

UNVEILING CARBON TRANSPARENCY: THE IMPACT OF ENVIRONMENTAL MANAGEMENT AND MEDIA EXPOSURE WITH FIRM SIZE AS A MODERATOR

Yusvita Nena Arinta, Fetria Eka Yudianta, Agus Waluyo, Qimangku Bahjatullah, Saifudin, Priska Dini Azahra, Indah Lestari

Faculty of Economic and Bisnis Islam, State Islamic University of Salatiga
Jl. Selatan KM 2 Pulutan, Salatiga City, Central Java, 50721, Indonesia

nena@iainsalatiga.ac.id

ABSTRACT

This study aims to examine the effect of the Environmental Management System (EMS) and Media Exposure on Carbon Emission Disclosure with Company Size as a moderating variable. The research is motivated by the growing global concern over environmental issues, particularly carbon emissions, which have become an essential indicator of corporate sustainability. EMS implementation and media pressure are considered potential drivers of transparency in carbon emission disclosure, while company size is expected to strengthen these relationships. This research employs a quantitative approach using secondary data obtained from annual and sustainability reports of companies listed on the Indonesia Stock Exchange. Data analysis was conducted through Moderated Regression Analysis (MRA) using SmartPLS. The findings reveal that EMS has a positive but insignificant effect on Carbon Emission Disclosure. In contrast, Media Exposure has a positive and significant effect on Carbon Emission Disclosure. Furthermore, Company Size does not moderate the relationship between EMS and Carbon Emission Disclosure, nor between Media Exposure and Carbon Emission Disclosure. Theoretically, this study contributes to the environmental accounting literature by emphasizing the pivotal role of media in encouraging transparency of carbon emission disclosure, while EMS and company size have not shown consistent impacts. Practically, the findings suggest that companies should pay closer attention to media exposure as an effective external pressure to enhance environmental accountability. Additionally, regulators may use these insights as a basis for strengthening carbon disclosure policies in Indonesia.

Keywords: Carbon Disclosure, Environmental Management, Media Exposure

INTRODUCTION

Unstable climate change and rising average surface temperatures are among the hot topics currently being discussed on the global agenda, including in Indonesia. This phenomenon is certainly a major challenge of this century because it can affect the human survival system. Natural disasters and adverse economic impacts have become a threat to governments and communities around the world. Physical changes in nature that impact environmental changes and increased average global temperatures are triggered by climate change (Putri & Ariefiara, 2023). The tangible impacts of climate change currently being felt include rising average global surface temperatures, extreme weather changes, and rising sea levels.

Human activities are the main cause of this problem, especially greenhouse gas emissions generated by the industrial sector (Suherman & Kurniawati, 2023). Human life will continue to coexist with activities from the industrial sector. This creates a dilemma for governments. On the one hand, increased industrial development can accelerate the pace of the global economy, but on the other hand, there will be adverse effects such as a decline in environmental quality and an increase in greenhouse gas emissions. According to the Intergovernmental Panel on Climate Change (IPCC), over the last three centuries, the average temperature of the Earth has risen by one degree Celsius.

Indonesia is among the 10 largest carbon emitters in the world, particularly from the energy sector, contributing around 733 million tons of CO₂ in 2023, placing Indonesia eighth globally. Data from the Global Carbon Project shows that Indonesia ranks first as the largest carbon emitter in Southeast Asia. This clearly indicates that Indonesia

contributes significantly to global climate change. The following is a ranking of the largest carbon dioxide emitting countries in Southeast Asia:

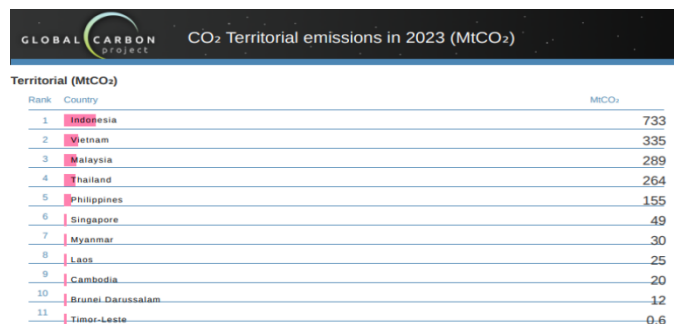


Figure 1. Carbon Project In Country Asia Tenggara
Source: Global Carbon Project (2025)

Carbon emissions occur as a result of human activities in industry, whose production processes generate gases that are released into the air while also seeking to increase company profits. According to the World Resources Institute, the energy sector produces the largest greenhouse gas emissions to date, accounting for 75.7% of the global total. According to the website databoks.co.id, the use of coal and petroleum still dominates Indonesia's energy mix, with fossil fuels contributing 81%. Indonesia itself ranks third as the world's largest coal producer with a production volume of 659.357 million tons per year, according to Global Fire Power.

Companies are the largest contributors to GHG emissions through industrial activities such as the burning of fossil fuels and the use of fuel. Carbon dioxide gas produced from company operations can damage the ozone layer, which then causes global warming. Cases of environmental pollution involving companies in Indonesia show that industrial activities have an impact on the environment, both locally and globally. A concerning phenomenon currently is PT Adaro's plan to build a coal-fired power plant in North Kalimantan. This project developed by PT Adaro aims to supply 1.1 gigawatts of electricity for PT Adaro's aluminum smelter, with a target of producing 500,000 tons of aluminum per year. However, during the Annual General Meeting of Shareholders (AGM), PT Adaro investors objected to the decision. They were concerned that the construction of a coal-fired power plant by PT Adaro would exacerbate the already high levels of air pollution (Greenpeace, 2023).

There is also the case of PT Mayawana Persada, an industrial forest plantation company operating in Ketapang and Kayong Utara districts, West Kalimantan. In 2023, it deforested more than 5,000 hectares of forest. In addition, since 2022, it has drained 14,505 hectares of peatland, releasing 797,775 metric tons of CO₂ and significantly contributing to the increase in greenhouse gas emissions. As part of its efforts to improve the global climate, Indonesia signed the Kyoto Protocol, which is regulated by Law No. 17 of 2004. With this decision, Indonesia reaffirmed its dedication to reducing greenhouse gas emissions in order to achieve development that is oriented towards environmental and socio-economic sustainability.

