

TRANSFORMING CARBON EMISSION TRANSPARENCY: THE IMPACT OF GREEN R&D, MEDIA EXPOSURE, AND ENVIRONMENTAL COSTS IN INDONESIA**Rona Majidah^{1a}, Ayu Dwiny Octary^{2b}, Syaharani Noer Fathia^{3c}**¹²³Department of Accounting, Faculty of Economic and Business, Universitas Lampung, Lampung, Indonesia
rona.majidah@feb.unila.ac.id^a, ayu.dwiny@feb.unila.ac.id^b, syaharani.noer@feb.unila.ac.id^c**INFO ARTIKEL****Dikumpulkan:** 25 September 2024**Diterima:** 10 Januari 2025**Terbit:** 30 Januari 2025

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<http://doi.org/10.23960/jak.v30i1.3438>**ABSTRACT**

The Indonesian government has supported efforts to reduce carbon emissions by issuing Law Number 16 of 2016 concerning the Ratification of the Paris Agreement to the United Nations Framework for Climate Change Convention and Presidential Regulation Number 61 of 2011 concerning the national action plan for reducing greenhouse gas emissions. In addition, the Indonesia Financial Services Authority (OJK) is also involved in organizing carbon exchanges to reduce carbon emissions by implementing a good environmental management system. This study aims to investigate the effects of R&D intensity, media exposure, and environmental cost allocation on the quality of carbon emission disclosure. Carbon emission disclosure is measured using a scoring index developed by (Choi, Lee, & Psaros, 2013) based on the Carbon Disclosure Project (CDP). The study's results show that environmental costs and media exposure have a positive and significant effect on carbon emission disclosure in Indonesia, while R&D intensity has a positive but insignificant effect. In Indonesia, factors such as environmental budgets and media exposure play a crucial role in encouraging companies to be more transparent about their carbon emissions. Regarding R&D intensity, although it fosters corporate innovation, it has not yet significantly driven companies to be more open about their carbon emissions at this time.

Keywords: carbon emission disclosure, environmental cost, green innovation, media exposure, RnD intensity

ABSTRAK

Pemerintah Indonesia telah mendukung upaya penurunan emisi karbon dengan menerbitkan Undang-Undang Nomor 16 Tahun 2016 tentang Pengesahan Paris Agreement to the United Nations Framework for Climate Change Convention dan Peraturan Presiden Nomor 61 Tahun 2011 tentang rencana aksi nasional penurunan emisi gas rumah kaca. Selain itu, Otoritas Jasa Keuangan (OJK) juga turut serta dalam penyelenggara bursa karbon demi menekan tingkat emisi karbon. dengan menerapkan sistem manajemen lingkungan yang baik. Penelitian ini bertujuan untuk menginvestigasi efek RnD intensity, media exposure, dan alokasi biaya lingkungan pada kualitas pengungkapan emisi karbon. Dimana, RnD intensity diukur dengan membagi biaya RnD dengan total aset, media exposure diukur dengan dummy yaitu nilai 1 untuk industri yg memiliki exposure di media yang kredibel, dan alokasi biaya lingkungan diprosikan dengan total biaya lingkungan perusahaan. Sedangkan, pengungkapan emisi karbon diukur dengan menggunakan skoring indeks yang dikembangkan oleh (Choi et al., 2013) berdasarkan Carbon Disclosure Project (CDP). Hasil penelitian menunjukkan bahwa variabel biaya lingkungan dan media exposure berpengaruh positif dan signifikan terhadap pengungkapan emisi karbon di Indonesia, sedangkan variabel RnD intensity berpengaruh positif namun tidak signifikan. Di Indonesia, faktor-faktor seperti anggaran lingkungan dan eksposur media berperan penting dalam mendorong perusahaan untuk lebih transparan terkait emisi karbon mereka. Adapun intensitas R&D, meskipun memberikan kontribusi terhadap inovasi perusahaan, belum secara signifikan mendorong perusahaan untuk lebih terbuka dalam pengungkapan emisi karbon mereka pada saat ini.

Kata Kunci: pengungkapan emisi karbon, biaya lingkungan, inovasi hijau, media exposure, RnD intensity

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Climate change is an environmental issue that is an important topic of discussion in the world, where companies are the largest contributors of carbon emissions, which can cause harm to humans and nature itself. This

leaves no doubt that business plays a significant role in delivering environmental performance results through production, operations and efforts to achieve more sustainable product innovation and practices (Busch & Hoffmann, 2011). The Indonesian government issued Law Number 16 of 2016 concerning Ratification of the Paris Agreement to the United Nations Framework for Climate Change Convention and Presidential Regulation Number 61 of 2011 concerning the National Action Plan in Reducing Greenhouse Gas Emissions (RAN-GRK) to set targets for reducing greenhouse gas emissions, but in its realization it still depends on voluntary participation. Furthermore, the Conference of the Parties 28 held in 2023 in Dubai, United Arab Emirates resulted in an agreement to mitigate the global climate as well as an effort to control and account for countries in the previous conference agreement. This is also a follow-up to the Paris Agreement to keep global temperatures from reaching 1.5°C. In response to the agreement, the Financial Services Authority (OJK) stated that it was ready to support the implementation of the carbon exchange through a press release in September 2022.

