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# Environmental Transparency and Financial Success: The Mediating Influence of Carbon Emission Reporting

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## ABSTRACT

This research aims to analyze the mediating role of carbon emission disclosure (CED) in the relationship between carbon performance (CP), green product innovation (GPI), environmental costs (EC), and the percentage of women directors (WBD) on green financial performance (FP). Using data from 66 energy sector companies listed on IDX-IC during 2021–2023, the study employs PLS-SEM path analysis to test its hypotheses. Results reveal that GPI, EC, and WBD positively impact FP, while CP does not. Similarly, CED is influenced by CP, GPI, and EC but not by WBD. The mediation test yields three key findings: first, WBD directly affects FP; second, CED partially mediates the relationships between GPI and FP, as well as EC and FP; third, CED fully mediates the link between CP and FP. The study underscores the significance of CED as a mediator, particularly in connecting CP with FP, highlighting environmental transparency as an effective strategy. Furthermore, the findings demonstrate that GPI and EC management directly enhance FP, while gender diversity on boards significantly drives green financial outcomes. Transparent CED compels companies to be more accountable for their environmental impacts, fostering improved environmental practices and financial performance through enhanced accountability.

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## INTRODUCTION

Climate change has become an urgent global issue, prompting companies around the world to be more transparent in disclosing their environmental impacts (Oliver Yébenes, 2024). Disclosure of information regarding a firm's carbon footprint is very important to encourage the enhancement of the firm's environmental and financial performance. Regulation Number 40 of 2007 regarding Limited Liability Corporations in Indonesia governs corporate responsibilities, especially those engaged in the natural resource extraction sector, through responsibility for social and environmental (CSR). Article 74 paragraph (1) of the law requires the implementation of CSR for companies in this sector. In 2023, global carbon dioxide emissions records reached their highest point, with a total of 40.6 billion tons released into the atmosphere (Diamastuti et al., 2024). Environmental issues are gaining widespread attention due to the increasing negative impact of industrial activities, especially in the energy sector. Energy companies that rely on fossil fuels, such as coal, oil, and gas, produce greenhouse gas emissions, including carbon dioxide (CO2), which contribute significantly to global warming and climate change (Rahmadhani & Indriyani, 2019). In addition, the process of taking and processing energy resources also produces hazardous waste that requires careful management to prevent environmental pollution. Carbon emissions disclosure (CED) is not only about meeting reporting obligations but also about emphasizing a company's commitment to sustainability and ecological responsibility (Cai et al., 2024). In this context, carbon emission disclosure can act as a mechanism that acts as a mediator for some factors in the monetary results of the business.

A company's financial results are usually affected by a range of factors from within and outside. Factors such as corporate governance, stakeholder demands, and environmental regulations can significantly influence financial performance. (Lee & Cho, 2021). However, the connection between these factors and financial performance is not always straightforward. This is where carbon emission disclosure can act as a mediator. By disclosing information regarding their carbon emissions, companies can send signals to the market and stakeholders regarding their commitment to sustainability. These signals can affect the perception of investors, customers, and other stakeholders, which can eventually impact the company's financial results (Prayogo et al., 2024).

Studies examining the link between the disclosure of carbon emissions and financial performance have yielded varied outcomes. Several studies suggest that the disclosure of carbon emissions has a beneficial effect on financial performance. While other studies find the opposite result. The differences in these results indicate that the link between carbon emissions disclosure and financial performance could be intricate and affected by additional factors. Consequently, studies investigating the function of CED as an intermediary for elements influencing financial performance are vital to provide a more profound and thorough understanding of this connection.

This research intends to investigate how carbon emission disclosure acts as a mediator for elements influencing the financial performance of the company. Leveraging data from publicly traded companies, the research will examine how the reporting of carbon emissions influences the connection between elements like corporate governance, stakeholder pressure, environmental regulations, and financial performance. The findings of this research are anticipated to offer important insights to companies, investors, and other stakeholders about the significance of carbon emission disclosure concerning financial performance.