Furthermore, the Indonesian has demonstrated its commitment through the issuance of various legal policy instruments specifically designed to regulate climate change mitigation efforts through Presidential Regulation No. 61 of 2011 on the National Action Plan for Greenhouse Gas Emission Reduction and Presidential Regulation No. 71 of 2011, which serve as fundamental instruments in monitoring and evaluating Indonesia's performance in greenhouse gas emission mitigation efforts (Apriliana et al., 2019). Not stopping there, the Indonesian government also ratified the Paris Agreement through Presidential Regulation No. 98 of 2021 on greenhouse gas emission reduction (Tsuroyya

& Ratmono, 2024). Indonesia targets a 29-41 percent reduction in carbon emissions by 2030 (Florenca & Handoko, 2021).

In the context of sustainability, transparency in carbon emissions disclosure is a strategic step for companies to encourage transformation towards sustainable business. Several companies in Indonesia are becoming increasingly aware of the risks of carbon emissions and the importance of transparency in doing business. By openly reporting information related to social and environmental responsibility, companies not only provide accurate information to the public but also demonstrate a strong commitment to the environment. Responsible companies that minimize the environmental impact of their business operations are more attractive to modern society (Febriani & Darmawati, 2025). As a result, investors will be interested in partnering with companies that maintain a good reputation. environmental management and social responsibility. Compliance with environmental conservation efforts has a positive impact on companies, as it enables the long-term sustainability of business operations, supported by healthy environmental conditions (IEC, 2023).

Research conducted by Suherman & Kurniawati (2023), involving 141 observations, shows that the average rate of carbon emission disclosure is only 38%. This figure indicates that many companies in Indonesia still disclose very little information about their carbon emissions and that business actors lack concern for the environment. The relatively high cost of calculating and reporting emissions is one of the factors contributing to the gap in carbon emissions disclosure in Indonesia.

The voluntary nature of carbon emissions disclosure gives companies the freedom to decide whether or not to publish their emissions data. The voluntary nature results in inconsistencies in reporting, particularly among entities that have close ties to the environment and are highly dependent on natural resources (Amaliyah & Solikhah, 2019).

In an effort to disclose its carbon footprint, the company will be faced with several considerations. On the one hand, the company will be faced with the reality that carbon emissions reporting requires significant costs, from measurement to verification. However, on the other hand, companies are increasingly aware that transparency in disclosing carbon emissions can be a catalyst for creating competitive advantage, reducing pressure from various stakeholders who are increasingly demanding accountability and transparency. This can facilitate report users in identifying risks, evaluating performance, and making more informed investment and operational decisions. Ultimately, all these efforts have implications for improving reputation, legitimacy, and good name of the company in the eyes of the public and all stakeholders (Suherman & Kurniawati, 2023).

The first factor considered to influence carbon emission disclosure is the environmental management system (Suherman & Kurniawati, 2023). Environmental management systems An environmental management system is a structured framework adopted by companies to systematically identify, manage, and mitigate the adverse impacts of their operational activities on the environment. This system is necessary for planning and evaluating company operations that affect environmental disclosure while improving operational efficiency. To address environmental management issues, the approach taken is to implement ISO (Oktaviani et al., 2024). ISO 14001 certification offers a comprehensive framework for companies to identify, measure, and manage significant environmental aspects, including carbon emissions. Thus, companies that have implemented the ISO 14001 environmental management system have more accurate and relevant data to support their carbon emissions disclosures (Suherman & Kurniawati, 2023).

Research conducted by (Suherman & Kurniawati, 2023), (Rohmah & Nazir, 2022), (Desvita & Rahma, 2025), (Puteri & Inawati, 2023) and (Ferdiani & Mulyani, 2023) shows

that environmental management systems have a significant positive effect on carbon emission disclosure. This proves that ISO 14001 certification within a company will strengthen the disclosure of greenhouse gas emissions, as companies are more likely to be transparent about their carbon emissions. ISO 14001 certification empowers companies to effectively identify, prioritize, and manage environmental risks, resulting in more accurate data. As a result, the carbon emission figures disclosed by companies will have high credibility compared to companies that do not implement environmental management systems. This is in contrast to research conducted by (Destiyuanita et al., 2022), (Sari & Sulfitri, 2023) and (Iratiwi & Sulfitri, 2023), which shows that environmental management systems do not affect carbon emission disclosure.

Although ISO 14001 as an environmental management system provides a systematic framework for managing environmental aspects, its implementation does not necessarily guarantee a significant increase in transparency or carbon emission reporting. The second factor considered influential is media exposure (Florescia & Handoko, 2021). Media exposure can be interpreted as the obligation of companies to transparently communicate all forms of social responsibility and other crucial information closely related to stakeholders. Positive or negative media exposure can affect the company's reputation. This is because the media plays an important role in monitoring company activities and providing information to the public, especially regarding environmental aspects. Research conducted by (Florescia & Handoko, 2021), (Puspita et al., 2024) and (Marheni et al., 2025) shows that media exposure has a positive effect on carbon emission disclosure. This proves that media exposure shapes public perception of companies, as it facilitates easier access to information for the public and stakeholders regarding environmental conditions and performance, including carbon emissions produced by companies.

In contrast, studies conducted by (Putri & Hermi, 2024), (Sandi et al., 2021), and (Putri & Ariefiara, 2023) show that media exposure does not correlate with carbon emission disclosure. Although the media plays a role in disseminating information, its existence is not always the main stimulus that encourages companies to voluntarily improve carbon emission disclosure. This is because companies' decisions to disclose environmental information tend to be based on internal fundamentals, rather than pressure or spotlight from media coverage.