With several regulations issued by Indonesia, companies in Indonesia must participate in reducing carbon emissions. However, in Indonesia, environmental disclosure related to greenhouse gas emissions is still voluntary (Majid & Ghozali, 2015). This proves that in Indonesia the level of corporate disclosure related to environmental improvement and emission reduction is very low, namely 10.1% (Asmaranti & Lindrianasari, 2014). By looking at the phenomena that occur, it can be seen that when compared to developing countries that implement mandatory rules, they get more significant or real results than voluntary ones (Lindrianasari, Kufepaksi, Asmaranti, & Komalasari, 2018). So, government intervention is needed to deal with environmental issues (Lindrianasari & Asmaranti, 2004). Thus, the implementation of an environmental management system is important to be used as a sustainability strategy in companies, such as pollution prevention, reuse or recycling of waste and unused products, energy efficiency by seeking alternative non-renewable energy, and carbon management (Lee & Min, 2015).

Some companies do this by developing green products or production supported by increased operational and energy efficiency (Dangelico & Pujari, 2010a; Triguero, Moreno-Mondejar, & Davia, 2013) (Dangelico & Pujari, 2010b), where environmental innovation carried out by companies is closely related to investment in research and development (RnD). Study Lee and Min (2015) shows that RnD spending has a positive effect in reducing carbon emission intensity through technological innovation. In addition, Lee and Min (2015) found that green RnD investment has a positive and significant causality with carbon emissions as a proxy for environmental performance. In addition to research and development, carbon emission disclosure is also closely related to media visibility or media exposure. Media is an external factor that can encourage corporate disclosure because there is a framing effect of media coverage that can influence public views of the company (Dawkins & Fraas, 2011). With the influence of internal (R&D intensity) and external (media exposure) it will be able to encourage disclosure of carbon emissions (Dawkins & Fraas, 2011); (Michelon, 2011). Furthermore, the quality of such disclosure can be improved by the way companies allocate environmental costs so as to provide transparency regarding the environmental impact of the company's business operations (Clarkson, Li, Richardson, & Vasvari, 2008). This study aims to obtain empirical evidence on the effects of RnD intensity, media exposure, and environmental cost allocation on the quality of environmental disclosure in terms of carbon emission reduction activities as a development of previous research.

B. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Natural Resource-Based View (NRBV) Theory

The NRBV and RBV theories state that a company's competitive advantage lies in heterogeneous resources that have unique characteristics that are valuable, expensive to imitate, and cannot be substituted. The resource-based view (RBV) and the natural resource-based view (NRBV) provide an appropriate theoretical basis for discussing the contribution of resources and capabilities to ecoinnovation performance (Dangelico & Pujari, 2010b). This theory highlights the relationship between environmental strategy and corporate competitiveness, where to achieve long-term success, companies need to accumulate resources and manage capabilities with a long-term focus while paying attention to the environment. In addition, companies must have the ability to plan sustainable technology and products in order to lead to competitive advantage (Hart & Dowell, 2011). Specifically, NRBV argues that companies need to develop three types of proactive environmental strategies, namely preventive efforts on pollution control, product management and sustainable development.

Research and Development (RnD)

Research and development (RnD) is a company investment that is useful for increasing knowledge so that the company's performance in the long term can increase, thus having an impact on firm value through innovation and

continuous improvement, from the process to the product (Padgett & Galan, 2010). In addition, sustainable competitiveness can be achieved through R&D investment, namely by allocating company resources and capabilities to products, processes and technologies that increase efficiency and reduce environmental disturbances. Several studies in the field of sustainability research claim that proactive environmental policies including R&D investment can create a win-win situation by improving the financial and environmental performance of companies (Alam, Atif, Chien-Chi, & Soytaş, 2019). In line with the findings Kabongo and Okpara (2013) that investment in environmental innovation through green R&D can enable companies to reduce environmental problems.

Media Exposure

Media exposure is one of the factors related to voluntary disclosure. Stakeholder pressure on environmental management depends on public attitudes influenced by media coverage (Kioussis, Popescu, & Mitrook, 2007). In reflecting and shaping public priorities, the media can put pressure on companies that care about their corporate reputation (Capriotti, 2009). Previous research has shown that media attention to environmental issues is associated with increased environmental disclosure in response to public pressure (Coetzee & Staden, 2011); (Cormier & Magnan, 2015); (Islam & Deegan, 2010); (Islam, Dissanayake, Dellaportas, & Haque, 2018). In addition, media coverage can influence the strategic decisions of managers who care about reputation (Liu & McConnell, 2013) and voluntary environmental disclosure in its company (Rupley, Brown, & Marshall, 2012).

