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Determinants of Carbon Emission Disclosure: Does Environmental Sensitivity Strengthen The Relationship?

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Abstract

Introduction/Main Objectives: This study aims to examine the influence of Corporate Environmental Performance (CEP) and Green Intellectual Capital (GIC) on Carbon Emission Disclosure (CED), with Environmentally Sensitive Industry (ESI) as a moderating variable. The research addresses corporate transparency in environmental accountability. **Background Problems:** Although carbon disclosure is increasingly expected by stakeholders, many firms remain inconsistent in reporting emissions. Previous studies provide mixed results on how environmental performance and intellectual capital affect disclosure, particularly in industries with significant environmental impact. **Novelty:** This research integrates legitimacy theory and the Triple Bottom Line framework to analyze the interaction between CEP, GIC, and ESI in relation to CED. The study's novelty lies in testing ESI as a moderating variable and using updated data from Indonesian firms listed in the KEHATI Index. **Research Methods:** The study applies a quantitative approach using Structural Equation Modeling-Partial Least Squares (SEM-PLS) with WarpPLS 7.0. A total of 41 companies listed in the KEHATI Index from 2020 to 2022 were selected through purposive sampling. **Finding/Results:** The results show that CEP and GIC positively influence CED. ESI also has a significant positive effect and strengthens the relationship between both independent variables and carbon disclosure. **Conclusion:** Companies with strong environmental performance and intellectual capital tend to disclose emissions more transparently. The presence of ESI enhances these relationships, suggesting that external pressure from environmentally sensitive sectors plays a critical role in driving corporate climate accountability.

Keywords: Carbon Emission Disclosure, Environmental Performance, Intellectual Capital, Environmentally Sensitive Industry, Sustainability

JEL Classification: M14; M41; Q56; L25

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INTRODUCTION

Climate change has emerged as a global concern, garnering attention not only in Indonesia but also across many nations due to the rise in global temperatures and its widespread environmental consequences. Addressing this issue effectively hinges on the active participation and commitment of major carbon-emitting countries. An increasing number of governments are now setting long-term targets for net-zero emissions, demonstrating a growing resolve to tackle the complex challenges of transitioning to low-carbon development pathways. Achieving significant reductions

in anthropogenic carbon dioxide emissions requires comprehensive economic and societal transformations at both macro and micro scales. These transformations rely heavily on technological advancements and sustained commitment from both public institutions and private enterprises (World Economic Forum, 2020). Currently, Indonesia stands as the leading carbon emitter among ASEAN countries (Our World in Data, 2023).

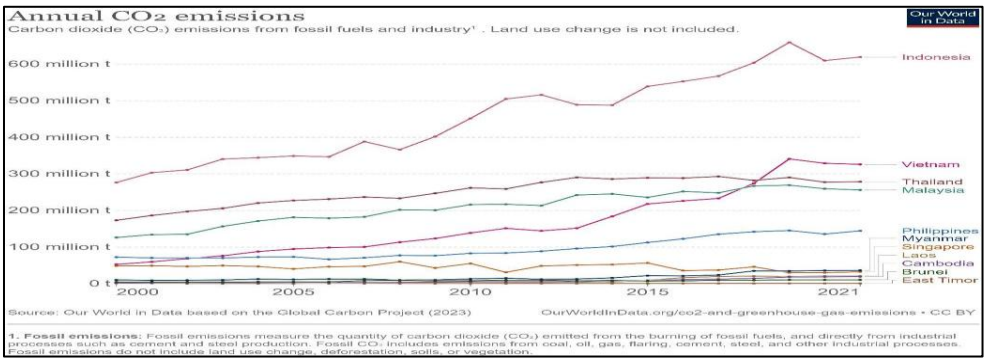

Figure 1. Annual CO_2 Emissions in ASEAN

The Indonesian government has demonstrated its awareness of the urgency in tackling carbon emissions and has declared its commitment to reducing greenhouse gas (GHG) emissions. This commitment is reflected in Presidential Regulation No. 98 of 2021 concerning the Implementation of Carbon Economic Value to Achieve Nationally Determined Contribution (NDC) Targets and the Control of Greenhouse Gas Emissions within National Development. Issued by President Joko Widodo on October 29, 2021, this regulation outlines key directives aimed at improving corporate responsibility in disclosing carbon emissions. It introduces the concept of Carbon Economic Value (NEK), which assigns a monetary value to each unit of greenhouse gas emissions. Companies are mandated to prepare sustainability reports that detail both emission levels and mitigation efforts. The regulation also establishes a framework for carbon markets and trading schemes. In addition, it enforces sanctions on entities that fail to report emissions and mitigation actions while offering incentives to firms that successfully reduce their emissions.