Recognizing the gap between previous studies, it is necessary to develop research by including company size as a moderating variable, which will either strengthen or weaken the relationship. One indicator to measure company size is the natural logarithm of the company's total assets (Nawangsih et al., 2025). Company size will influence companies in disclosing their carbon emissions because larger companies generally have a higher level of public attention and a higher demand to provide information on how the company protects the environment from its operations (Putri & Amin, 2022). From the above description, it can be estimated that company size can be a moderator of the relationship between environmental management systems and media exposure to carbon emission disclosure.

The topic of carbon emission disclosure research may have been widely discussed, but most studies tend to focus on conventional companies, with few researching sharia-based companies. Therefore, researchers are interested in conducting research on companies listed on ISSI. The selection of ISSI is based on the belief that companies listed on it have proven and reliable sharia commitments. The energy sector, especially those relying on solar fuel and coal, is the largest contributor to global greenhouse gas emissions. Based on the background described above, the researcher is interested in conducting research entitled "Unveiling Carbon Transparency: The Impact of Environmental Management and Media Exposure with Firm Size as a moderator".

LITERATURE REVIEW

Research on the factors influencing carbon emission disclosure (CED) has been widely conducted, with particular emphasis on the role of the environmental management system (EMS). Desvita and Rahma (2025) examined the effects of capital expenditure, environmental performance, EMS, institutional ownership, and the independent board of commissioners on CED, and found that EMS had a positive effect. The novelty of their study lies in the use of media exposure and firm size as moderating variables, as well as the focus on energy sector companies listed on the ISSI. In line with these findings, Oktaviani et al. (2024) also confirmed the positive influence of EMS on CED by incorporating environmental performance as an independent variable and corporate governance as a moderating variable. Similarly, Suherman and Kurniawati (2023) included profitability, institutional ownership, and audit committee as independent variables, yet consistently demonstrated that EMS positively affects CED.

Furthermore, Puteri and Inawati (2023) emphasized EMS and environmental performance as independent variables, yielding similar results—namely, a positive effect of EMS on CED. The distinct feature of their study lies in the analytical model, which excluded media exposure and firm size. Ferdiani and Mulyani (2023) broadened the scope by incorporating social performance and media exposure as independent variables and adding firm size as a moderating variable, again reinforcing the significant role of EMS in promoting carbon emission disclosure. Overall, despite variations in the choice of independent variables, moderating variables, and research objects, all studies consistently highlight EMS as a crucial determinant in enhancing corporate carbon emission disclosure.

Although previous studies consistently demonstrate that the environmental management system (EMS) has a positive effect on carbon emission disclosure (CED), several research gaps remain to be addressed. First, differences across prior studies are mainly reflected in the choice of independent variables, such as profitability, institutional ownership, environmental performance, and social performance. However, most studies have not comprehensively examined external factors, such as media exposure or public pressure, which may play a critical role in strengthening corporate carbon disclosure. Second, there is variation in the moderating variables used. Some studies employed corporate governance and firm size, while others included media exposure. Nevertheless, limited attention has been given to the interaction of these moderating variables and how they may simultaneously reinforce or weaken the relationship between EMS and CED, particularly in high-risk industries such as the energy sector.

Third, most prior studies focused on companies listed on the ISSI, thereby limiting the findings to the context of sharia-based energy companies. This raises the question of whether similar results would be obtained in other industries or among non-sharia companies that operate under different governance mechanisms and regulatory pressures. In summary, the research gaps can be identified in three main areas: (1) the need to expand the scope of independent and external variables influencing CED, (2) the need for a deeper exploration of the role of moderating variables in the EMS–CED relationship, and (3) the necessity to broaden the research context across sectors and financial systems to obtain more generalizable findings.

Legitimacy Theory

Legitimacy can be defined as a reflection of the harmony between the actions of an entity and the norms and values that apply in society. This perception is formed based on the value system, norms, and beliefs widely held by society (Suchman, 1995). According to Dowling & Pfeffer (1975), the originators of legitimacy theory, the existence and sustainability of a business entity greatly depends on the extent to which its activities are in harmony with the values and norms that apply in society. Companies that wish to gain

legitimacy from society must work hard to show that they are able to adapt to the dynamics of their social environment.

As entities operating within society, companies have ethical and social obligations to ensure that their operations are carried out responsibly, especially in terms of their social and environmental impacts. The relationship between legitimacy and practice Company operations are very significant, considering that the output produced by the company will directly influence the public's view and interpretation of the company's existence. When utilizing natural resources and the surrounding environment, companies are obliged to ensure that their exploitation practices are carried out responsibly and sustainably, and do not cause adverse effects on the local community (Suherman & Kurniawati, 2023).

If there is a misalignment between the company's value framework and the norms embraced by the community, or what is termed as a legitimacy gap, it can result in the company experiencing a withdrawal of social legitimacy. This will further pose risks that can threaten the company's continued existence (Iswati & Setiawan, 2020). One way to avoid a legitimacy gap is for companies to comply with existing regulations and norms. In addition, in order to gain legitimacy from the community, companies can reduce greenhouse gas emissions and report them in greenhouse gas emissions disclosures (Gunawan & Meiranto, 2020).

Transparency and accountability play an important role in building credibility with the public, which in turn will generate public trust and legitimacy. Voluntary carbon footprint disclosure efforts by companies are not only an indicator of commitment to environmental issues, but also a means of obtaining a range of benefits (Priliana & Ermaya, 2023).

From the above discussion, it can be concluded that legitimacy theory is a conceptual framework that discusses the interaction between corporate entities and the social environment in which they operate. The focus of this theory is on companies' efforts to gain validation and acceptance from the community, including through information transparency and the implementation of social responsibility. If a company succeeds in gaining validation and legitimacy from the community, this confirms that the company has demonstrated concern for prevailing norms and values, while taking into account the environmental and social conditions in the area around its operations (Florenca & Handoko, 2021).