Environmental Costs

Environmental costs are a group of costs that arise as a result of a company's failure to maintain environmental quality. In other words, environmental control costs arise from a weak environmental reputation. The approach to environmental costs in the early 90s began to be understood as costs used to reduce current and future environmental damage. Furthermore, the latest approach defines environmental costs as one of the tools in environmental control, either in terms of sustainable environmental improvement or prevention of environmental damage (Taygashinova & Akhmetova, 2019). In research Jasch (2003) explains that environmental costs include internal aspects related to the production process within a company and external aspects related to costs incurred as a result of the company's business activities for society.

Carbon Emissions Disclosure

Based on PSAK No. 1 (Revised 2009) states that environmental disclosure, including carbon emission disclosure is part of the additional report. This report contains environmental responses to their activities, namely by expanding the company's role in disclosing financial and environmental information (Rustam, Wang, & Zameer, 2019). In addition, environmental reporting is also useful for informing stakeholders that their business activities and investment decisions are environmentally sustainable (Masud, Nurunnabi, & Bae, 2018). This allows companies to increase stakeholder trust, assess potential risks associated with the implementation of business activities, and as a step in reducing negative environmental impacts resulting from company activities (Bhalla & Singh, 2018).

Research Hypothesis

The Effect of R&D Intensity on Carbon Emission Disclosure

Long-term commitment to adopting eco-innovation needs to be made, especially in the form of R&D which is useful for identifying production, environmental technology, increasing energy efficiency and at the same time leading to product innovation (Sambasivan, Bah, & Jo-Ann, 2013). Berrone, Fosfuri, Gelabert, and Gomez-Mejia (2013) also provides the fact that R&D intensity is directed towards environmental innovation, which focuses on pollution prevention programs aimed at protecting the environment. Padgett and Galan (2010) proves that RnD intensity has a positive causality towards CSR and that the causality is very significant in the manufacturing industry, while for non-manufacturing it has no effect. The same results were also found in the study (Clarkson, Li, Richardson, & Vasvari, 2011); (Huaman & Jun, 2014); (Lindrianasari & Asmaranti, 2004); Zhang, Peng, Ma, and Shen (2017), and Alam et al. (2019) which shows significant evidence between RnD intensity and environmental performance. In accordance with the NRBV theory that the use of company resources and capabilities in environmental activities helps companies achieve sustainable competitiveness by reducing energy use and emissions. This description is the background for researchers to propose the following hypothesis:

H1: R&D Intensity has a positive effect on Carbon Emission Disclosure

The Influence of Media Exposure on Carbon Emission Disclosure

In a disclosure strategy, a company always relates to stakeholders so that it can use the information to monitor the company including other sources of information (Michelon, 2011). Information is very important for companies to build an image in the eyes of the public, one of which is with the help of the media (Bednar, 2012); (Lucchini & Moisello, 2017). Companies will disclose more information through major media to gain legitimacy in the environment (Braojos-Gomez, Benitez-Amado, & Llorens-Montes, 2015). Thus, the presence of media can increase the attention of all evaluators to examine the size, profitability, influence, and environmental performance to reveal the company's carbon use (Dawkins & Fraas, 2011); (Elshandidy, Fraser, & Hussainey, 2013).

Several recent disclosure studies emphasize the importance of media coverage and visibility in shaping relationships between companies and stakeholders (Cho & Patten, 2007). This indicates that greater media coverage has an impact on stakeholder opinion, which then encourages disclosure of information about corporate sustainability (Cormier & Magnan, 2015); (Michelon, 2011). With the findings on causality between environmental disclosure and media visibility, it confirms that managers are more sensitive in maintaining the company's environmental reputation if it is highly visible. Therefore, this study proposes the following hypothesis:

H2: Media exposure has a positive effect on carbon emission disclosure.

The Influence of Environmental Cost Allocation on Carbon Emission Disclosure

Environmental cost allocation can provide transparency regarding the environmental impact of a company's business operations and is a form of company effort to achieve legitimacy (Clarkson et al., 2008). Thus, information disclosure will be carried out by the company in order to maintain legitimacy and obtain a good image in the eyes of the public or stakeholders. According to research Luo, Tang, and Lan (2013) shows that good financial planning by companies including the allocation of costs related to environmental activities will be able to make long-term decisions. On the other hand, companies with weak financial planning will only focus on meeting financial targets, thus limiting themselves to making efforts to reduce and report carbon emissions.

By allocating environmental costs, it means that the company has carried out activities or efforts to prevent damage, control and improve the environment (Raiborn, Butler, & Massoud, 2011). Thus, companies will be able to make environmental disclosures from the efforts they have made to show that their companies pay attention and respond quickly to global environmental issues that occur. Furthermore, companies that have adequate and quality disclosures will be able to provide information that can explain to investors that the company is taking proactive action.