The regulation is expected to encourage greater corporate attention to emission-related issues and foster operational changes that align with national climate targets. In doing so, Indonesia aims to enhance its ability to fulfill its NDC commitments and contribute to global climate change mitigation. Nevertheless, current conditions suggest a gap between regulation and implementation. Several companies continue to overlook the environmental consequences of their production processes, leading to environmental degradation and harm to surrounding communities.

Data from the Ministry of Environment and Forestry (2022) reinforces these concerns, revealing a significant increase in national GHG emissions. Emissions in 2021 were recorded at 92.88 million tons of CO_2, which rose to 112.88 million tons in 2022—an approximate 18% increase. This upward trend underscores the urgency of enforcing emission regulations more strictly and ensuring greater compliance among corporate actors.

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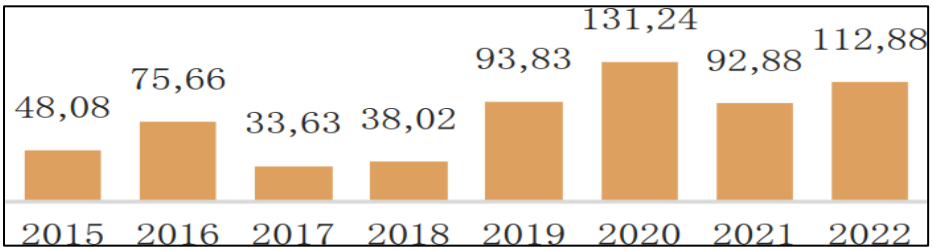

Figure 2. Increase in GHG Emissions (million tons of CO_2) in 2022

The commitment to reducing greenhouse gas (GHG) emissions in Indonesia is implemented across five key sectors, including energy, industrial processes and product use (IPPU), agriculture, forestry, and waste management. This national strategy aims to reduce GHG emissions by 29% unconditionally and up to 41% with international support by the year 2030. Despite these ambitions, the practice of carbon emission disclosure among corporations in Indonesia remains limited due to its voluntary nature. Carbon emission disclosure involves reporting on efforts to mitigate emissions, such as energy consumption data, environmental costs incurred, and internal policies on energy efficiency. By disclosing such information, companies can enhance their legitimacy and public image, particularly as the government explores the implementation of carbon tax policies, which will necessitate transparent emissions reporting (Amelia & Prasetyo, 2022).

Corporate commitment to disclosing environmental performance, especially regarding carbon emissions, plays a vital role in informing stakeholders and reinforcing accountability. This practice reflects a legitimacy strategy, where organizations demonstrate their environmental responsibility by publicly acknowledging the ecological consequences of their operations. Companies are increasingly expected to disclose carbon-related data to support environmental sustainability efforts (Purwanti et al., 2022). According to Berthelot et al. (2011), firms that engage in carbon emission disclosure often do so to maintain stakeholder trust, preempt potential risks such as operational cost increases, legal sanctions, reputational damage, and declining consumer demand. Furthermore, carbon disclosure is viewed as a mechanism to strengthen transparency and governance, although some firms remain reluctant due to the high costs and perceived disadvantages of such reporting.

Several internal factors influence the extent of carbon emission disclosure. Leverage, for instance, can exert pressure on firms due to creditor expectations. Highly leveraged companies may opt to reduce carbon disclosures as a form of cost control (Solekhah & Wahyudi, 2022). However, contrasting findings from Luo, Lan, and Tang (2013) suggest that leverage does not significantly impact disclosure practices. Profitability is another factor believed to encourage greater transparency in emissions reporting, as it signals a company's capacity to absorb the associated costs while maintaining stakeholder confidence (Yu et al., 2020). Still, Purwanti et al. (2022) report differing results, indicating no significant correlation between profitability and carbon disclosure, highlighting the complexity and variability in corporate motivations for environmental transparency. The next factor that influences carbon emission disclosure is green intellectual capital. One component of green intellectual capital, namely green human capital, which includes academic level, age and gender, can increase the level of individual and company concern for the environment, thereby encouraging attention and innovation in environmental protection. (Oktris, 2018).

Good corporate environmental performance is the basis for companies to convey carbon emission disclosure information. Companies that run their businesses in accordance with the limits and norms in society will get full support from the community which can improve the company's good image. (Dani and Harto, 2022). However, it is different from the results of research (Sekarini & Setiadi, 2021; Selviana & Ratomono, 2019; and Amaliyah & Solikhah, 2019) which state that Corporate Environmental Performance has no effect on Carbon Emission Disclosure.

