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Moderation of Environmental Performance on the Influence of Environmental Management Accounting and Green Innovation on Firm Value

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Abstract: This study was conducted to examine the relationship between Environmental Management Accounting (EMA) and green innovation on firm value with the moderation of environmental performance. The research was carried out on manufacturing companies, with a population of all manufacturing firms listed on the Indonesia Stock Exchange (IDX) during 2022–2024, totaling 171 companies. The sample was selected using purposive sampling, resulting in 79 companies that met the criteria, and with a three-year observation period, 237 financial reports were obtained. Data collection was conducted using documentation methods and analyzed with Moderated Regression Analysis (MRA) using STATA software. The results show that both EMA and green innovation partially have a positive and significant effect on firm value, while environmental performance does not strengthen the relationship between EMA and firm value nor between green innovation and firm value.

Keywords: firm value, EMA, green innovation, environmental performance.

INTRODUCTION

The increase of firm value is the primary objective of shareholders as it reflects their overall wealth. Firm value is closely associated with stock prices, where higher stock prices indicate good performance and positive future prospects (Abbas et al., 2020). One of the important measures of firm value is Price to Book Value (PBV), in which a higher PBV reflects stronger market appreciation toward the company's book value. However, the manufacturing sector being one of the dominant sectors in the Indonesia Stock Exchange has experienced a declining trend in firm value over the last five years. PBV consistently decreased from 2019 to 2021, and although it slightly recovered in 2022 and 2023, it has yet to return to pre-2019 levels. This condition was further exacerbated by the Purchasing Manager's Index (PMI), which has shown contraction since mid-2024, in line with the declining contribution of manufacturing to GDP and the rise in layoffs (CNBC Indonesia, 2024).

One contributing factor to the decline in firm value is the growing attention of investors toward environmental issues. The manufacturing sector is known as a major contributor to environmental pollution through industrial waste and emissions (Sari et al., 2020); (Zhang & Ma, 2021). Pollution cases involving manufacturing firms such as PT Kiat Pulp and Paper in Riau (Rahman, 2020) and PT Kimu Sukses Abadi in Bekasi (Beritacikarang.com, 2024) have reinforced negative investor perceptions. Moreover, industrial carbon emissions have contributed to climate change. Data show that global greenhouse gas emissions increased by 2.5% in the first quarter of 2024, with 2024 recorded as the hottest year since 1981 at an average temperature of 27.5°C (Deputy for Climatology, 2025). These conditions underscore the urgency of adopting carbon accounting concepts as a corporate effort to mitigate environmental impacts (Andriadi et al., 2023).

Environmental Management Accounting (EMA) is an accounting system that focuses on identifying, collecting, and analyzing environmental costs and performance information to support organizational decision-making (Dalila & Khairunnisa, 2024). As a branch of accounting that emphasizes social and environmental aspects, EMA encourages companies to report their environmental performance transparently. The implementation of EMA is believed to enhance firm value through stakeholder support and capital market appreciation (Effendi, 2021). From the perspective of the Natural Resource-Based View (NRBV), EMA serves as a strategic instrument that enables companies to manage natural resources more efficiently, reduce waste, and minimize environmental costs. NRBV emphasizes that firms integrating environmentally friendly practices into their business strategy can achieve sustainable competitive advantage. Through EMA, companies not only improve cost efficiency but also strengthen reputation and stakeholder trust, thereby increasing their market value. Thus, EMA is not merely an accounting tool, but also a sustainability strategy aligned with NRBV principles in creating long-term value.

Prior studies provide mixed evidence on the relationship between EMA and firm value. (Ethika et al., 2019) and (Endiana & Suryandari, 2020) found that environmental accounting disclosure positively affects firm value. However, (Dalila & Khairunnisa, 2024) and (Amira & Siswanto, 2022) reported that EMA and environmental accounting disclosure had no significant effect, suggesting that other factors beyond EMA play an important role in determining firm value.

H_1: Environmental Management Accounting has a positive effect on firm value.

