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Original Article

Sustainability in Business: How Green Accounting, Carbon Emission Disclosure, and Green Transformational Leadership Influence Firm Value with Eco-Efficiency as a Moderator

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Abstract: *Firm value is a key focus for stakeholders in assessing company performance, reflecting its current condition and providing insight into its future prospects. This study examines the influence of Green Accounting, Carbon Emission Disclosure, and Green Transformational Leadership on Firm Value, with Eco-Efficiency as a moderating variable. The research focuses on energy sector companies in Indonesia listed on the Indonesia Stock Exchange (IDX) during the 2018–2023 period, as this sector significantly contributes to environmental impacts. The study employs panel data analysis using 208 observations after removing outliers. The findings reveal that Green Accounting positively affects Firm Value, while Carbon Emission Disclosure has a negative impact. Green Transformational Leadership shows no significant effect. Furthermore, Eco-Efficiency weakens the relationship between Green Accounting and Firm Value but strengthens the relationship between Carbon Emission Disclosure and Firm Value. However, Eco-Efficiency does not moderate the relationship between Green Transformational Leadership and Firm Value. This study provides new insights into how sustainability practices influence Firm Value in Indonesia's energy sector. The findings highlight the importance of more integrated strategies to achieve sustainable competitive advantage in an industry with substantial environmental impacts.*

Keywords: *Carbon Emission Disclosure, Eco-efficiency, Firm Value, Green Accounting, Green Transformational Leadership.*

I. INTRODUCTION

In today's era of economic growth and intensifying competition, companies are striving to maximize profits and enhance their value in the eyes of stakeholders. To improve both stakeholder welfare and corporate value, businesses are increasingly expected to adopt environmentally sustainable and eco-friendly practices. In addition to providing benefits to society, companies are also expected to provide social responsibility, including environmental aspects [1].

As time goes by, public awareness of the importance of environmental protection is increasing; companies are now increasingly required to be able to run an environmentally friendly business [2]. Currently, many impacts arise as a result of environmental damage. Given the increasing number of adverse impacts generated by companies on the environment and also on society, the implementation of corporate social responsibility is very important for companies [1]. The negative impacts that arise are depletion of natural resources, worsening air pollution, environmental pollution, noise, as well as discrimination, coercion and arbitrariness [3].

In recent times, companies that have begun to implement green accounting practices have increased. Green accounting reflects the environmental effects arising from various company operating activities [4]. Green accounting is an accounting approach that considers the additional costs and benefits of economic activity, including environmental and health impacts resulting from business decisions and strategies [5]. Companies can create complete and reliable financial information based on economic and environmental factors to make it easier for stakeholders to evaluate the company's current and future conditions in decision-making [6].

The media and investors have shown a significant deal of interest in climate change, which encourages businesses to keep putting their environmental performance first [7]. Excessive carbon emissions are caused by fossil fuel combustion, land reclamation, agriculture and other human activities [8]. These environmental concerns have encouraged various parties, especially in the government sector, to make a transition towards low-carbon emissions to mitigate current global challenges [9]. Disclosure of carbon emissions for companies can provide benefits in terms of environmental preservation and building a positive image of the company for the community [7].

To achieve success in reducing emissions and protecting the environment, much of a company's success depends on the role of a leader who supports and implements good environmental management practices [10]. Green leadership is a clear example of transformational leadership behavior in environmentally friendly practices [11]. Leaders have an important role in company management, providing direction to employees and supporting the long-term growth of the company by emphasizing social responsibility and business ethics [12].

Companies face different challenges in increasing their firm value due to the influence of firm size. Firm size indicates the ability of a company to support financial performance and also the possibility of the company to innovate in its business [13]. Firm size is another component that will have an impact on firm value.

This research is a development of the research of Firdaus et al. (2023) by adding an independent variable, namely Green Transformational Leadership, as adopted from Suherman's research (2017) [14], [15]. In addition, this study also uses firm size as a control variable and applies Eco-efficacy as a moderating variable. This study refers to a different approach compared to previous studies, such as those conducted by Firdaus et al. (2023), which used a sample of the raw goods sector for the period 2021-2022 [14]. This study focuses on energy sector companies listed on the Indonesia Stock Exchange (IDX) during the 2018-2023 period. The selection of the energy sector is based on the argument that companies in this sector play a major role as contributors to carbon emissions and environmental pollution [5].

In addition, this study uses a new measurement method for Green Accounting variables, namely through total environmental costs, as well as measuring Carbon Emissions Disclosure based on the Carbon Disclosure Index formulated by Li et al. (2019) [16]. In addition, the addition of the independent variable Green Transformational Leadership and Eco-Efficiency moderation based on the ownership of ISO 14001 certification provides a new dimension in this study.

II. LITERATURE REVIEW

A) Stakeholder Theory

Stakeholder theory focuses on the company's responsibility to all its stakeholders, not limited to shareholders (Barsky et al., 1999). Freeman (1994) defines stakeholders as individuals or groups that can influence or be influenced by the achievement of corporate goals. This theory emphasizes the importance of managing relationships with various stakeholders to achieve corporate sustainability, not just for the benefit of certain parties [17]. Businesses can create value by achieving sustainable long-term success by balancing the needs and expectations of multiple stakeholders[18]. By considering the interests of all stakeholders, the company can foster stronger relationships, improve the company's reputation, and maintain the company towards a more sustainable direction [5].