Environmentally sensitive industries can contribute to carbon emission disclosure because these industries have a significant impact on the environment and human health. Companies operating in environmentally sensitive industries need to make transparent and accurate carbon emission disclosures to meet stakeholder expectations and improve their environmental performance. (Ramadhani and Venusita, 2020). Meanwhile, different results were shown by (Tana and Diana, 2021) who found no influence between environmentally sensitive industry and carbon emission disclosure. Based on the background of the problems that have been explained and inconsistent research results, the researcher intends to conduct further research.

Corporate Environmental Performance (CEP) reflects a company's ability to maintain a clean and green environment. According to legitimacy theory, companies must adhere to societal norms to gain public legitimacy, including environmental stewardship. Firms with strong environmental performance are more likely to disclose environmental-related information to demonstrate accountability (Dani & Harto, 2022). Proactive companies implement environmental strategies to mitigate climate risks, including renewable energy use, waste reduction, and carbon mitigation (Zanra, 2020). Improved CEP is associated with increased carbon emission disclosure and enhances corporate image, especially when evaluated through the PROPER index (Purnayudha, 2022). However, some studies contradict this view, finding no significant link between CEP and disclosure practices (Sekarini & Setiadi, 2021; Selviana & Ratomono, 2019; Amaliyah & Solikhah, 2019). Based on these findings, the following hypothesis is proposed:

H_1: Corporate Environmental Performance influences carbon emission disclosure.

Green Intellectual Capital (GIC) is essential for sustainable growth. It encompasses investments in eco-friendly knowledge, practices, and innovation. Developing GIC not only supports environmental protection but also aligns organizational operations with climate policies (Sheraz et al., 2021). GIC can finance renewable energy and low-carbon projects (Lin et al., 2021; Sarkodie et al., 2020). One key component, Green Human Capital, includes demographic factors like education, age, and gender, which influence environmental awareness and innovation (Oktris, 2018). However, opposing studies report that increased human capital may lead to higher carbon emissions (Khan, 2020; Yao et al., 2020). Greater investment in GIC encourages broader carbon disclosure by improving transparency and technological innovation. Thus, the second hypothesis is proposed:

H_2: Green Intellectual Capital influences carbon emission disclosure.

Industries classified as Environmentally Sensitive are under increased pressure from stakeholders to reduce environmental harm. Legitimacy theory suggests that these industries are compelled to disclose carbon emissions to gain societal approval (He et al., 2019; Shen et al., 2020; Tang et al., 2019). Stakeholder demands, including from creditors, drive these companies to be transparent. While some studies support a positive impact, others find no significant correlation (Nastiti & Hardiningsih, 2022). This leads to the hypothesis:

H_3: Environmentally Sensitive Industry influences carbon emission disclosure.

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Moreover, this industry type may moderate the influence of CEP and GIC on carbon disclosure. Due to their high environmental risk and stakeholder scrutiny, these industries have greater incentives to disclose emissions and adopt GIC to reduce their environmental impact (Sheraz et al., 2021; Tang et al., 2019; He et al., 2019; Harnovinsah et al., 2023). Therefore, additional hypotheses are proposed:

H_4: Corporate Environmental Performance influences carbon emission disclosure as moderated by Environmentally Sensitive Industry, and

H_5: Green Intellectual Capital influences carbon emission disclosure as moderated by Environmentally Sensitive Industry.

The following Figure 3 below is a conceptual framework consist summary of the hypotheses of this study.

