

Sustainable Strategy: Environmental Performance as a Moderator in the Relationship Between Carbon Emission Disclosure, Eco-Efficiency, and Green Innovation on Firm Value

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Abstract

Carbon Emission Disclosure refers to voluntary disclosure related to the carbon emissions produced by a company. **Eco-Efficiency** is a form of environmental management system. **Green Innovation** is an innovation that emphasizes competitive advantages along with reducing environmental impacts, useful for managing and controlling the environmental impact. **Firm Value** refers to the realized asset value when the company is sold, or the value of the company's stock price. **Environmental Performance** is closely related to environmental management as a means for a company to build a good image and establish positive relationships with stakeholders.

The objective of this study is to test, analyze, and provide empirical evidence regarding the impact of carbon emission disclosure, eco-efficiency, and green innovation on firm value, with environmental performance as a moderating variable. This study uses secondary data obtained from the official website of the Indonesia Stock Exchange (www.idx.co.id), company websites, PROPER results, and the sustainability report database (database.globalreporting.org).

The population used in this study consists of high-profile companies listed on the Indonesia Stock Exchange (IDX) during 2021-2024 that participated in the PROPER ranking by the Ministry of Environment and Forestry during the observation period. The sampling method used is purposive sampling, which involves selecting samples based on predefined criteria.

The analytical method used is moderated regression analysis to test whether the effect of independent variables (X) on the dependent variable (Y) is influenced by the moderating variable (Z).

The results of the study show that environmental performance can moderate the relationship between carbon emission disclosure, eco-efficiency, and green innovation, with firm value.

Keywords: Environmental Performance; carbon emission disclosure; eco-efficiency; green innovation; firm value.

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I. INTRODUCTION

Climate change has become one of the major global challenges directly affecting corporate business sustainability (Ritchie & Roser, 2020). Increasing industrial activities have contributed to higher carbon emissions and environmental pollution, forcing companies to adopt sustainable business practices (Elkington, 1997). The concept of the triple bottom line emphasizes the importance of balancing profit, people, and planet in corporate business activities (Slaper & Hall, 2011).

Indonesia is recognized as one of the world's largest carbon emitters due to the increasing use of fossil energy and industrial expansion (Kurnia et al., 2021). High-profile industries such as mining, manufacturing, energy, and agribusiness significantly contribute to environmental pollution (Panggau & Septiani, 2017). Therefore, stakeholders increasingly demand companies to disclose environmental impacts transparently through carbon emission disclosure (Hardiyansah et al., 2021).

Carbon emission disclosure represents voluntary disclosure regarding corporate carbon emissions (Choi et al., 2013). Such disclosure serves as a positive signal to investors regarding the company's commitment to environmental sustainability (Connelly et al., 2011). Damas et al. (2021) found that carbon emission disclosure positively affects firm value. However, Iskandar and Efita (2016) reported contradictory findings, showing that carbon emission disclosure negatively affects firm value.

In addition to carbon disclosure, eco-efficiency has become an important corporate strategy to improve resource efficiency and reduce environmental impacts (Schaltegger & Sturm, 1990). Eco-efficiency is commonly identified through ISO 14001 certification as an environmental management system indicator (Ong et al., 2016). Gao and Zhang (2020) explained that companies with high eco-efficiency tend to gain better market appreciation and investor trust.

Green innovation also plays a significant role in improving corporate sustainability through environmentally friendly technologies, products, and production processes (Agustia et al., 2019). Huang and Li (2020) found that green innovation enhances operational efficiency and firm value. However, Yao et al. (2019) reported that green innovation may negatively affect firm value in the short term.

The inconsistency of previous findings encourages this study to introduce environmental performance as a moderating variable. Environmental performance reflects a company's capability to manage environmental issues effectively and sustainably (Suhardi & Purwanto, 2015). Studies conducted by Khan and Muttakin (2020), Al-Tahat (2020), and Hussain and Ali (2021) demonstrated that environmental performance strengthens the relationship between sustainability practices and firm value.

This study contributes to sustainability accounting and green accounting literature by examining the moderating role of environmental performance in strengthening the relationship between carbon emission disclosure, eco-efficiency, green innovation, and firm value among high-profile companies in Indonesia.

II. OBJECTIVES

The objectives of this study are:

1. To analyze the moderating effect of environmental performance on the relationship between carbon emission disclosure and firm value.
2. To analyze the moderating effect of environmental performance on the relationship between eco-efficiency and firm value.
3. To analyze the moderating effect of environmental performance on the relationship between green innovation and firm value.