### Grand Research Theory

There are two theories underlying this research. The first is the stakeholder theory, which explains that financial success depends not only on operational efficiency and profitability but also on the company's capacity to handle relationships with various stakeholders. Based on stakeholder theory, companies that successfully maintain stability in the concerns of multiple stakeholders tend to have better financial performance in due course. (Wang et al., 2021). Second, Legitimacy theory explains how companies seek to maintain recognition and support from the public by meeting the expectations and demands of stakeholders. Introduced by Dowling and Jeffrey Pfeffer in 1975, this theory states that companies seek to create harmony between their activities and the norms that apply to the social system in which they operate. Therefore, the company will seek to gain legitimacy from the community by providing information related to its environmental and social practices and performance. (Prasetyowati & Marsono, 2024).

### The impact of carbon performance on financial performance

Based on stakeholder theory, carbon performance management is a form of corporate responsibility to stakeholder expectations, which Is anticipated to influence financial performance positively. Companies with high profitability levels tend to be more active in managing carbon emissions. This more active carbon emission management activity indicates the organization's better financial capability to meet the cost of environment-related investments. Thus, the company's profitability is the main driving factor in efforts to manage carbon emissions. (Yu et al., 2022). Effective carbon emission management, in response to stakeholder expectations, can recover a company's monetary performance. (Wulandari et al., 2024; Yuliandhari & Ramadhanty, 2024).

H1 Carbon performance positively impacts financial performance.

**The influence of green product innovation on financial performance**

Sustainable product innovation allows companies to offer environmentally responsive technologies or services, thereby attracting stakeholder interest and improving the company's financial act (Rahmadhani et al., 2024). This stakeholder interest has the potential to create new markets for the company, which is anticipated to contribute to enhanced financial performance. (Saenggo & Widoretno, 2024). By stakeholder theory, companies that successfully implement green product innovation will be able to attract more customers. This increase in the number of customers directly contributes to the increase in the company's revenue and market share. Thus, GPI is an important strategy for enhancing the organization’s financial outcomes through increasing attractiveness in the eyes of stakeholders. (Amalia, 2023; Millenia & Etty, 2023).
H2: Green product innovation positively impacts financial performance.

**Impact of environmental costs on financial performance**

Companies' spending on environmental costs can be seen as an investment in risk mitigation, helping to prevent future financial losses. Efficient management of these costs can enhance long-term profitability(Nurjannah et al., 2022). As per stakeholder theory, businesses that allocate resources to environmental improvement show firm dedication to social responsibility. This commitment increases investment attractiveness for stakeholders who are becoming more worried about environmental issues. Ultimately, this increase in investment attractiveness drives positive growth In the organization's financial outcomes. (Rahmawati, 2023).
H3: Environmental expenses positively impact financial performance.

**The influence of females on financial presentation**

The presence of women on the board of directors in companies is positively correlated with improved financial performance (Nurwahyudi & Mudasetia, 2020). The long-term perspective of female directors drives sustainable investment decisions, which positively impact long-term financial performance. (Miharja et al., 2023). According to stakeholder theory, boardroom gender diversity affects decision-making and corporate accountability. In addition, the understanding of female directors of the company's financial condition often exceeds the understanding of male directors, providing a distinct advantage in strategic decision-making.
H4: Women directors have a positive effect on financial performance.

**The impact of carbon emission disclosure on financial performance**

Carbon emission disclosure is a driver for companies to improve operational efficiency (Suparman & Ng, 2024). This efficiency is achieved through waste reduction practices and more effective use of energy. These practices have the potential to significantly reduce the company's operational costs. This reduction in operating expenses subsequently leads to a rise in the company’s long-term profitability. (Khairunisa & Pohan, 2022). According to stakeholder theory, companies that commit to carbon emission disclosure will get greater support from stakeholders, which in turn strengthens financial performance (Rahmadhani & Salim, 2024).
H5: Carbon emission disclosure positively impacts financial performance.

**The effect of carbon performance on carbon emissions disclosure**

Companies with good carbon performance tend to have stronger motivation to make carbon emission disclosures objectively and credibly (Rahmadhani & Indriyani, 2019). The main purpose of this disclosure is to enhance the company's public image by strengthening its environmental profile. (Surianti et al., 2024). The legitimacy theory explains that

companies exhibiting better carbon performance will have a greater incentive to reveal details regarding their carbon emissions. This disclosure aims to gain legitimacy from the public for the responsive environmental efforts that the company has made. Consequently, revealing carbon emissions serves as a strategic instrument for businesses to foster trust and gain backing from stakeholders (Ladista et al., 2023).
H6: Carbon performance positively impacts carbon emissions disclosure.