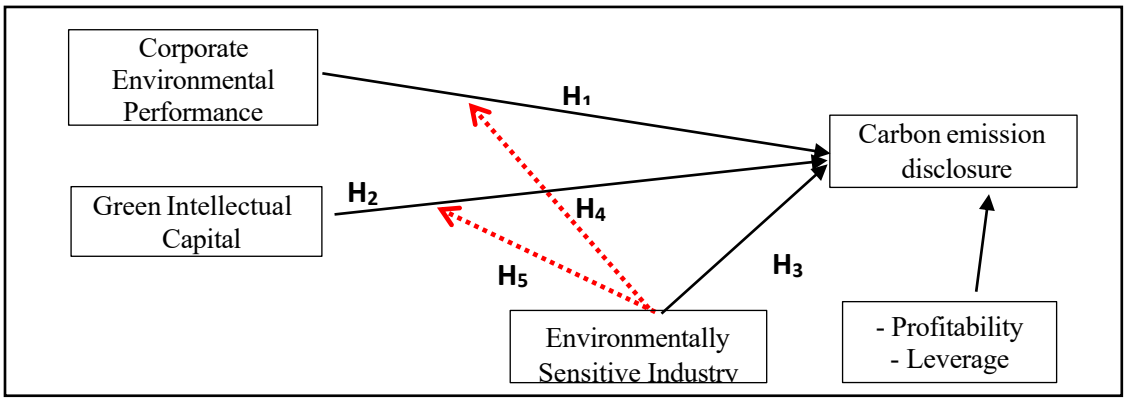

Figure 3. Conceptual Framework

RESEARCH METHODS

The population in this study comprises all companies listed on the KEHATI stock index between 2020 and 2022 that disclosed sustainability and financial reports on the official Indonesia Stock Exchange website (www.idx.co.id). The sample was selected using purposive sampling, with specific criteria including consistent inclusion in the KEHATI index, the publication of both sustainability and annual reports over the three-year period, and the presence of carbon emission disclosures or policies related to greenhouse gases. The research relies on secondary data sourced from company websites. Based on these criteria, 41 companies met the sampling requirements, resulting in a total of 45 observations.

This research adopts a quantitative approach by analyzing statistical data using Structural Equation Modeling-Partial Least Squares (SEM-PLS) with WarpPLS version 7.0. SEM-PLS is chosen for its ability to simultaneously test complex research models and to evaluate latent variables that are not directly measurable while considering measurement error (Hair et al., 2019). The study investigates the effect of Corporate Environmental Performance and Green Intellectual Capital on Carbon Emission Disclosure. Additionally, it examines the moderating role of Environmentally Sensitive Industry in strengthening the relationship between these variables and corporate carbon reporting practices.

The measurement of Carbon Emission Disclosure is conducted using the content analysis method. This method involves examining the sustainability reports of companies that serve as the research sample. To determine the extent of carbon emission disclosure, the study uses parameters

based on an index adopted from a previous study (Purwanti et al., 2022), which has been modified to include categories corresponding to the scores disclosed. The index developed by Purwanti et al. (2022) consists of five major categories related to climate change and carbon emissions, as follows: climate change (risks and opportunities), greenhouse gas emissions, energy consumption, greenhouse gas reduction and costs, and carbon emission accountability. To measure the extent of carbon emission disclosure, a checklist of carbon emission disclosure items used in this study is provided in Table 1.

Table 1. Carbon Emission Checklist

Category	Item Code	Description
Climate Change: Risks and Opportunities	CC-1	Assessment/description of risks (specific or general regulations) related to climate change and actions taken to manage those risks.
	CC-2	Current (and future) assessment/description of the financial, business, and opportunity implications of climate change.
Greenhouse Gas Emissions	GHG-1	Description of the methodology used to calculate GHG emissions (e.g., GHG protocol or ISO).
	GHG-2	Existence of external verification for GHG emission calculations, including by whom and on what basis.
	GHG-3	Total GHG emissions (metric tons of CO2-e) generated.
	GHG-4	Disclosure of Scope 1, 2, or 3 direct GHG emissions.
	GHG-5	Disclosure of GHG emissions based on their sources (e.g., coal, electricity, etc.).
	GHG-6	Disclosure of GHG emissions by type, facility, or segment.
	GHG-7	Comparison of GHG emissions with previous years.
Energy Consumption	EC-1	Total energy consumed (e.g., in terajoules or petajoules).
	EC-2	Calculation of energy used from renewable sources.
	EC-3	Disclosure by type, facility, or segment.
Reduction and Cost	RC-1	Details of plans or strategies to reduce GHG emissions.
	RC-2	Details of current GHG emission reduction targets and future reduction goals.
	RC-3	GHG emission reductions and costs or savings achieved to date as a result of planned reductions.
	RC-4	Future emission costs considered in capital expenditure planning.
Accountability of Carbon Emissions	ACC-1	Indication that the board committee (or other executive body) has responsibility for climate change-related actions.

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Category	Item Code	Description
	ACC-2	Description of the mechanism by which the board (or other executive body) reviews the company's climate-related progress.

Source: Mohd et al. (2019)

The checklist consists of 18 items that need to be identified. The development of the checklist is based on identification (Purwanti et al., 2022) on the questionnaires usually sent by CDP (Carbon Disclosure Project) to companies to find out the extent of carbon emission disclosure. CDP is an independent non-profit organization that holds the largest volume of climate change information in the world, namely more than 3,000 organizations in 60 countries.