H3: Environmental Cost Allocation has a positive effect on Carbon Emission Disclosure

C. RESEARCH METHODS

Sample

The sample of this research is companies listed on the Indonesia Stock Exchange from 2019 to 2022 and have published annual reports or sustainability reports on the IDX website or each company.

Operational Definition of Variables

1. RnD Intensity

Research and development (RnD) is proxied by RnD intensity (RnDit). This measurement refers to studies conducted (Berrone et al., 2013); (Lu, Tsai, & Yen, 2010), they divide the RnD costs by the total assets owned by the company.

$$RnD_{it} = \frac{Biaya\ RnD}{Total\ Aset}$$

2. Media Exposure

Media exposure is calculated using a dummy, which gives a value of 1 for industries that disclose news related to carbon emissions or have credible media exposure and a value of 0 is given to industries that do not disclose news. The information in question comes from sustainability reports, annual reports, newspapers, and various other information. In addition, media containing company information comes from five trusted electronic media, namely CNN Indonesia, Media Indonesia, VIVANews, KOMPAS, and Republika.

3. Environmental Cost Allocation

Allocation of environmental costs is measured by the nominal amount of the environmental cost account or similar costs related to environmental activities in the profit and loss financial report and/or annual report.

4. Carbon Emissions Disclosure

Disclosure of carbon emissions using content analysis techniques in annual reports and sustainability reports. In assessing the quality of disclosure, it will refer to the scoring index developed by (Choi et al., 2013). Where, there are 18 items with 5 assessment categories.

Hypothesis Testing

Hypothesis testing in this study was carried out using the following regression model:

$$CED = \alpha + b_1RnD + b_2.ME + b_3.EC + e_3.....(3)$$

Where, CED is Carbon Emission Disclosure, RnD is Green RnD Intensity, ME is Media Exposure, and EC is environmental cost/*environmental cost*.

D. ANALYSIS AND DISCUSSION

Population and Sample

The population in this study is all companies listed on the Indonesia Stock Exchange in 2019-2023. Meanwhile, for sampling based on purposive sampling with certain criteria, namely companies listed on the IDX, publishing annual reports and/or sustainability reports during the research period, and companies that explicitly disclose carbon emissions include at least one policy related to carbon emissions or greenhouse gases based on (Choi et al., 2013). Based on the results of observations conducted by researchers, it can be seen that according to sample selection using purposive sampling techniques, there are 322 samples of companies listed on the IDX in the year (2019-2023).

Descriptive Statistics

Table 1. Descriptive Statistics

Variables	Minimum	Maximum	Mean	Standard Deviation
CED	0.0556	0.9444	0.3708	0.2302
RnD Intensity	0.0000	0.1199	0.0011	0.0096
Environmental Costs	0	111,026,000,000	4,555,738,163	11,552,371,102
Media Exposure	0.0	1.0	0.530	0.4999
Total Assets	20.72355	34.88715	28.6913610	3.25243876

Source: Data processed by researchers (2024)

Based on the table above, the results of the descriptive statistical analysis can be seen. The explanation of the analysis results will be described as follows:

1. Carbon Emissions Disclosure

The mean value of environmental disclosure (Dawkins & Fraas, 2011) of 0.3708 indicates that in general companies disclose about 37.08% of the information related to their environmental responsibilities. The range between the minimum value of 0.0556 and the maximum value of 0.9444 indicates significant variation in disclosure practices among these companies. The standard deviation of 0.2302 reflects a fairly large variation, with some companies being very proactive in environmental disclosure, while others are very minimal. According to the study Clarkson et al. (2008) companies in industries with high environmental risks are more likely to provide more comprehensive environmental disclosures due to higher pressure from regulators and investors.

2. Research and Development (RnD)

The mean of research and development (R&D) expenditure of 0.0011 indicates that R&D expenditure as a percentage of total assets is relatively small. The maximum value of 0.1199 and the minimum value of 0.0000 indicate that some companies do not allocate any budget to R&D, while others invest almost 12% of their assets. This variation, indicated by the standard deviation of 0.0096, indicates that although some companies prioritize R&D, most companies may not see innovation as an important part of their business strategy. Hall and Lerner (2010) states that R&D is a key driver of innovation, especially in the technology sector, so low levels of investment can have a negative impact on a company's competitiveness in the long term.

3. Environmental Costs

The average environmental cost of IDR 4.55 billion indicates that companies significantly allocate funds for environmental impact management. However, the very large range from 0 to IDR 111 billion and the very high

standard deviation (IDR 11.55 billion) indicate significant variation in environmental costs across companies. Sharfman and Fernando (2008) suggest that larger firms or those operating in sectors with high environmental risk are more likely to spend more on environmental mitigation, which may explain this difference. Some firms may face greater pressure from regulators and the public to address environmental issues, while others may operate in sectors that are less exposed to environmental issues.