Stakeholder

(Freeman, 2010) the originator of stakeholder theory argues that the operations of an entity should not solely focus on meeting the expectations of shareholders, but must also consider the interests of various parties related to the company. In other words, companies have an obligation to optimize value for all their stakeholders. According to Clarkson (1995), stakeholders are defined as any individual or group that has ownership status, contractual rights, or interests that are affected by and influence the operations and activities of the company. Stakeholders are entitled to all information relevant to the company's operations. This category of stakeholders includes shareholders, creditors, employees, customers, suppliers, community organizations, and the government (Roberts, 1992).

Stakeholder theory highlights how corporate social interactions and activities can create synergies that lead to benefits and impacts on the stability and continuity of company operations (Winarsih & Supandi, 2020). In order to fulfill its responsibilities to stakeholders, companies must consistently publish reports that reflect transparency regarding their environmental performance. These reports not only provide transparency to stakeholders regarding the company's environmental footprint, but also serve as a tangible form of the company's attention to environmental issues and demonstrate accountability for its operations. Through the presentation of informative and accurate

carbon emission information, companies have the opportunity to enhance their credibility and strengthen their relationships with all stakeholders (Angelina & Handoko, 2023).

From the above description, it can be concluded that the essence of stakeholder theory is to explain how companies establish relationships with all parties who have an interest in their activities, such as shareholders, creditors, consumers, suppliers, the government, the community, and other related parties. This theory emphasizes that a company's operations have responsibilities that are not limited to shareholders but also include consideration of the interests of all stakeholders, thereby creating harmony between profitability and social contribution. Effective disclosure of carbon emission information provides public access to the environmental impact of a company's activities. This empowers stakeholders to assess the company's commitment to social responsibility and its dedication to environmental conservation efforts.

Carbon Emission Disclosure

One of the components of greenhouse gases is carbon compounds. According to Presidential Regulation No. 98 of 2021, greenhouse gases (GHGs) are defined as gases in the atmosphere, both naturally occurring and resulting from human activities. Greenhouse gases include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and various types of hydrofluorocarbons (HFCs). It should be noted that the industrial and energy sectors are the main sources of carbon dioxide emissions (Ministry of Environment and Forestry, 2018).

The increase in greenhouse gas concentrations in the atmosphere continues substantially, both on a global and regional scale. This increase is a consequence of various human activities, with company operations playing a central role as a major contributor. In carrying out their operational activities, many companies use fuels that produce carbon emissions, thereby directly contributing to the acceleration of climate change. In accordance with the requirements of the Kyoto Protocol, companies are now obliged to maintain transparent carbon emission accountability by identifying, calculating, recording, and presenting data on carbon emissions they produce. This aspect is important because companies must be aware of their role in global warming and adopt strategies to minimize the negative impacts caused (Irwhantoko & Basuki, 2016).

Carbon emission disclosure is a manifestation of corporate transparency and accountability in environmental management (Probosar & Kawedar, 2019). This openness allows companies to clearly communicate their carbon footprint to the public. The strategies implemented to reduce emissions, as well as the evaluation of the impact of climate on their business prospects. This condition reflects the high dedication of companies in addressing climate change issues and their positive response in reducing the volume of carbon emissions produced. The transparency of carbon emission disclosure is expected to encourage companies to actively reduce carbon emissions as a form of accountability to the environment (Rini et al., 2021).

Companies are required to classify themselves into one of three emission categories. The three categories are as follows (Choi et al., 2013):

1) First category how companies establish relationships with all parties who have an interest in their activities, such as shareholders, creditors, consumers, suppliers, the government, the community, and other related parties. This theory emphasizes that a company's operations have responsibilities that are not limited to shareholders but also include consideration of the interests of all stakeholders, thereby creating harmony between profitability and social contribution. Effective disclosure of carbon emission information provides public access to the environmental impact of a company's activities. This empowers stakeholders to assess the company's commitment to social responsibility and its dedication to environmental conservation efforts.

Indirect GHG Emissions

These emissions stem from the company's operational activities, but their main sources are outside the company's direct ownership or control. This includes emissions from the extraction and production processes of acquired raw materials, emissions from the purchase of fuel for transportation purposes, and emissions related to the use of products and services marketed by the company.

Environmental Management System

An Environmental Management System is a planning and implementation framework adopted by companies to control how they interact with the environment. An environmental management system facilitates companies to improve their economic and environmental performance, while mitigating risks related to environmental responsibility. The foundation of an environmental management system consists of organizational structure, planning activities, accountability, practices, procedures, processes, and resources that are vital for developing, applying, implementing, evaluating, and maintaining the consistency of environmental policies.

According to the Indonesia Environment Energy Center (IEC), ISO 14001 is an international standard that serves to synergize business growth with a commitment to environmental preservation. Companies that adopt and comply with the ISO 14001 standard will be recognized internationally for meeting environmental management standards that are considered the benchmark for contributing to responsible environmental management (Oktaviani et al., 2024). Covering a precise organizational structure, the establishment of personal accountability, metric-based planning, and integrated environmental policies, this system enables companies to demonstrate their responsibility for environmental sustainability (Ferdiani & Mulyani, 2023). The existence of an environmental management system will encourage companies to be more transparent in reporting the carbon emissions generated from their activities, while also ensuring more accurate information compared to companies that do not have an environmental management system (Rohmah & Nazir, 2022). This standard offers a comprehensive framework designed to manage and minimize the negative impact of company activities on the environment, including air, water, and soil quality.

Companies that implement the ISO 14001 international standard in their environmental management systems tend to have greater openness and confidence in communicating their efforts to reduce greenhouse gas emissions to stakeholders such as investors and the public. This structured and systematic framework provides a basis for companies to improve their capabilities in collecting and reporting greenhouse gas emissions data with a high level of accuracy and credibility. Companies that have obtained ISO 14001 certification are considered to have a strong commitment to the environment and sustainability, an attribute that has the potential to improve their reputation and increase their competitiveness in attracting investment (Deantari et al., 2019).