Corporate Environmental Performance is commonly assessed using the Corporate Performance Rating Program in Environmental Management (PROPER). This program evaluates both regulatory compliance and environmental performance that exceeds minimum legal standards in areas such as pollution control and hazardous waste management. PROPER aims to promote sustainable development, strengthen stakeholder commitment to environmental conservation, raise awareness among business entities, and ensure compliance with environmental regulations (Andriani & Werastuti, 2020). The Corporate Environmental Performance Scoring Scale consists of: 1). Gold = 5; 2). Green = 4; 3). Blue = 3; 4). Red = 2; 5). Gold = 5; 6). Not include in PROPER = 0.

Green Intellectual Capital refers to the integration of environmental concerns into intellectual capital, allowing companies to demonstrate environmental awareness and enhance their overall performance (Firmansyah, 2017). This variable is measured using a scoring approach developed by Mohd et al. (2019), in which each disclosed item receives a score of one, while undisclosed items receive a score of zero. The total score is then used to classify the company based on the extent of its disclosure across predefined indicators. The following Table 2 presents a translated version of the Green Intellectual Capital checklist. This framework is used to assess a company's environmental awareness and practices across three dimensions: Green Human Capital, Green Structural Capital, and Green Relational Capital. The checklist items reflect various indicators of environmental responsibility at individual, organizational, and relational levels.

Table 2. Green Intellectual Capital checklist

Category	Item Code	Description
Green Human Capital	GHC-1	Employees participate in environmentally friendly production activities and contribute to environmental awareness programs.
	GHC-2	Employees possess sufficient skills related to environmental awareness.
	GHC-3	Employees create high-quality, environmentally friendly products and services.
	GHC-4	The company has a team that collaborates effectively to achieve environmental awareness goals.

Category	Item Code	Description
	GHC-5	Company managers provide full support for environmental initiatives.
Green Structural Capital	GSC-1	The company has a well-established environmental management system.
	GSC-2	The proportion of staff in environmental management roles is high relative to total employees.
	GSC-3	The company has made adequate investments in environmental protection facilities.
	GSC-4	The company's environmentally oriented operations run efficiently.
	GSC-5	The company maintains a beneficial environmental knowledge management system.
	GSC-6	The company has a team to monitor eco-friendly operations.
	GSC-7	The company has established detailed rules and regulations concerning environmental protection.
	GSC-8	The company has developed a reward system for completing environmental tasks.
Green Relational Capital	GRC-1	The company designs its products or services to align with customer environmental preferences.
	GRC-2	Customers are satisfied with the company's environmental protection efforts.
	GRC-3	The company maintains stable environmental collaboration with its suppliers.
	GRC-4	The company has stable partnerships with clients in environmental protection.
	GRC-5	The company maintains stable environmental cooperation with its strategic partners.

Source: Mohd et al. (2019)

Environmentally Sensitive Industry refers to sectors such as chemical, petroleum, energy, paper, metal, material, pharmaceutical, mining and extractive, telecommunications, and transportation, which are characterized by high environmental impact (Dutta & Dutta, 2021). In this study, the classification of companies within this industry group is based on a dummy scoring method, where firms operating in these sectors are assigned a score of one, while others are assigned a zero, following the approach outlined by Dutta and Dutta. The scoring for Environmentally Sensitive Industry is based on a binary classification system. Companies operating within the chemical, petroleum, energy, paper, metal, material, pharmaceutical, mining and extractive, telecommunications, or transportation sectors are assigned a score of one (1) , while companies outside these categories receive a score of zero (0).

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A control variable is a constant factor in an experimental or research setting used to assess the validity of relationships between variables and to eliminate spurious correlations. It plays a critical role in determining whether the observed connection between independent and dependent variables holds after accounting for other potential influences (Boslaugh, 2012). In this study, control variables include profitability and leverage, all of which are included to ensure the robustness of the main findings.

In order to address the research question, the study treats the Environmentally Sensitive Industry (ESI) variable as a moderating variable. It does not directly influence the dependent variable, Carbon Emission Disclosure (CED), but instead interacts with the independent variables, namely Corporate Environmental Performance (CEP) and Green Intellectual Capital (GIC). The model proposed in this study is reflected in the regression equation through interaction terms representing the moderation effect (Baron & Kenny, 1986).

$$\mathbf{CED}_{it} = \alpha + \beta_1 CEP_{it} + \beta_2 GIC_{it} + \beta_3 ESI_{it} + \beta_4 (CEP*ESI)_{it} + \beta_5 (GIC*ESI)_{it} + \beta_6 PROF_{it} + \beta_7 LEV_{it} + \varepsilon \quad \mathbf{(1)}$$