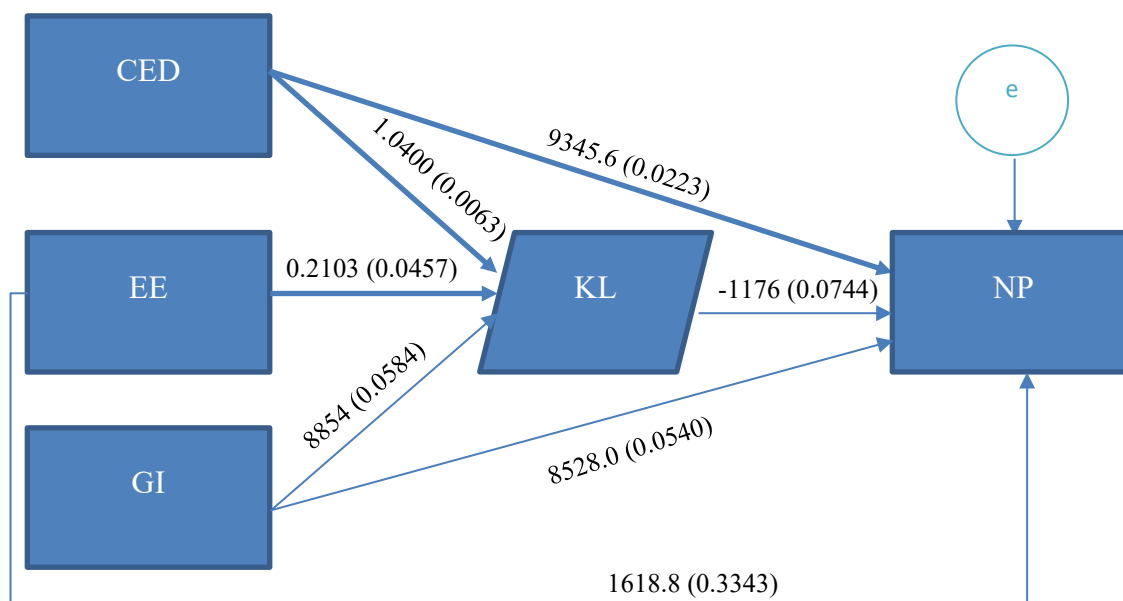
III. METHODOLOGY

This study employs a quantitative approach using secondary data obtained from the Indonesia Stock Exchange (IDX), sustainability reports, annual reports, and PROPER environmental ratings issued by the Ministry of Environment and Forestry during 2020–2023. The population consists of high-profile companies listed on the IDX and participating in the PROPER program during the observation period.

The sampling technique applied is purposive sampling based on predetermined criteria. The dependent variable is firm value measured using Tobin's Q Ratio (Sabrin et al., 2016). The independent variables include carbon emission disclosure, eco-efficiency, and green innovation. Carbon emission disclosure is measured using the Carbon Disclosure Project (CDP) checklist developed by Choi et al. (2013). Eco-efficiency is measured using ISO 14001 certification as a dummy variable, while green innovation is measured through content analysis related to environmentally friendly innovation activities (Agustia et al., 2019).

The moderating variable is environmental performance measured using PROPER scores. Data analysis techniques include panel data regression and Moderated Regression Analysis (MRA) using Python 3 software. The analysis involves classical assumption tests, panel data model selection, and hypothesis testing using t-tests and bootstrapping methods (Wooldridge, 2010).

IV. RESULTS AND DISCUSSION



Picture 1. General Estimation Results

The results indicate that carbon emission disclosure positively affects firm value. These findings support the studies conducted by Hardiyansah et al. (2021), Kurnia et al. (2021), and Khan and Muttakin (2020), which stated that carbon emission disclosure enhances corporate legitimacy and investor confidence.

Environmental performance significantly strengthens the relationship between carbon emission disclosure and firm value. Companies with superior environmental performance gain greater benefits from environmental disclosure because they are perceived as more responsible by stakeholders (Al-Tahat, 2020; Hussain & Ali, 2021).

Eco-efficiency also demonstrates a positive relationship with firm value, particularly when supported by strong environmental performance. These findings are consistent with Gao and Zhang (2020), Chen and Xu (2021), and Zhang and Sun (2021), who concluded that companies with high eco-efficiency obtain better market reputation and firm value.

Green innovation significantly improves firm value through operational efficiency and competitive advantage. These findings support Huang and Li (2020), Liu and Wang (2021), Wang and Zhang (2021), and Zhao and Zhou (2022), which found that green innovation enhances firm value, especially in companies with strong environmental performance.

Overall, this study confirms that sustainability practices supported by superior environmental performance can increase firm value and strengthen investor confidence toward environmentally responsible companies.

V. CONCLUSION

This study proves that environmental performance moderates the relationship between carbon emission disclosure, eco-efficiency, and green innovation on firm value. The strongest moderating effect is identified in the relationship between carbon emission disclosure and firm value.

Companies with superior environmental performance are more capable of improving legitimacy, reputation, and investor confidence through the implementation of sustainability practices. Therefore, companies should enhance environmental management quality and sustainable business strategies to maximize long-term firm value.

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