4. Media Exposure

The average media exposure was 0.530, indicating that approximately 53% of the firms in the sample received media exposure. The standard deviation of nearly 0.5 indicates that firms had significantly varying levels of media exposure, with some firms receiving no media coverage at all and others receiving significant attention. Media exposure can play an important role in a firm's oversight of environmental issues. Research by Wang and Qian (2011) shows that high media exposure often causes companies to be more proactive in maintaining their public image, especially in relation to environmental and social impact management.

5. Ln Total Assets

The average total assets of the companies in this sample were Rp 28.69 billion, indicating that most of the companies were medium to large companies. The range between a minimum of Rp 20.72 billion to a maximum of Rp 34.88 billion and a standard deviation of Rp 3.25 billion indicated that the size of the companies in this sample was relatively uniform. According to Brammer and Pavelin (2006) company size often influences the level of environmental and social disclosure, with larger companies tending to have more resources to manage and disclose such information.

Overall, these interpretations indicate that there is significant variation in environmental disclosure, R&D expenditure, environmental costs, and media exposure among the companies in the sample. Based on previous research, this variation can be explained by factors such as company size, industry sector, and the level of media exposure they receive. Higher disclosure tends to be found in larger companies or companies that are more exposed to environmental risks, while R&D expenditure remains relatively low in most companies, indicating a potential lack of innovation that could negatively impact long-term competitiveness.

Classical Assumption Test

1. Multicollinearity Test

The multicollinearity test aims to prove whether there is a correlation between independent variables. This test can be identified from the tolerance and VIF values, if the tolerance value ≥ 0.1 and the VIF cut-off value ≤ 10 then the regression model is free from multicollinearity. The results of the multicollinearity test are as follows

Table 2. Multicollinearity Test

Information	Collinearity Statistics	
	Tolerance	VIF
(constant)		
RnD Intensity	0.989	1,011
Environmental Costs	0.928	1,078
Media Exposure	0.893	1,120
Total Assets	0.968	1,033

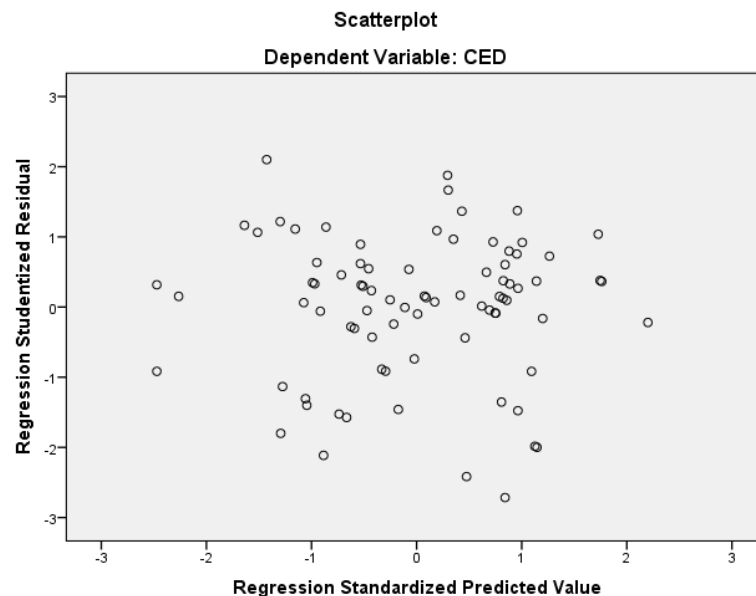
a. Dependent Variable: Carbon Emissions Disclosure

Source: Data processed by researchers (2024)

In table 2, it can be seen that each research variable has a tolerance value of more than 0.1 and a VIF value of less than 10. Thus, this research is free from multicollinearity problems as evidenced by the absence of correlation between independent variables.

2. Heteroscedasticity Test

The heteroscedasticity test aims to test whether in the regression model there is inequality of variance from one residual to another observation. This test is done by looking at the scatter plot graph between the predicted value of the dependent variable and its residual. The results of the heteroscedasticity test are as follows.



Picture 1. Heteroscedasticity Test
Source: Data processed by researchers (2024)

In the image above, it is known that there are no points that form a regular pattern. Thus, it is proven that the data used in this study is free from heteroscedasticity problems. In large sample testing, there will generally be high heteroscedasticity problems between variables which cause heteroscedasticity problems to be difficult to avoid.

Hypothesis Testing

1. Test of Determination Coefficient R

The determination coefficient test aims to measure how much the model's ability to explain the variation of the dependent variable. A small R^2 value means that the ability of the independent variables to explain the dependent variable is very limited. Conversely, if the R^2 value is large, it means that the ability of the independent variables to explain the dependent variable is very broad. The results of the determination coefficient test in the study are as follows.