RESULTS AND DISCUSSION

Table 3. Statistics Descriptive (n = 123)

Variables	Min	Max	Mean	Std. Dev
Carbon Emission Disclosure (CED)	0,333	1,000	0,780	0,157
Corporate Environmental Performance (CEP)	0,634	0,024	1,317	1,794
Green Intellectual Capital (GIC)	0,556	1,000	0,851	0,080
Environmentally Sensitive Industry (ESI)	0,415	0,585	0,585	0,495
Profitability (PROF)	-0,094	0,348	0,052	0,067
Leverage (LEV)	0,119	0,935	0,569	0,228

Source: data processed

Based on data from 123 research samples, the dependent variable Carbon Emission Disclosure showed a minimum score of 0.333 recorded by WSKT and a maximum of 1.000 by JSMR. The average disclosure level was 0.780, indicating that companies on average disclosed approximately 78% of carbon-related items, equivalent to 14 out of 18 indicators based on the Carbon Disclosure Project (CDP) index. The standard deviation was 0.507. Since the mean exceeds the standard deviation, this suggests a relatively homogeneous data spread, indicating low variability within a diverse sample.

For the independent variable Corporate Environmental Performance, measurement was based on the PROPER environmental rating system issued by Indonesia's Ministry of Environment. The results indicated that 63% of the sample companies had not received a PROPER rating, while only 2.4% had achieved the gold rating. The mean score was 1.317, which aligns with the black PROPER rating category, meaning that while companies have taken steps toward environmental management, these efforts do not yet fully comply with legal requirements. The standard deviation of 1.794, which exceeds the mean, reflects high variability among firms. Green Intellectual Capital, another independent variable, recorded the lowest score at 0.556 for BNII and the highest at 1.000 for BSDE. The mean value was 0.851, suggesting that on average, companies

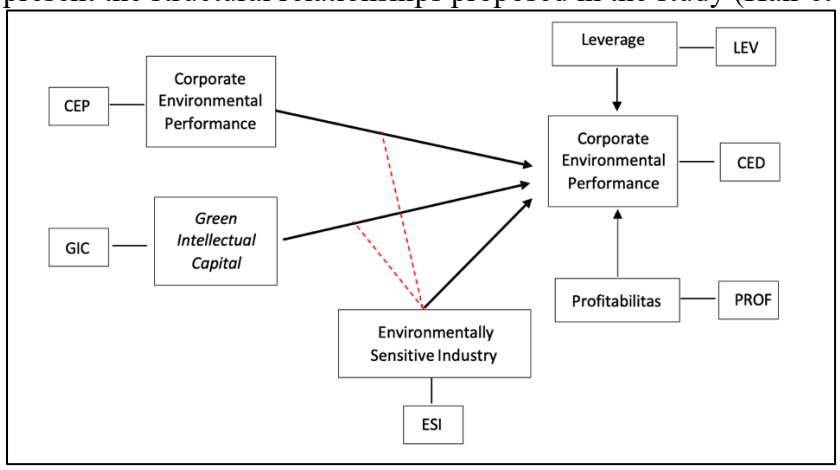
implemented approximately 85% of the 18 GIC indicators. The relatively low standard deviation of 0.080 indicates consistent implementation across the sample.

The Environmentally Sensitive Industry variable, serving as both an independent and moderating variable, was measured using a binary dummy. Approximately 41.5% of firms were not classified as environmentally sensitive, while 58.5% met the criteria. The mean was 0.585 and the standard deviation was 0.495. As the mean is higher than the standard deviation, this suggests moderate diversity with low variation in the classification of industries within the sample.

As a control variable, profitability ranged from -0.094 to 0.348, with a mean of 0.052, indicating that the average firm generated a 5% return on assets. The median was 0.033, and the standard deviation was 0.067, again reflecting low variability in profitability across the sample. Leverage, another control variable, had a minimum value of 0.119 and a maximum of 0.935. The mean score was 0.568, indicating that approximately 57% of company assets were financed by debt. The median value was 0.559, and the standard deviation was 0.227. Since the mean is higher than the standard deviation, the sample is considered diverse, but with relatively low variation.

Measurement model assessment

At this step, the researcher presents a conceptual model to illustrate the relationships among the variables under investigation. The reflective indicators of Corporate Environmental Performance and Green Intellectual Capital are theorized to influence Carbon Emission Disclosure, either directly or through the moderating effect of the Environmentally Sensitive Industry variable. This framework is constructed based on established theoretical foundations and is intended to represent the structural relationships proposed in the study (Hair et al., 2017).