**The impact of green product innovation on carbon emission disclosure**

Green product innovation boosts companies' confidence to transparently disclose carbon emissions (Li et al., 2020). This announcement seeks to obtain credibility from the community, serving as a concrete demonstration of the company’s commitment to environmental matters. This is supported by the development of green products that use raw materials and energy efficiently and produce lower emissions (Ladista et al., 2023). Legitimacy theory suggests that disclosure of carbon emissions can validate corporate sustainability. This legitimacy is obtained because the company has met the pressure and expectations of the public regarding the harmony between expectations and real actions.
H7: Green product innovation positively impacts carbon emission disclosure.

**Effect of environmental costs on carbon emissions expose**

The environmental cost investments that companies make have the potential to significantly affect the level of carbon emission disclosure (Yuliandhari & Ramadhanty, 2024). This disclosure is the company's strategic response to meeting the expectations of stakeholders and the wider community. This argument is backed by legitimacy theory, which asserts that companies that invest in environmental management will be more active in disclosing their carbon emission information. This active disclosure aims to improve the public perception of the company, ultimately strengthening the legitimacy and support to ensure the company's long-term viability. Thus, environmental costs are an important driving factor in carbon emission transparency, which in turn supports the sustainability of companies (Cahyani & Gunawan, 2022; Suandi & Ruchjana, 2021).
H8: Environmental costs positively impact carbon emission disclosure.

**The influence of women on carbon emissions disclosure**

The presence of female directors in companies has the potential to influence decision-making related to carbon emission disclosure (Abi Wijaya et al., 2024). Legitimacy theory explains that women's participation in leadership positions is positively correlated with increased transparency and corporate accountability. This increased transparency and accountability directly contribute to more comprehensive and quality carbon emissions disclosure (Hariswan et al., 2022). Businesses with female board members are generally more proactive in disclosing carbon emission data in annual and sustainability reports. Therefore, having gender diversity on the board of directors is a crucial element in promoting transparency and sustainability within the corporate setting (Al-Qahtani & Elgharbawy, 2020; Ladista et al., 2023).
H9: Women directors positively influence the disclosure of carbon emissions.

**The mediating role of carbon emission disclosure in the relationship between carbon performance, green product innovation, environmental costs, and female directors on financial performance**

Effective carbon performance management can enhance the financial performance of a company through transparent carbon emission disclosure. Companies that demonstrate good carbon performance and disclose such information credibly will increase a positive image in the eyes of investors and stakeholders, potentially improving financial performance. Financial performance is also affected by green product innovation and carbon emissions; Companies that are active in green product innovation and transparent

in carbon emission disclosure tend to have better financial performance due to increased stakeholder trust (Arwangga & Raharja, 2023). Carbon emission disclosure also encourages businesses to adopt eco-friendly practices, which may reduce long-term costs and contribute positively to financial performance by considering environmental costs as an important factor (Kılıç & Kuzey, 2019). Finally, the existence of woman directors in the company brings a new and inclusive perspective to decision-making, which has the potential to increase attention to environmental issues, including Carbon emission disclosure, positively influencing financial performance (Arwangga & Raharja, 2023).
H10 Carbon emission reporting serves as a mediator between carbon performance and financial performance.
H11 Disclosure of carbon emissions acts as an intermediary between financial performance and green product innovation.
H12 Disclosure of carbon emissions as an intermediary in the link between environmental expenses and financial outcomes.
H13 The connection between environmental expenses and financial outcomes is influenced by carbon emission reporting.

## METHODS

This research employs a quantitative approach using secondary data. The study population includes energy sector companies listed on the IDX IC during the 2021-2023 period. The study sample was chosen through a purposive sampling method with the criteria outlined below: Energy sector firms listed on the IDX IC, issue annual and sustainability reports. consecutively in 2021-2023 and provide data relevant to the study variables, including carbon emission disclosure, carbon performance, green product innovation, conservation costs, the proportion of womanly directors, and profitability. The details of the selected data samples for this study are presented in Table 1.