Table 3. Coefficient of Determination Test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.553a	0.305	0.297	0.1933478795

Source: Data processed by researchers (2024)

In the table above, it is known that the R^2 value of the multiple linear regression of the R&D intensity variables, Environmental Costs, Media Exposure, and Total Assets is 0.305 or 30.5% of the carbon emission disclosure variable. This shows that the two independent variables can only explain their influence on the dependent variable by 30.5% and the remaining 69.5% is influenced by other variables outside this study. The low R^2 value indicates that the research variables do not explain the dependent variable well, such as R&D intensity where in companies in Indonesia the R&D intensity tends to be very low. Adjusted R Square which is close to the R Square value indicates that the model is quite efficient in using the existing variables without adding excessive complexity.

2. F Statistic Test

The F test aims to see whether all independent variables in the study included in the regression model are suitable for predicting the dependent variable. Namely, by measuring the influence of independent variables on the dependent variable together (simultaneously). The results of the F test in this study are as follows.

Table 4. Test Coefficient of Determination

Model	F	Sig.
1 Regression	34,749	0.000b

Source: Data processed by researchers (2024)

Based on the results of the statistical test in the table above, it can be seen that the F statistic value is 34.749 with a significance value of 0.000. Because the significance value is less than $\alpha = 5\%$, namely $0.000 < 0.05$, which means that the regression model of this study is feasible to be used to predict carbon emission disclosure. In other words, the variables of R&D intensity, Environmental Costs, Media Exposure and total assets have a significant influence and are feasible to be continued in predicting their influence on the dependent variable, namely carbon emission disclosure.

3. Statistical Test t

The t-statistic test aims to see the influence of each independent variable on the dependent variable. The criteria for this test use a significance level of 0.05. If the significance value is less than 0.05, then the independent variable has a partial effect on the dependent variable. The results of the t-statistic test in this study are as follows.

Table 5. Statistical t Test

Model	B	t	Sig.
(Constant)	0.501	5,175	0,000
RnD Intensity	2,164	1,909	0.057
Environmental Costs	3,877	3,997	0,000
Media Exposure	0.209	9,152	0,000
Total Assets	0.009	2,685	0.008

Source: Data processed by researchers (2024)

Based on the t-statistic test in table 4.11 above, the following regression equation is obtained.

$$\text{Carbon Emission Disclosure} = 0.501 + 2.164 \text{ RnD Intensity} + 3.877 \text{ Environmental Cost} + 0.209 \text{ Media Exposure} + 0.009 \text{ Total Assets}$$

Based on the test results in table 4.7, the t-test results were obtained which will be described as follows.

1. The constant of 0.501 shows that if the values of all independent variables are considered constant or equal to zero, the score of the carbon emission disclosure variable will decrease.
2. The R&D intensity variable has a regression coefficient of 2.164 indicating the magnitude of the influence of R&D intensity on carbon emission disclosure. Which means that every 1 point increase in R&D intensity will increase the carbon emission disclosure score by 2.164. The t-statistic value is 1.909 with a significance of 0.057, where this value is greater than the 5% significance level, which is $0.000 < 0.05$. Thus, it can be concluded that R&D intensity individually (partially) has a positive relationship but does not have a significant effect on carbon emission disclosure. This significance value is close to 0.05 indicating that the R&D intensity variable has a significant effect if this study adds a research period to obtain more relevant results.
3. The environmental cost variable has a regression coefficient of 3.877, which shows the magnitude of the influence of environmental costs on carbon emission disclosure. This means that every 1 point increase in environmental costs will increase the carbon emission disclosure score by 3.877. The t-statistic value is 3.997 with a significance value of 0.000. Thus, it can be concluded that environmental costs individually (partially) have a positive relationship and significant influence on carbon emission disclosure.
4. The media exposure variable has a regression coefficient of 0.209, which indicates the magnitude of the influence of media exposure on carbon emission disclosure. This means that if a company discloses exposure related to environmental improvement efforts on the company's website or on other credible websites, it will increase the carbon emission disclosure score by 0.209. The t-statistic value is 3.997 with a significance value of 0.000. Thus, it can be concluded that media exposure individually (partially) has a positive relationship and significant influence on carbon emission disclosure.
5. The total assets variable has a regression coefficient of 0.009, which indicates the magnitude of the influence of total assets on carbon emission disclosure. Which means that every 100 rupiah increase in total assets will increase the carbon emission disclosure score by 0.9. The t-statistic value is 2.685 with a significance of 0.008, where this value is smaller than the 5% significance level, which is $0.000 < 0.05$. Thus, it can be concluded that the total assets variable as a control variable individually (partially) has a positive relationship and has a significant effect on carbon emission disclosure.