Companies can achieve competitive advantage when they are able to develop technologies that produce environmentally friendly products and processes, a concept known as green innovation (Takalo et al., 2020). Green innovation emphasizes waste reduction, pollution prevention, and the adoption of environmental management systems to minimize the ecological impact of operations (Meilani & Sukmawati, 2023). In line with the Natural Resource-Based View (NRBV), green innovation enables firms to build unique capabilities that are difficult for competitors to imitate, either through more efficient production processes or the creation of value-added green products. Its implementation not only drives productivity and financial performance but also strengthens social legitimacy by reducing the risk of claims or sanctions from communities and regulators, ultimately contributing to the sustainable enhancement of firm value.

However, prior research on the relationship between green innovation and firm value has shown mixed results. (Tonay & Murwaningsari, 2022) and (Akib, 2023) found a positive and significant effect of green innovation on firm value. In contrast, (Meilani & Sukmawati, 2023) reported no significant effect, while (Yuliandhari et al., 2023) even documented a negative impact. These inconsistent findings highlight a research gap that warrants further investigation.

H_2: Green innovation has a positive effect on firm value.

In the current era, companies are increasingly required to contribute to sustainable development without reducing investor confidence in business continuity (Dinatha & Darmawan, 2023). This encourages firms to disclose environmental information that is accurate, reliable, and difficult to manipulate. Companies with strong environmental performance generally obtain higher ratings as recognition for their achievements in preserving the environment (Yasa & Purnamawati, 2024). Such disclosures not only reflect corporate reputation and accountability but also enhance investor perception, attract investment, and strengthen public trust (Stiawan et al., 2025).

Environmental performance refers to corporate efforts to maintain environmental sustainability and minimize the negative impacts of production activities (Rahman, 2020). In Indonesia, this is evaluated through the PROPER program initiated by the Ministry of Environment and Forestry, which aims to encourage compliance with regulations and improve environmental management based on sustainability principles. Prior studies provide evidence of its role in enhancing firm value, as shown by (Supadi & Sudana, 2018) and (Surya et al., 2023), who found that firms with strong environmental performance tend to build positive reputations and improve firm value.

Building on this perspective, environmental performance is expected to strengthen the relationship between Environmental Management Accounting (EMA) and green innovation with firm value. EMA provides accurate and transparent environmental cost information, while green innovation develops eco-friendly products and processes; both are likely to have a stronger effect on firm value when supported by superior environmental performance.

H_3: Environmental performance strengthens the positive effect of Environmental Management Accounting on firm value.

H_4: Environmental performance strengthens the positive effect of green innovation on firm value.

The novelty of this study lies in employing environmental performance as a moderating variable, which remains underexplored in the context of Indonesia's manufacturing sector. While prior studies often examined EMA and green innovation separately in relation to financial or environmental outcomes, this research integrates them into a single analytical model to provide a more comprehensive understanding of how sustainability strategies jointly contribute to firm value. This approach enriches the literature on environmental accounting and green innovation in emerging economies, where sustainability practices still face regulatory, managerial, and technological challenges.

From a practical standpoint, the study offers insights for management in designing effective sustainability strategies and for stakeholders in evaluating corporate value more holistically. Thus, it contributes not only to academic development but also to encouraging manufacturing firms in Indonesia to enhance competitiveness, financial value, and their role in sustainable development.

METHOD

This study employs a quantitative associative approach, which explains the causal relationship between Environmental Management Accounting and green innovation on firm value, with environmental performance as a moderating variable. The population of this research consists of all manufacturing companies listed on the Indonesia Stock Exchange (IDX) from 2022 to 2024, totaling 171 firms. The sample was selected using purposive sampling, resulting in 79 companies. With three years of observation, a total of 237 firm financial reports were analyzed. Data were collected through documentation by examining financial reports in accordance with the required variables for data tabulation. The data were

analyzed using Moderated Regression Analysis (MRA) with the assistance of STATA software.

RESULTS AND DISCUSSION

Prior to hypothesis testing, a descriptive statistical analysis was conducted to examine the characteristics of the collected data. The results of the descriptive statistical analysis are presented as follows.