**Table 1. Research Sample**

| Criterion | Amount |
|---|---|
| Energy sector companies listed on IDX IC | 66 |
| Total research data 2021-2023 (66 x 3 years) | 198 |
| Casewise | (32) |
| Data processed in the study | 166 |

Sources: Data processed result (2025)

Data analysis was conducted using the Partial Least Squares (PLS) method with SmartPLS software to estimate the relationship between variables with a complex model. The regression equivalence model utilized in this study is:

$$GFP = \alpha + \beta_1 CP + \beta_2 GPI + \beta_3 EC + \beta_4 WBD + \beta_5 CED + \varepsilon_1 \quad (1)$$

$$CED = \alpha + \beta_1 CP + \beta_2 GPI + \beta_3 EC + \beta_4 WBD + \varepsilon_2 \quad (2)$$

Description: GFP: Green Financial Performance; CED: Disclosure of carbon emissions; CP: Carbon Efficiency; GPI: Green Product Invention; EC: Environmental Cost; WBD: Woman on Board Of Direction; β: Regression coefficient; α: Constant; ε: error.

Table 2 presents the operational definitions and formulations applied in the study.

**Table 2. Variable Operational Definition**

| Operational Definition | Measuring Instruments |
|---|---|
| Carbon Emission Disclosure, information related to the measurement, recognition, and presentation of carbon emissions. | The 18 disclosure items are given a value of 1 if there is a disclosure item and 0 if there is no item. The highest possible score is 18, while the lowest is 0. (Ladista et al. 2023) |

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| | |
|---|---|
| Carbon Performance is a company's ability to reduce carbon emissions. | $$Cp = Ln\left(\frac{EMI}{S}\right)$$ CP = *Carbon Performance*<br>EMI = Total emissions emitted by the company<br>S = Total sales<br>(Yuliandhari & Ramadhanty, 2024) |
| Green Product Innovation is an effort to improve product quality and safety so that products not only reduce environmental issues but also achieve product differentiation by promoting sustainability. | By calculating green patents containing the keywords:<br>Energy-efficient products, Raw material-saving products, The product can be easily recycled, reused, and decomposed.<br>Each item is valued 1 point if found in the firm's sustainability reporting so that a maximum green produce innovation value of 3 is obtained.<br>(Intari & Khusnah, 2023) |
| Environmental Cost is an economic sacrifice made by a company to prevent the possibility of deterioration of environmental quality or overcome environmental damage that arises due to company operations. | Environmental Charges:<br>CSR expenses incurred by the company in the current period<br>(Yanthi & Goddess,2023) |
| Female directors are female gender who contribute to the company's top management. | $$\frac{\text{Female Directors}}{\text{Total Overall Directors}} x100\%$$ (Ladista et al.,2023) |
| Economic performance is an overview of the company's financial status over a specific period, which is then analyzed so that the company's shortcomings and achievements can be known. | $$\text{ROA} = \frac{\text{Net Profit}}{\text{Total Assets}}$$ (Nastiti & Hardiningsih,2022) |

## RESULTS AND DISCUSSION

This research focuses on energy sector companies listed on the Indonesia Stock Exchange (IDX IC). This research can provide insights into how companies in the energy sector can improve their financial performance through the implementation of Carbon Performance (CP), Green Product Innovation (GPI), Environmental Costs (BL), Women Directors (WBD), and Carbon Emission Disclosure (CED) management.

**Table 3. Descriptive Summary Statistics**

| Variable | N | Minimum | Maximum | Mean | Std.Deviation |
|---|---|---|---|---|---|
| CP | 166 | .00 | .70 | .2417 | .19133 |
| GPI | 166 | .00 | 1.04 | .5173 | .34826 |
| EC | 166 | 20.30 | 30.23 | 25.8325 | 1.96164 |
| WBD | 166 | .00 | 1.00 | .4518 | .49918 |
| CED | 166 | .29 | .94 | .6084 | .13353 |
| FP | 166 | -.36 | .46 | .0987 | .10802 |

Data source processed, 2025

Table 3 presents descriptive statistical data from 6 variables measured on 166 samples. With a standard deviation lower than the mean, the data already has a prediction value that can explain the results.