Discussion of Research Results

The Effect of R&D Intensity on Carbon Emission Disclosure

The results of the study show that the R&D intensity variable has a regression coefficient of 2.164, indicating that every 1 point increase in R&D intensity will increase the carbon emission disclosure score by 2.164. However, the t-statistic value of 1.909 with a significance of 0.057 indicates that this effect is not significant at the 5% significance level, although it is close to the significance limit. This shows that R&D intensity has a positive relationship but has not had a statistically significant impact on carbon emission disclosure. So based on the results of the regression analysis, it can be concluded that the first hypothesis (H1) is not supported. In other words, this study has not been able to prove a significant effect between R&D intensity and carbon emission disclosure in Indonesia.

However, the results of this study provide positive influence results that can confirm the theory of natural resource-based view (NRBV) that in order to respond to the natural environment and achieve long-term success, companies need to accumulate resources and manage capabilities with a long-term focus rather than a short-term focus. This long-term commitment can be done by adopting eco-innovation, especially in the form of research and development (R&D) which is useful for identifying production, environmental technology, increasing energy efficiency and at the same time leading to product innovation (Sambasivan et al., 2013).

The research results showing an insignificant effect are in line with the studies conducted. Liesen, Hoepner, Patten, and Figge (2015) in their study on carbon disclosure in European companies found that R&D intensity has no significant effect on companies' decisions to disclose carbon emissions information. They explained that R&D expenditures, especially those related to technological innovation, are often more focused on new products or processes that can increase economic profits, rather than on the purpose of increasing environmental transparency. In addition, Qian and Schaltegger (2017) also found that R&D intensity does not significantly affect carbon emission disclosure in multinational companies. In their study, companies that invest heavily in R&D often focus more on innovation that drives long-term efficiency and profitability, while environmental disclosure responsibilities are seen as a separate matter. They stated that the influence of R&D on sustainability is more visible in long-term results than in short-term carbon disclosure information transparency. Other studies have found no results between R&D intensity and environmental, social, and governance disclosure, indicating that there is no direct or indirect relationship between R&D intensity and environmental disclosure in sharia companies (Ramadhan, Mulyany, & Mutia, 2023). Companies in this sector may tend to make their R&D strategy to maintain a competitive advantage in the financial sector, and as a result, do not always prioritize more transparent disclosures regarding carbon emissions.

In a study of Korean companies, it was also found that R&D intensity was not significantly correlated with environmental disclosure. They concluded that R&D expenditure intensity may not have a direct effect on environmental and financial performance in Korean companies (Lee & Min, 2015). Furthermore, this finding implies that companies face a trade-off between environmental, social, and governance, making it difficult to achieve a balanced outcome. Companies that allocate large budgets for R&D are more likely to prioritize product and service innovation, while environmental disclosure, including carbon emissions, is often not a major concern. They stated that disclosure policies are often driven more by external factors such as government regulations or stakeholder expectations, rather than by the company's internal R&D policies.

The findings of this study indicate that many companies in Indonesia may have high R&D intensity, but their main focus is on technical or market-oriented innovation rather than on managing and disclosing their environmental impacts. This also shows that R&D intensity can have different purposes depending on the company's strategic priorities, so it does not always have a direct impact on environmental disclosure policies. In addition, in Indonesia the level of R&D disclosure is still very low.

The Impact of Environmental Costs on Carbon Emission Disclosure

Environmental costs have a regression coefficient of 3.877, with a t-statistic value of 3.997 and a significance of 0.000. This shows a significant and positive effect on carbon emission disclosure, meaning that every 1 point increase in environmental costs will increase the carbon emission disclosure score by 3.877. So based on the results of the regression analysis, it can be concluded that the second hypothesis (H2) is supported. These results are consistent with previous studies stating that companies that allocate a larger budget for environmental costs tend to be more open in disclosing their carbon emissions.

The results of this study are in line with studies conducted Al-Tuwaijri, Christensen, and Hughes (2004) found

that companies with higher environmental costs tend to be more transparent in disclosing environmental information, including carbon emissions, to meet stakeholder expectations. Huang and Kung (2010) also shows that environmental costs are positively related to environmental disclosure, because companies use these expenses to mitigate the negative impact of their operations on the environment. In addition Imansari, Irmadaryani, and Sayekti (2024) stated that companies facing pressure from regulators and the public often increase spending on the environment and as a result, they are more transparent in reporting carbon emissions. Garzon-Jimenez and Zorio-Grima (2021) research also supports this argument, stating that environmental costs can be used as a tool to improve a company's reputation, thereby increasing the incentive for companies to disclose carbon emissions. Other studies that support this finding are Khan, Muttakin, and Siddiqui (2013) who found that higher environmental costs were significantly associated with carbon emissions disclosure in companies operating in emerging markets, where awareness of environmental issues is increasing. Research by Anshorie et al. (2024) also confirmed that environmental costs are an important factor in increasing corporate transparency regarding carbon emissions, especially in the energy sector.