Table 1. Results of descriptive statistical tests

	Obs	*Mean*	*Std. Dev*	*Min*	*Max*
EMA (X_1)	237	0,525	0,217	0,100	0,800
GI (X_2)	237	0,616	0,237	0,211	0,947
EP (Z)	237	2,950	0,497	2,000	4,000
FV (Y)	237	0,391	0,192	0,091	0,581

Source: Processed Data (2025)

Based on the descriptive analysis presented in Table 1, the EMA variable recorded a minimum value of 0.100 and a maximum of 0.800, with a mean of 0.525 and a standard deviation of 0.217. The mean value, which is closer to the maximum, indicates that the implementation of EMA among most manufacturing firms tends to be high. The green innovation variable shows a minimum value of 0.211 and a maximum of 0.947, with a mean of 0.616 and a standard deviation of 0.237, suggesting that green innovation practices are also relatively high. Meanwhile, environmental performance ranges from 2.000 to 4.000, with a mean of 2.950 and a standard deviation of 0.497. Since the mean is closer to the minimum, it indicates that the environmental performance of most firms remains relatively low. Finally, the firm value variable has a minimum of 0.091 and a maximum of 0.581, with a mean of 0.391 and a standard deviation of 0.192. The mean value, which is closer to the maximum, reflects that firm value among manufacturing companies tends to be relatively high. Following the descriptive analysis, model feasibility was tested using the Chow test and the Lagrange Multiplier test, with the results summarized in Table 2.

Table 2. Results of the model feasibility test

Test	Standard	Result	Selected model
Chow Test	Prob Cross Section > 0,05 (CEM) Prob Cross Section < 0,05 (FEM)	Prob Cross Section 0,00 < 0,05	Fixed Effect Model
Hausman Test	Prob chi2 < 0,05 (FEM) Prob chi2 > 0,05 (REM)	Prob chi2 0,59 > 0,05	Random Effect Model
Lagrange Multiplier Test	Prob chi2 < 0,05 (REM) Prob chi2 > 0,05 (CEM)	Prob chi2 0,00 < 0,05	Random Effect Model

Source: Processed Data (2025)

Referring to the results of the mode feasibility test, it was found that the selected model was the Random Effect Model (REM). Furthermore, the results of the Random Effect Model regression test are summarized in Table 3.

Table 3. Direct influence regression model

FV	*Coef.*	*Std. Err*	*t*	*P>|t|*	*[95% Conf. Interval]*	
EMA (X_1)	0,25	0,17	2,45	0,01	0,59	0,09
GI (X_2)	0,11	0,08	2,27	0,02	0,27	0,06
EP (Z)	0,10	0,03	3,12	0,00	0,04	0,16
cons	0,17	0,23	0,71	0,48	0,63	0,29

Source: Processed Data (2025)

$$FV = 0{,}25EMA + 0{,}11GI + 0{,}10EP + e \quad ... (1)$$

The EMA coefficient of 0.25 indicates that for every one-unit increase in EMA, firm value will increase by 25 percent, assuming other variables remain constant. Testing the first hypothesis (H1) yielded a probability value of 0.01 < 0.05, with a positive t-value. This indicates that EMA has a positive and significant effect on firm value, thus **Hypothesis 1 can be accepted.**

The green innovation coefficient of 0.11 indicates that for every one-unit increase in green innovation, firm value will increase by 11 percent, assuming other variables remain constant. Testing the second hypothesis (H2) yielded a probability value of 0.02 < 0.05, with a positive t-value. This indicates that green innovation has a positive and significant effect on firm value, thus **Hypothesis 2 can be accepted.**

The interaction/moderation effect test aims to determine whether the moderating variable can strengthen or weaken the relationship between the independent variable and the dependent variable. The results of the regression model test after the inclusion of the moderating variable are presented below.

Table 4. Moderated regression model

FV	*Coef.*	*Std. Err*	*t*	*P>|t|*	*[95% Conf. Interval]*	
EMA.EP	0,02	0,01	1,85	0,07	0,35	0,00
GI.EP	0,11	0,02	1,42	0,10	0,06	0,15
cons	0,31	0,05	6,28	0,00	0,21	0,42

Source: Processed Data (2025)

FV = 0,02EMA.EP + 0,11GI.EP + e ... (2)

Based on the analysis results, the coefficient value of the EMA variable after including environmental performance is 0.02, indicating that every one-unit increase in EMA indirectly increases firm value by 2 percent through environmental performance, assuming other variables remain constant. However, the third hypothesis test (H3) yielded a probability value of 0.07 > 0.05, meaning that environmental performance is unable to strengthen the relationship between EMA and firm value. Thus, **Hypothesis 3 is rejected.**