Source: data processed

Figure 4. Model Path

The results of the study on the influence of Corporate Environmental Performance and Green Intellectual Capital on Carbon Emission Disclosure with Environmentally Sensitive Industry as a moderating variable were carried out using the WarpPLS 7.0 application and can be seen in the figure 4 below:

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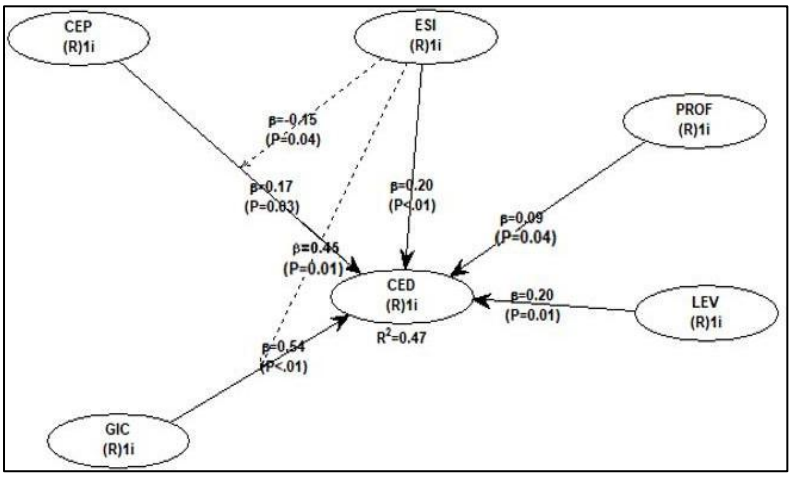

Source: data processed

Figure 5. Model Path Coefficients and p values

Goodness of Fit (R^2)

Structural model is done by looking at R^2, β value and p path. The test results can be seen in Figure 4 and the full moderation model in following table 4:

Table 4. Path Coefficients and Hypotheses Testing

Path	R^2	**Direct Effect**		
		B	P-Value	Results
CEP – CED	0,47	0,17	0,03	H_1 Supported
GIC – CED		0,54	<0,01	H_2 Supported
ESI – CED		0,20	<0,01	H_3 Supported
PROF – CED		0,09	0,04	Supported
LEV – CED		0,20	0,01	Supported
Path		**Moderating Effect**		
		B	P-Value	Results
CEP – ESI		0,15	0,04	H_4 Supported
GIC – ESI		0,45	0,01	H_5 Supported

Source: data processed

Table 4 presents the coefficient of determination (R^2), which indicates the extent to which exogenous variables can explain the variance of the endogenous variable. A value of R^2 closer to 1 suggests a stronger explanatory power of the model (Gujarati, 2011). In this study, the R^2 value for the Carbon Emission Disclosure variable is 0.47, meaning that 47% of the variation in carbon disclosure practices can be explained by Corporate Environmental Performance, Green Intellectual Capital, Profitability, Leverage, and Environmentally Sensitive Industry.

In this study, for evaluate the predictive relevance of the model, the Q^2 value is calculated using the formula $Q^2 = 1 – (1 – R^2)$. Based on the given R^2 of 0.47, the resulting Q^2 value is also 0.47, indicating that the model has strong predictive capability. According to Ghozali and Latan (2015), a Q^2 value above 0.35 is considered strong, and any value greater than zero reflects

acceptable predictive relevance. Therefore, with a Q^2 of 0.47, the model in this study is deemed to have strong and meaningful predictive power.

The findings reveal that Corporate Environmental Performance (CEP) has a significant positive effect on Carbon Emission Disclosure. CEP reflects the extent to which firms manage their operations in an environmentally responsible manner. Firms with high environmental performance are more likely to communicate their efforts transparently through emission disclosures, which align with legitimacy and stakeholder theories. These theories suggest that firms are expected to align with societal norms—particularly environmental stewardship—to gain legitimacy. Participating in government programs like PROPER enhances a company's environmental image and provides credibility among stakeholders (Purnayudha, 2022; Dani & Harto, 2022; Zanra, 2020). Green Intellectual Capital (GIC) also shows a positive relationship with Carbon Emission Disclosure. GIC contributes to the development of effective environmental management systems, green technologies, and environmentally aware organizational cultures. Firms with strong GIC are better equipped to disclose their environmental impacts transparently, as they possess the skills, knowledge, and innovation needed to reduce emissions sustainably. These findings are supported by studies emphasizing GIC's role in supporting renewable energy initiatives and low-carbon technologies (Oktris, 2018; Sheraz et al., 2021; Lin et al., 2021; Sarkodie et al., 2020).