Based on the results of this study in Indonesia there is an increase in public awareness and regulations related to the environment. Companies operating in the energy, manufacturing, and natural resources sectors face great pressure from the public, government, and non-governmental organizations to be more transparent in managing their carbon emissions. Allocating a larger budget for environmental costs is one of the strategies of companies to ensure that they meet strict environmental standards, both from domestic and international regulators. Companies facing international scrutiny also feel the need to allocate a budget for environmental costs as part of their commitment to sustainability. Therefore, these companies are expected to increase spending on environmental costs and, ultimately, increase disclosure of their carbon emissions as a form of corporate responsibility towards the environment.

The Influence of Media Exposure on Carbon Emission Disclosure

The media exposure variable has a significance of 0.000, indicating a significant and positive effect on carbon emission disclosure. So based on the results of the regression analysis, it can be concluded that the third hypothesis (H3) is supported. This shows that the more often companies are exposed to the media, the higher their tendency to disclose carbon emissions, because public attention encourages companies to be more transparent. A study conducted by Li and Long (2024) stated that companies with high media exposure are more susceptible to public scrutiny regarding environmental issues, which encourages them to increase environmental, social, and governance disclosures as a form of social responsibility. Research by Qiu et al. (2016) also shows that media exposure significantly affects the level of environmental disclosure, because companies often use media platforms to demonstrate their efforts to reduce environmental impacts.

These findings are in line with Du et al. (2017) who found that higher media exposure increases external pressure from stakeholders, so that companies feel the need to disclose environmental information more openly. Furthermore, research by (Ferdiani & Mulyani, 2023) revealed that companies that receive media attention regarding their environmental performance often use carbon disclosure as a tool to manage the company's image in the public eye. In addition, research by Li and Long (2024) shows that media exposure can increase corporate environmental transparency, especially in high-risk industries, namely those with high levels of pollution. In addition, the study by Moalla and Dammak. (2023) also found that media coverage plays an important role in encouraging corporate mechanisms to be more transparent regarding their environmental impacts, this is relevant for stakeholders, including investors and regulators in understanding the transparency of environmental, social, and governance performance.

These findings show that large companies in Indonesia in the energy, manufacturing, and mining sectors are often in the media spotlight, especially regarding environmental and sustainability issues. Using the media to showcase the steps taken to reduce carbon emissions and preserve the environment can build a positive image and maintain good relations with stakeholders.

E. CONCLUSION AND SUGGESTIONS

This study aims to examine the effect of R&D intensity, environmental costs, and media exposure on carbon emission disclosure in Indonesia in all companies listed on the Indonesia Stock Exchange in 2019-2023. Based on the results of data processing that has been carried out, the following research conclusions can be drawn:

1. The results of the study prove that R&D intensity has a positive but insignificant effect on carbon emission

disclosure in Indonesia. This result is consistent with several previous studies that also showed the absence of a significant effect of R&D intensity on environmental transparency, indicating that companies in Indonesia may focus more on product innovation than disclosure related to carbon emissions. However, expanding the research period can strengthen this relationship.

2. The results of this study indicate that environmental costs have a positive and significant effect on carbon emission disclosure. This means that budget allocation for environmental costs encourages greater transparency in carbon emission disclosure. In Indonesia, larger companies with higher environmental budgets tend to respond to pressure from regulators and stakeholders by increasing their disclosure regarding environmental impacts, including carbon emissions.
3. The results of this study indicate that media exposure also shows a significant and positive influence on carbon emission disclosure. However, this shows a positive but insignificant regression coefficient of foreign ownership. Media exposure triggers companies to be more transparent in disclosing carbon emissions in order to maintain their image and reputation amidst increasingly stringent public scrutiny.
4. Then, this study includes the total asset control variable to control this research model so that the R square results are better. Where, the total asset variable has a positive and significant effect on carbon emission disclosure. This means that the greater the assets owned by the company, the higher the carbon emission disclosure made by the company, because the company has sufficient additional funds to make disclosures..

This research has urgency in the business world which is expected to provide a basis for consideration for companies/investors in making investment policies/decisions, in addition to looking at profits, investors also need to look at environmental performance. For further research, it is expected to be able to increase the research period in order to obtain more relevant results with a longer period of time. Further research can also consider adding moderating or mediating variables such as corporate governance or corporate social responsibility (CSR) in analyzing the relationship between R&D intensity, media exposure, and environmental costs with carbon emission disclosure. These variables can provide a broader perspective on how internal company factors can influence the decision to disclose carbon emissions. This study took a sample of all companies on the IDX so that for further research it is recommended to conduct cross-industry comparisons, especially between industries that have a large carbon footprint such as energy, manufacturing, and mining, with more environmentally friendly industries, to understand the different dynamics in carbon emission disclosure. In addition, it can try to use a qualitative approach, such as in-depth interviews with company managers, to further understand the motivations and challenges faced by companies in disclosing carbon emissions. Thus, through this approach, it can be identified whether government policies in Indonesia are effective in encouraging companies to disclose carbon emissions more transparently.

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