**Table 4. Hypothesis Test Results**

| Hypothesis | Path Analysis | Coefficient | t Statistics | P value | Conclusion |
|---|---|---|---|---|---|
| H1 | CP → FP | -0,064 | 0,947 | 0,344 | Rejected |
| H2 | GPI → FP | 0,213 | 4,764 | 0,000*** | Confirmed |
| H3 | EC → FP | 0,332 | 4,351 | 0,000*** | Confirmed |
| H4 | WBD → FP | 0,241 | 4,640 | 0,000*** | Confirmed |
| H5 | CED → FP | 0,271 | 4,370 | 0,000*** | Confirmed |
| H6 | CP → CED | 0,178 | 2,147 | 0,032** | Confirmed |
| H7 | GPI → CED | 0,235 | 2,321 | 0,021** | Confirmed |
| H8 | EC → CED | 0,195 | 2,733 | 0,007** | Confirmed |
| H9 | WBD → CED | 0,241 | 1,466 | 0,143 | Rejected |
| **The Role of CED Mediation** | | | | | |
| H10 | CP → CED → FP | 0,048 | 2,139 | 0,033** | Confirmed |
| H11 | GPI → CED → FP | 0,036 | 1,979 | 0,045** | Confirmed |
| H12 | EC → CED → FP | 0,053 | 2,285 | 0,023** | Confirmed |
| H13 | WBD→CED→ FP | 0,031 | 1,376 | 0,169 | Rejected |

*$p$ value < 0.1; **$p$ value < 0.05; ***$p$ value < 0.01

Data source processed, 2025

Table 4 shows that a hypothesis with a p-value below 0.05 is significant and accepted, which means that there is support for the hypothesis. The supported hypotheses include 2, 3, 4, 5, 6, 7, and 8, while hypotheses 1 and 9 are rejected. In the mediation test based on the mediation table, H10 is full mediation because the direct relationship of CP→FP has no effect, and the indirect relationship of CP→ CED → FP has a significant result. For H11 and H12, it is partial mediation because the direct relationship between GPI→ FP and EC→ FP is influential, and in the indirect relationship (GPI→, CED→, FP, and EC→CED→FP), there is significant mediation. Meanwhile, H13 CED is not a mediator and emphasizes that WBD only has a direct effect on FP because WBD on CED also shows insignificant.

## DISCUSSION

The findings of the hypothesis test in Table 7 illustrate that CP does not affect FP. Efforts to improve carbon performance by reducing emissions do not necessarily align with changes in the financial performance of energy companies. This finding is aligned with research conducted by Busch et al. (2020) and Putri & Agustin (2023). In the energy sector, investor and stakeholder pressure to improve carbon performance is more about maintaining a company's legitimacy and reputation than about immediate financial gains. Energy companies disclose carbon emissions information and adopt sustainable practices to demonstrate environmental commitment, increasing stakeholder trust. The sector faces unique challenges due to its reliance on fossil fuels, and the transition to a low-carbon economy requires significant time and resources.

GPI has a significant positive impact on FP in the energy sector. Investment in green product innovation generates significant financial benefits for energy sector companies. Green product innovation has been shown to have an impact on the financial performance of companies in the energy sector. This is aligned with research by Amalia (2023); Izzaty & Atiningsih (2024) and Wang & Ahmad (2024) which states that companies that focus on green product innovation tend to achieve stronger financial performance. The growth of green technology reduces operating costs and opens new markets. The company's reputation increases in the eyes of stakeholders. Green product innovation provides a competitive advantage. The advancement of environmentally friendly innovation restores financial performance. Innovation helps reduce regulatory risk and increase competitiveness.

The EC has a positive impact on FP in energy-related companies. This shows that companies that allocate funds for environmental costs determine an obligation to sustainability, which can improve the reputation and performance of green finance. This result is in line with investigations directed by Fahira (2023) and Rahmawati (2023); Companies that bear environmental costs have taken these costs into account in determining selling prices and selecting consumers who are willing to pay these prices. This has the potential to increase sales and financial performance of the company. Investments in clean technology and efficient production processes reduce energy and raw material consumption, thereby lowering operating costs. Effective waste management and recycling reduce disposal costs and generate additional revenue. Thus, environmental costs become a form of investment to reduce risk, which can improve future financial performance.

