based on the Global Reporting Initiative (GRI) 305 guidelines by comparing the number of disclosed items to the total number of relevant items. ISO 14001 certification is measured using a dummy variable, with a value of one for companies with ISO 14001 certification and zero for companies without.

Environmental performance is measured using a company's environmental performance rating obtained from an environmental-performance-assessment program. Industry competition is measured using the industry concentration ratio, which reflects the level of competition within the industry sector in which a company operates. Data analysis was performed using descriptive statistics and multiple linear regression to test the effects of independent variables on the dependent variable. Classical assumption testing was performed prior to regression analysis to ensure the feasibility of the research model. All data processing was performed using the statistical software.

4. Results and Discussions

Data analysis was performed using descriptive statistics and multiple linear regression to test the effect of independent variables on the dependent variable. Classical assumption testing was performed prior to the regression analysis to ensure the feasibility of the research model. All data processing was performed using statistical software. The sample was determined through purposive sampling based on certain criteria, followed by analysis using SPSS (version 26). The details of sample acquisition are presented in Table 1.

Table 1. Sampling criteria

Criteria	Number of Companies
Total companies in the energy and transportation sector	130
Transportation and energy sector companies that did not publish annual reports during the 2021-2024 period	(50)
Transportation and energy sector companies that did not publish sustainability reports during the 2021-2024 period	(17)
Number of research samples	63
Research period (2021-2024)	4
Total Sample	252
Outlier data	(140)
Total research data	112

Table 1 shows that of the 130 companies in the population, only 63 companies in the energy and transportation sectors met the research criteria. The research period was from 2021 to 2024. This resulted in 252 usable samples from 63 companies over four years.

4.1 Data Description

Table 2. Frequency distribution of companies based on ownership of ISO 140001 certification

ISO 140001 certification	Frequency (n)	Percentage (%)
ISO 14000 Certification Ownership	82	73.2
No ISO 14000 Certification ownership	30	26.8
Total	112	100

Based on Table 2, it can be seen that the majority of companies have ISO 140001 certification, with 82 data points (73.2%). Thirty data points do not have ISO 140001 certification.

Table 3. Frequency distribution of companies based on environmental performance (PROPER Rating)

Environmental Performance (Proper Rating)	Frequency (n)	Percentage (%)
No rating (Score 0)	57	50.9
Black (Score 1)	0	0
Red (Score 2)	1	0.9
Blue (Score 3)	17	15.2
Green (Score 4)	27	24.1
Gold (Score 5)	10	8.9
Total	112	100

Based on Table 3, of the 112 sampled companies, 57 (50.9%) did not have a PROPER rating. This indicates that most companies have not yet registered for environmental performance assessment through the PROPER program. No company received a black rating, whereas one company (0.9%) received a red rating. Seventeen companies received a blue rating, indicating compliance with the minimum environmental management requirements. Furthermore, 27 companies (24.1%) received green ratings, indicating above-standard environmental performance. Ten companies (8.9%) achieved a gold rating, reflecting their best environmental performance.

Tabel 4. Data description

Variables	Min	Max	Mean	SD
Industry Competition	0,09	26.77	5.27	6.74
Carbon Emission Disclosure	0	1	0.55	0.35

Based on Table 4, it can be seen that industrial competition has a minimum value of 0.09 and a maximum value of 26.77, with an average value of 5.27 and a standard deviation of 6.74. The carbon emission disclosure variable has a minimum value of 0 and a maximum value of 1, with an average value of 0.55 and a standard deviation of 0.35.

4.2 Hypothesis testing

Tabel 5. Hypothesis test results

Model	Unstandardized Coefficients		Standardized Coefficient	T	Sig.	Information
	B	Standard Error				
Constanta	0.299	0.058		5.187	0	
ISO	0.147	0.07	0.185	2.084	0.039	Significant positive
KL	0.048	0.018	0.27	2.665	0.009	Significant positive
K	0.011	0.005	0.213	2.207	0.029	Significant positive