Media Exposure

The existence of media coverage facilitates access for stakeholders to obtain the latest information on the company's environmental conditions and performance, including specific data on carbon emissions (Florescia & Handoko, 2021). The tendency of companies to disclose all their activities, including efforts aimed at significantly reducing greenhouse gas emissions, can shape perceptions and dispel negative stakeholder stigma regarding the company's credibility and reputation (Tsuroyya & Ratmono, 2024). Companies generally disclose all their activities, including carbon emission reduction efforts, based on the assumption that such actions can improve the company's financial performance by attracting investor interest in capital investment. Carbon emission transparency will equip companies with credibility in the eyes of the public, while also indicating that the company's operational practices are in line with applicable standards. Media exposure plays an important role in the survival of a company. The media serves as a vital means of interaction for disseminating information to the general public. With its ability to monitor company activities, the media requires companies to be cautious and

responsive to any news that may arise. Companies will implement strategies to prevent potential mistakes in order to maintain their credibility and image in the public eye. Media exposure allows the public to express their opinions, both positive and negative. Therefore, companies must strive to operate responsibly with regard to social and environmental issues (Sandi et al., 2021).

Company Size

Company size relates to the classification of a company as large or small. Company size is classified into three categories, namely: Large Firm, Medium-Size Firm and Small Firm (Small Firm). The size of a company can be determined in various ways, based on total assets, sales volume, market value, and others (Kholmi et al., 2020). In determining the size of a company, total assets are used as an indicator because they reflect the wealth owned by the company. The larger the company, the more activities it carries out. In addition, large companies tend to have a lower level of risk compared to small companies because large-scale companies generally have large reserves of funds and do not experience difficulties in obtaining funds from creditors (Nurmansyah et al., 2023).

HYPOTHESIS

The Effect of Environmental Management Systems on Carbon Emission Disclosure

According to the legitimacy theory proposed by (Dowling & Pfeffer, 1975), it emphasizes that companies must maintain consistency in their operations in order to be in line with the values and social norms that apply in society. ISO 14001 equips companies with an essential environmental management system to meet environmental standards and regulations enforced by the government and expected by society. Furthermore, stakeholder theory proposed by Freeman (1984) explains that companies have responsibilities that are not limited to creating profits for shareholders alone, but are also obligated to consider and provide positive impacts to all related parties. Through carbon emissions disclosure, companies that adopt the ISO 14001 standard will facilitate the collection and presentation of organized carbon emissions data, thereby increasing credibility and reducing stakeholder concerns.

Research conducted by Desvita & Rahma (2025), Suherman & Kurniawati (2023), Ferdiani & Mulyani (2023), and Puteri & Inawati (2023) states that environmental management systems have a positive relationship with carbon emission disclosure. ISO 14001 has been proven to positively influence companies to demonstrate greater transparency in disclosing carbon emission data. Companies that have obtained ISO 14001 certification are able to demonstrate their capability in building a structured system to identify, manage, and reduce the environmental impact of their business activities, leading to the presentation of accurate and transparent information related to environmental impact. Based on this description, the author proposes the first hypothesis: H1: Environmental management systems have a positive effect on carbon emission disclosure

The Effect of Media Exposure on Carbon Emission Disclosure

The media serves as an interactive platform that enables the communication of corporate sustainability information and environmental disclosures to stakeholders. Media publications will cause companies to be under more intense public scrutiny, which will result in their reputation being more closely monitored (Tsuroyya & Ratmono, 2024). In line with stakeholder theory, companies will tend to provide transparency on all their activities, including carbon emission reduction measures that are considered to enhance their reputation, thereby attracting investors to invest.

Through the company's own initiatives to disclose information regarding its environmental responsibilities, positive signals can increase if the company's environmental management activities are covered by the media (Tsuroyya & Ratmono, 2024). Companies that are in the spotlight of media coverage tend to be motivated to voluntarily

provide transparency on carbon emissions. This is supported by research Tsuroyya & Ratmono (2024), Puspita, et al (2024), Florencia & Handoko (2021), which states that media exposure has a positive influence on carbon emission disclosure.

In general, from the above discussion, it can be concluded that companies that want to gain legitimacy from the public must demonstrate positive initiatives. One strategic way to achieve this is through transparency in carbon emissions disclosure. The existence of media exposure related to environmental issues has the potential to shape stakeholder perceptions regarding the company's dedication to the environment. Therefore, it can be concluded that the second hypothesis proposed in this study is as follows: H2: Media Exposure has a positive effect on Carbon Emission Disclosure

The Effect of Environmental Management Systems on Carbon Emission Disclosure with Company Size as a Moderating Variable

An Environmental Management System is a structured framework that companies use to help manage their environmental impact systematically, including carbon emissions disclosure. Proper implementation of an Environmental Management System can encourage companies to disclose their carbon emissions data in a transparent, comprehensive, and accountable manner (Desvita & Rahma, 2025). Referring to stakeholder theory, company size has the potential to be a moderating factor, because large companies have greater resources and finances as well as stronger regulatory pressure in environmental reporting practices. The larger the company, the higher the level of public attention, and the greater the demand for information on how the company protects the environment from its operations (S. D. A. Putri & Amin, 2022). Therefore, company size is one aspect that can influence carbon emission disclosure. From the above description, it can be concluded that the third hypothesis proposed in this study is as follows: H3: Company Size moderates the influence of the Environmental Management System on Carbon Emission Disclosure.

The Effect of Media Exposure on Carbon Emission Disclosure with Company Size as a Moderating Variable

Referring to the theory of legitimacy, companies will strive to communicate their activities related to environmental issues. The purpose of this practice is to improve the company's image. In addition to the company itself disclosing information about its environmental responsibilities, a positive image can be reinforced when the company's environmental management activities are exposed and widely reported by the media. Based on stakeholder theory, the higher the media exposure received by a company, the greater the public pressure pushing the company to disclose environmental information in a more transparent manner, including carbon emission disclosure (Wiratno & Muaziz, 2020). Larger companies tend to have more adequate resources to meet expectations for more comprehensive information disclosure and receive greater media attention. This statement is in line with research conducted by (Diandra et al., 2023) that company size can moderate the influence of media exposure on carbon emission disclosure. From the above description, it can be concluded that the fourth hypothesis proposed in this study is as follows: H4: Company Size moderates the influence of Media Exposure on Carbon Emission Disclosure.