This research verifies that WBD has a positive influence on FP. This shows that gender diversity in leadership can bring different perspectives in decision-making related to sustainability, which can ultimately increase the company's monetary performance. This finding is aligned with Jao et al. (2021) and Widiarti et al. (2022), the presence of women on the board of directors provides an advantage, because they understand the company's financial condition better than men. Female directors are also more creative and make better quality decisions, which has a positive impact on company performance. In energy companies, their presence has been shown to improve financial performance through mechanisms that are in accordance with stakeholder theory. Gender diversity on the board of directors broadens the perspective in strategic decision-making.

Based on stakeholder theory, businesses are responsible for addressing the interests of multiple investors, such as employees and customers, investors, and the public. Female directors tend to bring different experiences and insights, which allows companies to gain a deeper understanding of and effectively respond to the needs and expectations of various stakeholders (Nurwahyudi & Mudasetia, 2020). This can improve associations using stakeholders, reduce the risk of conflict, and generate enduring value for a company. The attendance of womanly directors is often related to a more collaborative and inclusive leadership style, which can increase the effectiveness of decision-making. Gender diversity at the board level can encourage the creation of a more open and innovative company culture, which in turn can improve financial performance. In addition, investors who are increasingly concerned about good corporate governance practices tend to give positive assessments to companies with gender diversity at the board level, which can have a positive impact on the ease of access to capital, which ultimately improves financial performance.

Increasing Carbon Emission Disclosure has been shown to have a significant positive impact on improving Financial Performance (FP). Transparency in carbon emissions disclosure strengthens investor and stakeholder trust, which supports improved corporate financial performance. Investors tend to view transparent companies as safer and more responsible investments, thus increasing investment interest (Maryanti et al., 2025). These findings are supported by research from Kristanto & Lasdi (2021) and Khairunisa & Pohan (2022), which confirms that carbon emissions disclosure strengthens relationships with stakeholders and has the potential to improve a company's financial performance. This shows that investing in carbon emission transparency is not only an environmental obligation but also a smart business strategy to improve fiscal performance and produce long-term value.

This study proves that CP has a favorable impact on CED. This shows that companies with respectable carbon presentation have an incentive to release information connected to their carbon emissions. This finding is in line with research conducted by Ladista et al. (2023) and Siddique et al. (2021). Industries with good carbon performance tend to disclose carbon emissions more frequently. Companies that excel in carbon

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performance are more motivated to report emissions transparently to strengthen their reputation and demonstrate their achievements. Environmental responsibility encourages companies to be more accountable to stakeholders. In addition, pressure from investors and ESG stakeholders increases the demand for transparency, which is easier for companies with good carbon performance to meet. Disclosure of carbon emissions reflects environmental performance and increases corporate accountability.

GPI has been proven to have a positive effect on CED. This shows that the Company can reduce carbon emissions by adopting new green products. Products made using more efficient raw materials and energy have lower emissions and less environmental impact and can give companies the confidence to brand carbon emission disclosures (Li et al., 2020; Wei et al., 2020). Companies that develop environmentally friendly innovations, such as renewable energy or low-carbon products, tend to be more transparent in reporting CED. These innovations demonstrate a commitment to sustainability and encourage more detailed disclosure of carbon emissions. In addition to meeting the demands of environmentally conscious stakeholders, this also strengthens the company's reputation for sustainable business. More efficient production processes in these innovations help reduce carbon emissions, which are then communicated to investors, customers, and the public to increase transparency.

This study supports the results of EC having a significant positive effect on CED. This shows that large environmental costs can demonstrate a company's commitment to sustainability, thus encouraging more transparent disclosure of carbon emissions. This finding is in line with research conducted by Cahyaningtyas et al. (2022); Yuliandhari & Ramadhanty (2024). High environmental costs are driving companies to be more transparent in disclosing carbon emissions. Investments in clean technologies and green practices demonstrate a commitment to sustainability, increase stakeholder trust, and meet regulatory demands. Transparent disclosure also communicates innovations in emission-reducing technologies to the public.