B) Legitimacy Theory

Legitimacy Theory underscores the relationship between companies and society, where corporate sustainability depends on the extent to which companies are able to operate in accordance with social norms, values and expectations [19]. In this theory, companies voluntarily disclose social and environmental information to ensure that their business practices are positively accepted by society [20]. Legitimacy theory helps organizations comply with and demonstrate economic, environmental, and social rules to be accepted by society, as well as ensure that their existence is legitimate in society in general [21]. In this way, companies not only maintain operational sustainability but also strengthen legitimacy in the eyes of society and other stakeholders [22].

C) Resource Based Value Theory

Resources-Based View Theory emphasizes the importance of a company's rare, valuable, and difficult-to-imitate resources as the key to achieving sustainable competitive advantage [23]. The RBV-based approach allows companies to optimally utilize resources so as to increase efficiency and innovation [24]. Transformational leadership style helps employees understand and support the organization's long-term goals, value contributions to environmental management, and create a positive work environment [25]. By utilizing resources strategically, companies are expected to create long-term value that is not only beneficial to the company but also to the environment and society at large [26].

D) Green Accounting

Green accounting is accounting information relating to the indirect costs and benefits of economic activity, as well as its impact on the environment and health, as a consideration in corporate business decision-making [27]. The purpose of applying green accounting is to improve sustainability and control environmental impacts [28]. By implementing good green accounting, companies can improve their performance in supporting the environment and identify strategies to minimize environment-related costs caused by their production activities [5].

E) Carbon Emission Disclosure

Carbon emissions disclosure is the submission of information aimed at assessing a company's carbon emissions and setting targets for their reduction [29]. Global companies are beginning to recognize the risks of climate change, both from direct physical impacts and policies that affect their business [30]. Efforts to reduce carbon emissions involve investments in green technologies, low-carbon product development and other efforts that often require additional expenditures [31].

F) Green Transformational Leadership

Green transformational leadership is a characteristic of leaders who inspire and motivate them to achieve environmental goals that are greater than expectations [11]. This leadership provides an inspiring vision that encourages coworkers to set proactive environmental goals, build an environmentally friendly image, and create green opportunities [3]. Green transformational leadership is in line with society's need for sustainable development, so transformational leadership is a form of leadership supported by society [32].

G) Eco-Efficiency

Eco-efficiency is a company strategy to improve the environment through business operations, which aims to increase company value and stock prices [33]. Eco-efficiency is also defined as an effort to reduce environmental damage during business processes and improve environmental management with standards such as ISO 14001, which can increase company value [34]. ISO 14001 certification indicates the implementation of an environmental management system that complies with international standards, helping companies reduce environmental impacts and improve efficiency, competitiveness and corporate image [35].

H) Firm Value

Firm value is an investor's view of the extent to which the company's achievements are related to its share price [36]. Meanwhile, company value is the company's performance reflected through its share price, which is determined by supply and demand in the capital market [37]. Companies increase their value by implementing financial management; financial decisions made have an impact on other financial decisions and will ultimately affect the value of the company [38].

I) Firm Size

Firm size is the size of the company expressed in total assets and is measured by the natural logarithm of total [1]. By having larger funds, companies can create opportunities to grow and improve their performance [39]. The total value of the company's assets can be used to determine its size. Large asset bases will draw the interest of creditors, investors, and other customers of information, so leadership can use these resources more creatively to boost the value of the business. [40].

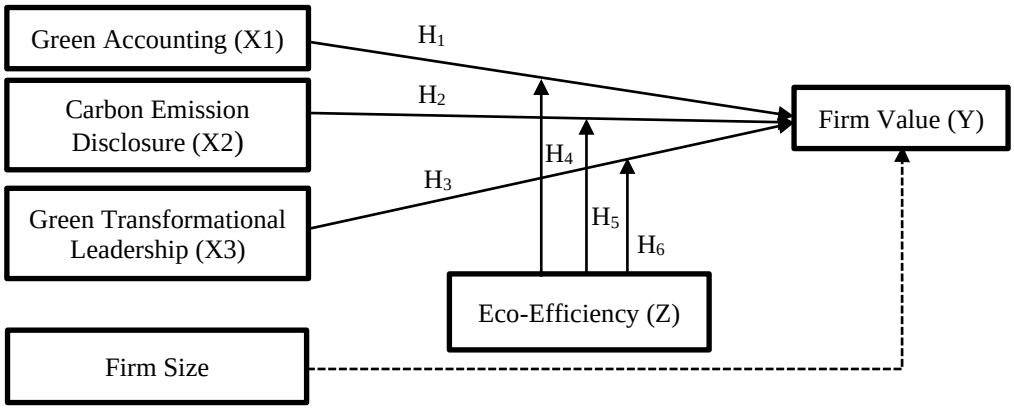

Figure 1: Research Framework

J) The Effect of Green Accounting on Firm Value

Green accounting is a step that companies take to improve environmental achievements, manage expenses, invest in sustainable, environmentally friendly technologies, and promote environmentally friendly products [41]. Green accounting measurement can be seen from the environmental performance of a company [42]. In the research of Wenni Anggita et al. (2022), it was found that green accounting variables have a positive effect on firm value [43]; this is also in line with research conducted by Dewi et al. (2024), which provides a statement that Green Accounting has a positive influence on Firm Value [5].