METHODS

This study uses quantitative and secondary data from annual reports and sustainability reports of energy sector companies in Indonesia listed on the Indonesian Sharia Stock Index (ISSI) for the 2021-2024 period, published on www.idx.co.id and the company's official website. The population used in this study is energy sector companies listed on the Indonesian Sharia Stock Index (ISSI) for the 2021-2024 period. The sample is a specific subject of the population to be studied (Pratama & Cahyono, 2021). The sample selection technique in this study uses a purposive sampling method, namely the researcher's subjective considerations based on predetermined population criteria. The

criteria set in this study are energy sector companies listed on the ISSI for the 2021-2024 period, energy sector companies not listed on the ISSI consecutively during the study period, and companies that do not publish sustainability reports. The sample obtained in this study is 140. This study uses ereviews with a Moderated Regression Analysis test.

$$Y = \alpha + \beta_1.X_1 + \beta_2.X_2 + \beta_3.X_1.Z + \beta_4.X_2.Z + e \quad (i)$$

Description: Y : Carbon Emission Disclosure, α : Konstanta

β : Koefisien Regresi , X_1 : Environmental Management System (EMS) , X_2 : Media Exposure , Z : Company Size

Table 1. Measurement of Carbon Disclosure

No	Categories	Item
1	Climate Change: Risks and Opportunities	CC-1: Assessment/description of the risks associated with climate change and the actions taken or actions to be taken to address the risks
		CC-2: Current (and future) assessment/description of the financial, business and opportunity implications of climate change.
2.	Calculation of GHG (Greenhouse Gas) emissions GHG/Greenhouse Gas)	GHG-1: Description of the methodology used to calculate greenhouse gas emissions
		GHG-2: The existence of verification from external parties in measuring the amount of GHG emissions
		GHG-3: Total GHG emissions produced
		GHG-4: Disclosure of scope 1 and 2, or scope 3 GHG emissions
		GHG-5: Disclosure of GHG emission sources
		GHG-6: Disclosure of GHG facilities or segments
		GHG-7: Comparison of GHG emissions with the previous year
3.	(EC/Energy Consumption)	EC-1: Total energy consumed
		EC-2: Quantification of energy used from renewable resources.
		EC-3: Disclosure by type, facility or segment
4.	Greenhouse Gas Reduction and Costs (RC/Reduction and Cost)	RC-1: Details of plans or strategies to reduce GHG emissions.
		RC-2: Specifications of the target level and year of GHG emission reduction
		RC-3: The reductions in emissions and costs or savings achieved to date are a result of the planned reductions in greenhouse gas emissions.
		RC-4: Future emission costs are taken into account in capital expenditure planning.

No	Categories	Item
5.	Carbon Emissions Accountability	AEC-1: Indications that the board committee has responsibility for actions related to climate change
	(AEC/Accountability of Emission Carbon)	AEC-2: Description of the mechanisms by which the board reviews the company's progress on climate change.

Source: Processed Data (2025)

Environmental management system measurement is calculated using a dummy variable. If a company has an ISO 14001 certificate for its environmental management system, it is given a score of 1; otherwise, it is given a score of 0 (Puteri & Inawati, 2023). Media exposure is measured using a dummy variable (Florescia & Handoko, 2021). A company receives a score of 1 if it discloses its carbon emissions information on its official website, and a score of 0 if it does not. The moderating variable used is company size. According to (Putri & Amin, 2022), company size is calculated from its total assets. Company size is measured as follows: $SIZE = LN(\text{Total Assets})$. The measurement uses the natural logarithm (Ln), which aims to reduce extreme values of the company's asset value.

RESULTS

Stationeritas Analysis

From the test results described in Table 2, the probability values for the independent, dependent, and moderating variables are significantly below 0.05 at the level. Therefore, it can be concluded that the observed data can be considered stationary.

Table 2. Stationeritas Test Result

No	Variable	Probability	Leveling	
1	Y	0.0000	Level	Stationer
2	X1	0.0014	Level	Stationer
3	X2	0.0379	Level	Stationer
4	Z	0.0000	Level	Stationer

Source: Secondary Data, Processed (2025)

Panel Data Regression Test

Because this study uses panel data, which is a combination of cross-sectional and time series data, a panel data regression test is necessary. There are three different estimation methods that can be applied to panel data regression models.

Common Effect Model

Table 3 shows the common effect model. This approach applies the Ordinary Least Squares (OLS) method to combine time series and cross-sectional data, without considering differences between time periods and individuals (Alamsyah et al., 2022).

Fixed Effect Model

Table 4 shows the fixed effect model. The intercept approach was chosen in this model because each entity is assumed to be stable and does not vary over time, so the dummy variable technique is used to estimate panel data (Alamsyah et al., 2022).

Random Effect Model

Table 5 shows the random effect model. This model estimates situations where confounding variables can be said to be both individual and time dependent (Alamsyah et al., 2022).

Table 3. Common Effect Model Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.489449	0.032494	15.06267	0.0000
X1	-0.278477	0.295954	-0.940947	0.3484
X2	-0.255115	0.278989	-0.914426	0.3621
X1Z	0.011136	0.010378	1.073048	0.2852
X2Z	0.013912	0.009657	1.440574	0.1520
R-squared	0.262055	Mean dependent var		0.639683
Adjusted R-squared	0.240190	S.D. dependent var		0.149679
S.E. of regression	0.130470	Akaike info criterion		-1.200279
Sum squared resid	2.298043	Schwarz criterion		-1.095220
Log likelihood	89.01954	Hannan-Quinn criter.		-1.157586
F-statistic	11.98509	Durbin-Watson stat		0.599941
Prob(F-statistic)	0.000000			

Source: Secondary Data, Processed (2025)