This study proves that WBD does not affect carbon emission disclosure. This shows that the presence of women on the board of directors does not have a significant impact on the company's policy in disclosing carbon emissions. In other words, gender in the composition of the board of directors is not a determining factor in a company's decision to disclose information related to carbon emissions. This finding is in line with research conducted by Arwangga & Raharja (2023); Sulistyowati (2023), that the presence of female directors in energy sector companies does not necessarily guarantee an increase in carbon emission disclosure. Energy companies' primary focus is often on profitability and operational efficiency, so carbon emissions disclosure can be considered an additional burden. The ability to manage carbon emissions depends more on individual competence and company culture than gender.

Carbon emission disclosure acts as an important link, or full mediation, between a company's carbon performance and financial performance. Good carbon performance does not directly improve financial performance but through transparent disclosure, which enhances reputation and stakeholder trust (Li et al., 2024). Without transparency, factors such as costs, uncertainty, and regulation inhibit the direct impact of carbon performance on financial performance. Companies with good carbon emission management tend to be more transparent, which is positive for financial performance (Al-Mari & Mardini, 2024).

Research proves that carbon emission disclosure mediates the connection between GPI and FP. Carbon emission disclosure acts as a partial mediator in the relationship between green product innovation (GPI) and a company's financial performance. This means that GPI directly improves financial performance through competitiveness and market attractiveness, while carbon emissions disclosure amplifies those positive impacts. Ha et al. (2024) state that companies that innovate with green products tend to be more transparent in reporting their carbon emissions, which improves reputation, investor trust, and relationships with stakeholders, thus positively impacting financial performance.

However, GPI itself already has intrinsic value that the market appreciates, such as production efficiency and environmentally friendly features, which directly contribute to financial performance. Therefore, companies need to focus on green product innovation and carbon emission disclosure to maximize financial benefits (Angelia & Lastanti, 2024).

Carbon emission disclosure acts as a partial mediation between environmental costs and a company's financial performance. This means that environmental costs directly improve financial performance through operational efficiency and risk reduction, while carbon emissions disclosure amplifies those positive impacts (Issa, 2024). Companies that manage environmental costs well tend to be more transparent in reporting their carbon emissions, which increases stakeholder confidence, attracts investors who care about the environment, and strengthens their reputation, thereby contributing positively to financial performance. However, environmental costs themselves already have a direct impact on the company's efficiency and financial risks, such as energy and raw material savings. Therefore, companies need to manage environmental costs effectively and transparently to maximize financial benefits (Adebayo et al., 2024).

Carbon emissions disclosure does not have a mediating part in the association between the existence of female directors and the company's financial performance. This means that female directors exert a beneficial influence on financial performance through diverse perspectives and skills, improved corporate image, and collaborative leadership styles (Mazumder, 2024). This influence does not depend on the transparency of carbon emission disclosures. Gender diversity on the BOD has intrinsic value that directly contributes to financial performance, and companies need to focus on improving this diversity, regardless of CED practices (Alkayed et al., 2024).

## CONCLUSION

This research intends to examine the impact of carbon performance, green product innovation, environmental costs, and the proportion of female directors on the financial performance of energy sector firms listed on IDX-IC from 2021 to 2023, utilizing carbon disclosure as a mediating factor. The study’s findings show that carbon performance has no impact on financial performance, whereas green product innovation, environmental costs, and the percentage of female directors positively influence financial performance. Furthermore, carbon disclosure was identified as a complete mediator in the connection between carbon performance and financial performance and also as a partial mediator in the link between green product innovation and environmental costs affecting financial performance. These findings suggest that openness in carbon reporting significantly contributes to enhancing a company’s financial performance. This discovery suggests that businesses should enhance transparency in carbon reporting as a means to bolster investor and stakeholder confidence, potentially leading to improved financial outcomes. Moreover, investing in the innovation of green products and efficient management of environmental costs are key elements that contribute to improved financial outcomes. This research also revealed that gender diversity in corporate leadership has a positive impact on financial performance, but it does not directly influence carbon disclosure. Consequently, businesses may view enhancing gender diversity on their boards of directors as a tactic to improve decision-making and boost corporate competitiveness. It is advisable to conduct additional research to broaden the range of industry sectors and research durations to acquire a more thorough insight into other elements that could influence carbon disclosure and corporate financial results.

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