The t-test results in Table 5 show that the ISO 14001 certification ownership variable has a t-value of 2.084 and a significance value of 0.039, which is smaller than the test requirement of 0.05. These results indicate that ISO 14001 certification ownership positively affects the dependent variable, carbon emission disclosure. Thus, H_1, which states that ISO 14001 certification ownership has a positive effect on carbon emission disclosure, is accepted. The T-test results in Table 5 show that the environmental performance (KL) variable has a t-value of 2.665 with a significance value of 0.009, which is smaller than the test requirement of 0.05. These results indicate that environmental performance positively affects the dependent variable, carbon emission disclosure. Thus, H_2, which states that environmental performance has a positive effect on carbon emission disclosure, is accepted. The T-test results in Table 5 show that the industrial competition variable (K) has a t-value of 2.207 with a significance value of 0.029, which is smaller than the test requirement of 0.05. These results indicate that industrial competition positively affects the dependent variable, carbon emission disclosure. Thus, H_3, which states that industrial competition has a positive effect on carbon emission disclosure, is accepted.

4.3 Discussion

4.3.1 The Impact of ISO 14001 Certification Ownership on Carbon Emission Disclosure

These results indicate that ISO 14001 certification ownership has a positive effect on carbon emission disclosure; thus, the first hypothesis (H_1) is accepted. The results of this study indicate that companies that have obtained ISO 14001 certification tend to disclose carbon emission information more openly than those that have not obtained ISO 14001 certification. The ownership of this certification reflects the company's commitment to a standardized environmental management system, thus encouraging companies to increase the transparency of their environmental reporting, especially in the disclosure of carbon emissions.

The results of this study align with legitimacy theory, which states that companies will seek to gain legitimacy from society by aligning their behavior with prevailing values and norms. Disclosure of carbon emissions is one tool for companies to demonstrate compliance with environmental standards and their responsibility for climate change. This is in line with the previous research by (Rohmah & Nazir, 2022) and (Putri & Yuliandhari, 2024), which showed that ISO 14001 certification positively impacts carbon emission disclosure. Therefore, this study strengthens the empirical evidence that environmental certification plays a significant role in encouraging corporate carbon emission disclosure practices.

4.3.2 The Influence of Environmental Performance on Carbon Emission Disclosure

The results of this study indicate that environmental performance positively influences carbon emission carbon emission disclosure, thus accepting the second hypothesis (H_2). The analysis in this study indicates that the better a company's environmental performance, as assessed by its PROPER rating, the higher its carbon emission disclosure level. Companies with good environmental performance are more transparent in disclosing their carbon emissions, as this is a tool and strategy for sustainability communication.

The results of this study indicate a self-selection phenomenon in voluntary disclosure, where companies with better environmental performance are more willing to disclose their environmental information transparently. This finding suggests that companies with good environmental performance have a greater incentive to disclose information related to carbon emissions as a form of accountability to their stakeholders. Although the number of companies with PROPER ratings in this study was relatively limited, environmental performance still showed a significantly influenced carbon emission disclosure. This condition indicates that environmental performance plays a significant role in encouraging carbon emission disclosure practices in energy and transportation sector companies, regardless of the proportion of companies receiving PROPER ratings during the study period.

The results of this study support stakeholder theory, which states that companies must consider the interests of stakeholders, including not only shareholders but also governments, investors, communities, and even the environment affected by the company's operations. The disclosure of carbon emissions serves as a form of corporate accountability for environmental performance to stakeholders. The results

of this study align with those of previous studies by Rohmah and Nazir (2022) and Sukmawati and Henny (2024), which showed that environmental performance positively influences carbon emission disclosure. This suggests that companies with good environmental performance tend to be more open about disclosing environmental information to build a positive image and increase public trust, one of which is through carbon emission disclosure. Cooperation with the government and the community in paying attention to the impact of the company's operational activities is one form of attention given by the company to maintain the environmental ecosystem, which can maintain the stability of the environment where the community around the company lives.

4.3.3 The Effect of Industrial Competition on Carbon Emission Disclosure

The results of this study indicate that industry competition has a positive effect on carbon emission disclosure, thus accepting hypothesis (H_3). The analysis in this study indicates that the higher the level of competition in an industry, the greater the incentive for companies to increase transparency regarding environmental disclosures, including carbon emission disclosures. Companies in a perfectly competitive market strive to differentiate themselves from their competitors by demonstrating their commitment to sustainable business practices.