Furthermore, the coefficient value of the green innovation variable after including environmental performance is 0.11, suggesting that every one-unit increase in green innovation indirectly raises firm value by 11 percent through environmental performance, with other variables assumed constant. Nevertheless, the fourth hypothesis test (H4) produced a probability value of 0.10 > 0.05, indicating that environmental performance also does not serve as a moderating variable in the relationship between green innovation and firm value. Therefore, **Hypothesis 4 is rejected.**

Overall, this study provides insights into the interrelationship among Environmental Management Accounting (EMA), green innovation, and environmental performance on firm value in manufacturing companies listed on the IDX during the 2022–2024 period. First, the findings confirm that EMA has a positive and significant effect on firm value. This indicates that EMA is not merely a tool for recording and reporting, but also a strategic instrument that enhances cost efficiency, manages environmental risks, and strengthens corporate legitimacy in the public eye. From the perspective of the *Natural Resource-Based View* (NRBV), EMA enables companies to manage resources more efficiently, minimize environmental impacts, and build a positive reputation that ultimately increases investor trust. This result is consistent with previous studies (Ethika et al., 2019), (Endiana & Suryandari, 2020) (Gerged et al., 2024).

Second, the study demonstrates that green innovation has a positive and significant impact on firm value. The implementation of green innovation, such as the development of environmentally friendly technologies, the use of renewable energy, and the creation of sustainability-oriented products, has been proven to improve cost efficiency while also opening new market opportunities. This strengthens corporate reputation, reduces regulatory risks, and

enhances investor appeal. In line with the NRBV framework, green innovation serves as a corporate strategy to build long-term competitive advantage.

Third, the results indicate that environmental performance does not act as a moderating variable in the relationship between either EMA or green innovation and firm value. This suggests that although companies have adopted EMA and green innovation, their environmental performance achievements are not yet strong enough to reinforce their impact on firm value. In practice, most manufacturing companies in Indonesia are still at a minimum environmental performance level (blue PROPER rating), which reflects regulatory compliance rather than a proactive strategy to create added value. In other words, environmental performance is still viewed as an administrative obligation rather than a strategic factor that significantly enhances firm value.

This phenomenon can be explained through signaling theory and legitimacy theory. Ideally, EMA and green innovation should function as positive signals to obtain legitimacy from the market and stakeholders. However, the effectiveness of these signals depends on the quality, credibility, and transparency of environmental disclosures. If environmental performance reports are symbolic, lack measurable indicators, or are even associated with greenwashing practices, investors will find it difficult to assess the company's real contribution to sustainability. This reinforces the argument that markets in developing countries such as Indonesia remain more focused on short-term financial indicators rather than long-term sustainability achievements.

CONCLUSION

The findings indicate that Environmental Management Accounting (EMA) and green innovation have a positive and significant effect on the firm value of manufacturing companies listed on the IDX, suggesting that both practices enhance cost efficiency, transparency, competitiveness, and corporate reputation in the eyes of investors and stakeholders. However, environmental performance was not proven to moderate the relationship between EMA or green innovation and firm value. This implies that the environmental performance achievements of manufacturing companies in Indonesia are not yet strong enough, or are not perceived as sufficiently relevant by the market, to strengthen the effect of sustainability practices on firm value.

Practical recommendations for companies include strengthening EMA implementation as a strategic tool for cost efficiency and value creation, and directing green innovation toward market value generation and sustainable reputation. Since environmental performance was not found to moderate the relationships, concrete measures are required, such as setting targets for emission reduction, energy and water efficiency, and waste minimization, accompanied by environmental audits and transparent reporting based on GRI standards. A pro-environmental corporate culture may also be reinforced through employee training and the adoption of real-time monitoring technologies. The integration of EMA, green innovation, and measurable environmental performance can simultaneously enhance firm value and support long-term sustainability.

For future research, it is suggested to consider other moderating variables such as corporate governance, quality of environmental disclosure, or stakeholder engagement, to better capture the dynamics between EMA, green innovation, and firm value. Studies may also be extended to other industrial sectors or across countries to improve generalizability. Furthermore, employing qualitative or mixed-method approaches could provide deeper insights into management and investor perceptions. External factors such as government regulations and environmental incentives should also be examined, as they may influence the effectiveness of sustainability strategies in enhancing firm value.

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