Environmentally Sensitive Industries (ESI) demonstrate a significant positive influence on carbon emission disclosure. Due to the high environmental impact of these sectors, companies within them are often subjected to greater societal and regulatory pressure to report emissions. Empirical evidence shows that firms in these industries disclose more environmental data to gain legitimacy and manage stakeholder expectations (He et al., 2019; Shen et al., 2020; Tang et al., 2019). The results indicate that ESI strengthens the positive relationship between Corporate Environmental Performance and Carbon Emission Disclosure. Companies in high-impact industries face increased pressure to comply with environmental standards and are more likely to disclose their efforts transparently. Thus, CEP becomes more influential in ESI contexts, as stakeholders expect these companies to demonstrate higher levels of environmental responsibility (Shen et al., 2020; Sheraz et al., 2021; Tang et al., 2019). The findings also confirm that ESI moderates the relationship between Green Intellectual Capital and Carbon Emission Disclosure. In environmentally sensitive sectors, the integration of GIC into business strategy—through employee training, stakeholder engagement, and investment in green innovation—enhances transparency and environmental accountability. Stakeholders in these industries demand more rigorous disclosure due to the higher environmental risks, thereby reinforcing the importance of GIC in reducing carbon emissions (Oktris, 2018; He et al., 2019; Sheraz et al., 2021; Sarkodie et al., 2020).

CONCLUSION

This study concludes that both Corporate Environmental Performance (CEP) and Green Intellectual Capital (GIC) have a positive influence on Carbon Emission Disclosure. The moderating role of Environmentally Sensitive Industry (ESI) is also significant, strengthening the effect of both CEP and GIC on carbon-related disclosures. All four proposed hypotheses in this research were supported. Companies with higher environmental performance tend to disclose carbon emissions more transparently. Similarly, organizations with greater investments in GIC are

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more likely to report emissions proactively and sustainably. Firms operating in environmentally sensitive industries are under greater stakeholder scrutiny, making them more inclined to disclose environmental data, including carbon emissions, to maintain legitimacy and public trust.

The implications of these findings are multifaceted. First, the positive effect of CEP highlights the importance of transparency in carbon reporting as a means of enhancing environmental accountability. Second, GIC fosters green innovation and awareness, enabling companies to identify opportunities to reduce environmental impact and gain a competitive edge. Third, ESI's influence emphasizes the role of industry-specific environmental responsibilities in shaping disclosure behavior. Moreover, ESI significantly strengthens the positive relationship between CEP and Carbon Emission Disclosure, as firms in such sectors often face regulatory pressure and higher public expectations. Similarly, ESI amplifies the effect of GIC by encouraging companies to invest in sustainable knowledge and innovation to meet stakeholder demands.

This study, however, has several limitations. It focuses only on a three-year period (2020–2022) and includes a limited set of variables: CEP and GIC as independent variables, with ESI as a moderator. Additionally, the sample is restricted to companies consistently listed in the KEHATI Index during the observation period. These constraints may limit the generalizability of the findings across broader contexts or different timeframes.

Future research can build upon these findings by examining other external factors that may influence the relationship between environmental practices and disclosure, such as regulatory pressure, economic conditions, or stakeholder activism. Scholars may also explore the link between GIC and financial performance or test alternative moderating variables like geographic location, innovation levels, or sustainable leadership. Incorporating qualitative methods such as interviews or case studies could yield deeper insights into organizational practices. Cross-industry or cross-country studies, as well as research into long-term impacts, psychological factors in decision-making, and alternative environmental performance metrics such as GRI or SASB standards, may further enrich the understanding of how corporate sustainability translates into disclosure behavior.

AUTHORSHIP CONTRIBUTION STATEMENT

The concept for the study titled "Determinants of Carbon Emission Disclosure: Does Environmental Sensitivity Strengthen the Relationship?" was conceived by Dr. Harnovinsah and Rafrini Amyulianthy., Ph.D. Data collection and analysis were carried out by Okky W. Amanda. The creation of tables and the initial draft of the manuscript were collaboratively undertaken by Dr. Harnovinsah, Rafrini Amyulianthy., Ph.D and Okky W. Amanda. Dr. Harnovinsah, Rafrini Amyulianthy., Ph.D and Okky W. Amanda developed the final version of the manuscript, incorporating input and feedback from the other authors at various stages of its preparation. All authors have read and agreed to the published version of the manuscript.

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