Table 4. Fixed Effect Model Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.448254	0.058752	7.629633	0.0000
X1	0.427685	0.463851	0.922031	0.3587
X2	-0.191354	0.567602	-0.337127	0.7367
X1Z	-0.011901	0.016449	-0.723535	0.4710
X2Z	0.012430	0.019719	0.630344	0.5299
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.703036	Mean dependent var		0.639683
Adjusted R-squared	0.591307	S.D. dependent var		0.149679
S.E. of regression	0.095688	Akaike info criterion		-1.624823
Sum squared resid	0.924779	Schwarz criterion		-0.805366
Log likelihood	152.7376	Hannan-Quinn criter.		-1.291820
F-statistic	6.292327	Durbin-Watson stat		1.491484
Prob(F-statistic)	0.000000			

Source: Secondary Data, Processed (2025)

Table 5. Random Effect Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.472733	0.042875	11.02585	0.0000
X1	0.060622	0.349487	0.173459	0.8626
X2	-0.378264	0.352117	-1.074256	0.2846
X1Z	6.47E-05	0.012317	0.005252	0.9958
X2Z	0.018446	0.012196	1.512414	0.1328
Effects Specification				
		S.D.		Rho
Cross-section random		0.092543		0.4833
Idiosyncratic random		0.095688		0.5167

Weighted Statistics			
R-squared	0.166456	Mean dependent var	0.293774
Adjusted R-squared	0.141759	S.D. dependent var	0.103483
S.E. of regression	0.095868	Sum squared resid	1.240737
F-statistic	6.739784	Durbin-Watson stat	1.095675
Prob(F-statistic)	0.000056		
Unweighted Statistics			
R-squared	0.246866	Mean dependent var	0.639683
Sum squared resid	2.345343	Durbin-Watson stat	0.579636

Source: Secondary Data, Processed (2025)

Classical Assumption Tests

To ensure that the regression model meets basic statistical requirements, a series of classical assumption tests must be performed. In this study, several tests will be used, including:

Normality Test

A normality test is necessary to determine whether the dependent and independent variables in the regression model are normally distributed. This test relies on the Jarque-Bera value, which stipulates that if the probability value is >0.05 , the data are normally distributed (Ghozali & Ratmono, 2017). Based on the normality test in diagram 1 the Jarque-Bera probability value is $0.2997759 > 0.05$, thus concluding that the residuals in the regression model are normally distributed.

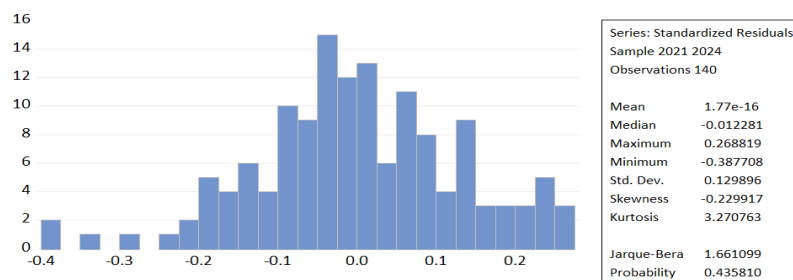


Figure 1. Normality Test
Source: Secondary Data, Processed (2025)

Heteroscedasticity Test

The heteroscedasticity test was conducted to detect the presence of unequal variances in the residuals. This study used the Glesjer test, with the stipulation that if the significance value is > 0.05 , heteroscedasticity does not occur (Ghozali & Ratmono, 2017). Based on the heteroscedasticity test in Table 6 the probability value for each variable is >0.05 , thus concluding that the regression model is free from heteroscedasticity.

Multicollinearity Test

The multicollinearity t-test is used to detect whether the regression model finds a correlation between variables. This test examines the correlation value; if the value is <0.80 , then multicollinearity is not present (Ghozali & Ratmono, 2017). Based on the results of the multicollinearity test in Table 7 several variables were found to have correlation values >0.80 . This indicates that the regression model used exhibits multicollinearity. Therefore, a data transformation approach is necessary to correct the correlation. The results of this correction are shown below (Table 8). Based on Table 8, after data transformation, the correlation value was <0.80 , indicating no signs of multicollinearity.

Table 6. Heteroscedasticity Test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.070708	0.025414	2.782219	0.0062
X1	-0.151792	0.217474	-0.697977	0.4864
X2	0.306392	0.212595	1.441199	0.1518
X1Z	0.006197	0.007649	0.810198	0.4193
X2Z	-0.010131	0.007361	-1.376223	0.1710
Effects Specification				
			S.D.	Rho
Cross-section random			0.044945	0.3025
Idiosyncratic random			0.068244	0.6975

Source: Secondary Data, Processed (2025)**Table 7. Multicollinearity 1 Test**

	X1	X2	X1Z	X2Z
X1	1.000000	0.005971	0.989925	0.040589
X2	0.005971	1.000000	0.004727	0.976645
X1Z	0.989925	0.004727	1.000000	0.064588
X2Z	0.040589	0.976645	0.064588	1.000000

Source: Secondary Data, Processed (2025)**Table 8. Multicollinearity 2 Test**

	X1	X2	D(X1Z)	D(X2Z)
X1	1.000.000	-0.008191	0.219391	-0.061341
X2	-0.008191	1.000.000	0.032140	0.302039
D(X1Z)	0.219391	0.032140	1.000.000	0.027881
D(X2Z)	-0.061341	0.302039	0.027881	1.000.000

Source: Secondary Data, Processed (2025)**Autocorrelation Test**

The autocorrelation test was conducted to detect deviations in the regression model, namely the correlation between residuals from one observation and another. This test uses the Durbin-Watson value (Ghozali & Ratmono, 2017). It is known from table 9 above that the value of the Durbin-Watson stat is 1.431708. This indicates that the number is between -2 and +2, which means the data has no autocorrelation.

Determination Test (R²)

The coefficient of determination test was conducted to determine the extent to which performance explains variation in the dependent variable (Ghozali & Ratmono, 2017). Based on the coefficient of determination (R²) test in Table 5.1, the R-squared value was obtained as 0.124439. Therefore, it can be concluded that the independent variable in this study influences the dependent variable by 12%, while the remaining 88% is influenced by other factors not included in the study.