The results of this study align with legitimacy theory, as companies use carbon emission disclosures as a tool to gain and maintain legitimacy in the eyes of the public. Furthermore, the results of this study support stakeholder theory, which suggests that companies in a perfectly competitive market experience greater pressure from investors and consumers to be transparent in disclosing their carbon emissions. These results align with those of Pranasyahputra et al. (2020) and Ramadhan et al. (2021), who found that a more competitive industry encourages companies to be more transparent in disclosing their carbon emissions to maintain market trust.

5. Conclusions

5.1 Conclusion

This study aims to analyze the influence of ISO 14001 certification, environmental performance, and industry competition on carbon emissions disclosure in companies in the energy and transportation sectors. Based on the analysis and discussion, we conclude that ISO 14001 certification positively affects carbon emission disclosure. This indicates that companies with ISO 14001 certification tend to disclose information related to carbon emissions, more transparently. This certification reflects a company's commitment to implementing a standardized environmental management system, thereby encouraging increased corporate transparency in conveying information regarding the environmental impact of its operations. Environmental performance also positively affects carbon emission disclosure. The analysis shows that companies with good environmental performance, as measured by higher PROPER ratings, tend to have higher levels of carbon emission disclosure. This finding indicates that companies with good environmental performance are more open to disclosing environmental information as a form of accountability to stakeholders. Industry competition positively impacts carbon emissions disclosure. Research shows that the higher the level of competition in an industry, the greater the incentive for companies to increase the transparency of environmental information, including carbon emission disclosure. In an increasingly competitive market, companies utilize carbon emissions disclosure as a strategy to maintain their reputations and increase market trust. Based on the results of this study, the government should consider clear regulations regarding carbon emission disclosure.

5.2 Research Limitations

This study has some limitations that should be considered in future research. These include the presence of numerous outliers in the dataset. This significantly reduced the number of samples available for analysis, even reaching more than half of the initial sample size. These outliers primarily stem from the industry competition variable, which has a very wide range of values, impacting data stability and necessitating adjustments in data processing. Measuring corporate environmental performance is another limitation of this study, particularly regarding the use of PROPER ratings. More than 50% of the companies in the study sample did not have a PROPER rating during the observation period; therefore, PROPER-based environmental performance measurement does not fully reflect the condition of all companies in the sample. This limited availability of PROPER ratings has the potential to impact

the ability of environmental performance variables to represent companies' overall environmental management practices.

Carbon emission disclosure is measured using content analysis based on GRI 305 indicators by comparing the number of disclosed items to the total number of available disclosure items. This approach does not fully consider the principle of materiality in sustainability reporting, as not all GRI 305 indicators are material to every company. Furthermore, the content analysis method carries a certain degree of subjectivity in the assessment process, particularly in determining the availability and completeness of disclosure information for each item in the checklist. The absence of a disclosure item in a sustainability report does not necessarily reflect a low level of carbon emission disclosure; rather, it may be due to the indicator's inconsistency with the company's characteristics and operations.

5.3 Suggestions and Directions for Future Research

Based on the discussion of the research limitations, several recommendations can be made. Companies are expected to increase their commitment to managing the environmental impacts of their operations not only through ISO 14001 certification but also through ongoing efforts to improve environmental performance. Furthermore, increased transparency in disclosing carbon emissions is expected to boost investor confidence and strengthen corporate legitimacy. Regulators are expected to consider developing more stringent and standardized policies regarding carbon emission disclosure so that reporting environmental information can become mandatory for companies and not just voluntary. Future researchers are advised to consider using a materiality-based approach to determine carbon emission disclosure items so that the measurement results can better reflect the level of disclosure relevant to each company. Further researchers are also advised to add other variables, such as media exposure pressure, good corporate governance, and green investment as independent variables, and to use research objects from other industrial sectors, such as mining or manufacturing, so that the research results obtained are more varied and comprehensive.

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Author Contributions

EJ was responsible for the data collection and analysis. DP supervised the study and revised the manuscript. All the authors have read and approved the final manuscript.

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