Simultaneous Significance Test (F)

The F test is used to determine whether all independent variables together influence the dependent variable (Ghozali & Ratmono, 2017). Based on table 5.2, the simultaneous significance test (F) obtained a probability F statistic value of 0.009397 < 0.05. Therefore, it can be concluded that Y is significantly influenced by X1 and X2.

Table 9. Autocorrelation Test

	Value
Durbin-Watson stat	1.431.708

Source: Secondary Data, Processed (2025)

Table 10. Results of the Coefficient of Determination Test

	Value
R-squared	0.124439
Adjusted R-squared	0.089416

Source: Secondary Data, Processed (2025)

Table 11. Simultaneous Test

	Value
F-statistic	3.553.109
Prob(F-statistic)	0.009397

Source: Secondary Data, Processed (2025)

Partial Test

Based on the partial test results in Table 12, the following conclusions can be drawn: 1) Environmental management system has a positive sign and a probability of $0.0685 > 0.05$, indicating that EMS has a positive but insignificant impact on carbon emission disclosure. 2) Furthermore, media exposure has a positive sign with a result of $0.0015 < 0.05$, indicating that ME has a positive and significant impact on carbon emission disclosure.

Uji Moderate Regression Analysis (MRA)

Based on the equations from the data testing results, the following results were obtained: 1) The results of the moderation test using a random effects interaction model between Environmental Management System and Company Size yielded a coefficient value of -0.000889 , with a negative direction and a probability value of 0.05049 . This value is >0.05 . This result indicates that the interaction between the Environmental Management System variable and company size has a statistically negative and insignificant effect on carbon emission disclosure. 2) The results of the moderation test using a random effects interaction model between media exposure and Company Size yielded a coefficient value of -0.003482 , with a negative direction and a probability value of 0.1740 . This value is >0.05 . This result indicates that the interaction between the media exposure variable and company size has a statistically negative and insignificant effect on carbon emission disclosure.

Table 12. Partial Test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.474510	0.053646	8.845.147	0.0000
X1	0.065749	0.035707	1.841.361	0.0685
X2	0.170476	0.052145	3.269.297	0.0015
D(X1Z)	-0.000889	0.001328	-0.669286	0.5049
D(X2Z)	-0.003482	0.002543	-1.369.245	0.1740

Source: Secondary Data, Processed (2025)

Table 13. MRA Test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.474510	0.053646	8.845.147	0.0000
X1	0.065749	0.035707	1.841.361	0.0685
X2	0.170476	0.052145	3.269.297	0.0015
D(X1Z)	-0.000889	0.001328	-0.669286	0.5049
D(X2Z)	-0.003482	0.002543	-1.369.245	0.1740

Source: Secondary Data, Processed (2025)

DISCUSSIONS

The Effect of Environmental Management Systems on Carbon Emission Disclosure

The test results indicate that ISO 14001 certification has a positive but insignificant effect on carbon emission disclosure, which is inconsistent with Hypothesis 1. The involvement of companies with ISO 14001 certification leads to higher levels of environmental disclosure. ISO 14001 implementation and certification help companies integrate their environmental, health, and safety management systems (Destiyuanita et al., 2022).

This contradicts legitimacy theory, which states that companies seeking societal legitimacy must maintain consistency and operate in accordance with prevailing social values and norms. ISO 14001 certification equips companies to meet environmental standards and regulations imposed by the government and expected by the public. The results of this regression suggest that the ISO 14001 environmental management system may not be adequate as a reference for companies to manage and mitigate the risks of climate change resulting from their carbon emissions. This research disagrees with research conducted by Desvita & Rahma (2025) and Suherman & Kurniawati (2023), which found that companies with ISO 14001 certification were more motivated to disclose their carbon emissions. However, this research aligns with research by Destiyuanita et al. (2022), which found that ISO 14001 certification had a positive but insignificant effect on carbon emission disclosure.

The Effect of Media Exposure on Carbon Emission Disclosure

The test results indicate that media exposure has a positive and significant effect on carbon emission disclosure, which aligns with Hypothesis 2. Media exposure will expose a company to greater public scrutiny, impacting its reputation, which will be scrutinized (Tsuroyya & Ratmono, 2024). Companies under scrutiny are more likely to be motivated to voluntarily provide carbon emission transparency. This aligns with stakeholder theory, which states that companies are more likely to provide transparency regarding all their activities, including carbon emission reduction measures. Through this, companies can build a positive image among the public if they prioritize not only profit but also environmental concerns. This research aligns with research conducted by Tsuroyya & Ratmono (2024) and Florencia & Handoko (2021), which found that media exposure positively influences carbon emission disclosure. However, this research disagrees with Putri & Hermi (2024), who found that media exposure showed no effect on carbon emission disclosure.

The Effect of Environmental Management System on Carbon Emission Disclosure, Moderated by Company Size

The test results indicate that company size does not moderate the effect of environmental management system on carbon emission disclosure. Having ISO 14001 certification serves as formal evidence that a company has implemented an internationally recognized environmental management system. Both small and large companies, when ISO 14001 certified, are more likely to maintain or even improve the quality of their environmental disclosures to gain public trust. This is inconsistent with stakeholder theory, which

suggests that company size can potentially act as a moderating factor. Larger companies, assumed to have greater resources and financial resources, and facing stronger regulatory pressures on environmental reporting practices, are expected to implement ISO 14001 within their companies. However, research findings indicate that ISO 14001 certification is not limited to large companies. Smaller companies can also obtain certification and must meet carbon emission disclosure standards, with an emphasis on environmental transparency. This research contradicts the statement (Putri & Amin, 2022), which states that the larger the company, the greater the public attention it receives, and the greater the demand for information on how the company protects the environment through its operations.

The Effect of Media Exposure on Carbon Emission Disclosure, Moderated by Company Size

The test results indicate that company size does not moderate the effect of media exposure on carbon emission disclosure. This finding indicates that company size does not always influence the strength of the relationship between media exposure and carbon emission disclosure.

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