H_1: Green Accounting has a positive effect on Firm Value

K) The Effect of Carbon Emission Disclosure on Firm Value

Global companies are starting to take the initiative to reduce carbon emissions voluntarily; carbon-related costs can still affect firm value [31]. With the company disclosing carbon emissions, the company will get a good reputation and attention from the public fiber other parties [43]. A number of earlier scholars have studied the disclosure of carbon emissions. According to research by Damas et al. (2021), firm value is impacted by carbon emissions disclosure [44]. The study's findings are consistent with research by Kurnia et al. (2021) that demonstrates that firm value is positively impacted by carbon emissions disclosure [20]. This explanation allows for the formulation of the hypothesis.

H_2: Carbon Emission Disclosure has a positive effect on Firm Value

L) The Effect of Green Transformational Leadership on Firm Value

Environmentally appropriate transformational leadership is needed to improve employee performance and company sustainability [45]. In addition to increasing corporate social responsibility for environmental preservation, green transformational leadership can expand the idea of environmental management to product development, which supports sustainable development [6]. The findings of Suherman's (2017) study, which looks at how green transformational management affects business performance and firm value, indicate that green transformational leadership increases firm value. [15].

H_3: Green Transformational Leadership has a positive effect on Firm Value

M) The Effect of Eco-Efficiency as a moderating variable

Eco-efficiency is an effort to reduce environmental damage as little as possible during business processes and improve eco-efficiency [34]. In this case, eco-efficiency can serve as a moderating variable that can strengthen or weaken the effect of green accounting, carbon emissions disclosure, and green transformational leadership on firm value. Research conducted by Khaireddine et al. (2024) indicates that ISO 14001: 2015 can function as a moderating variable that strengthens the relationship between variables. Therefore, the hypotheses formulated in this study are:

H_4: Eco-Efficiency moderates the effect of Green Accounting on Firm Value

H_5: Eco-Efficiency moderates the effect of Carbon Emission Disclosure on Firm Value

H_6: Eco-efficiency moderates the effect of Green Transformational Leadership on Firm Value

III. RESULTS AND DISCUSSION

A) Research Methodology

The type of data used in this research is quantitative research, which relies on data collection, factor analysis, and identification of determining the relationships that exist between variables. This study aims to evaluate the effect of green accounting, carbon emissions disclosure, and green transformational leadership on the dependent variable of firm value by using eco-efficiency as moderation. The population or sample in this study was obtained by collecting energy sector companies listed on the Indonesia Stock Exchange (IDX) in the period 2018-2023. This study uses secondary data in the form of annual reports and corporate sustainability reports published on the company's official website. The secondary data to be used has been previously collected by reliable and qualified sources. The sampling process uses a purposive sampling method to limit the sample based on predetermined criteria.

In this study, the independent variables are Green Accounting, Carbon Emission Disclosure, and Green Transformational Leadership. The dependent variable is firm value, the moderating variable is Eco-efficiency, and firm size is the control variable.

a. Green Accounting

Referring to research by Sidarta et al. (2023), green accounting measurement is measured using total environmental costs reported in the company's annual report or sustainability report [46]. Environmental costs are costs that arise or may arise due to low environmental quality [47]. In other words, environmental costs are related to green accounting as a form of disclosure of costs incurred by companies for the creation, detection, repair, and prevention of environmental damage [48].

$$\text{Green Accounting} = \text{Ln (Environmental Cost)}$$

b. Carbon Emission Disclosure

The disclosure of carbon emissions is measured by the content analysis method, which refers to the annual report or sustainability report, which is quantified based on certain indicators. This study uses the Carbon Disclosure Index measurement criteria according to Li et al. (2019) [16]. Measurement is carried out by giving value or scoring to each indicator in accordance with the criteria. The indicators that will be used consist of 14 items, which will be described in the following attachment:

Table 1: Scoring Method Carbon Emission Disclosure

NO	Indicator	Criteria Score
1	Timeliness of carbon disclosure in the report	Is carbon disclosure disclosed in the company's annual report/letter of intent? 1 = Disclosed in the report 0 = Not disclosed
2	Carbon data collection process	Is there a description of the carbon data collection process? 1= If yes 0= If no
3	Certification and verification of carbon disclosure	Is the carbon information disclosed certified and exposed by an independent third party? 1= If yes 0= If no
4	Graphs, tables and descriptions of carbon disclosure	Are there graphs, tables and text descriptions in the carbon transmission? 3 = If all three are used 2 = If two are used 1 = If one is used 0 = None
5	Terminology of carbon information	Is there terminology and explanation in the carbon coverage? 2 = Appropriate terminology and explanation 1 = No terminology 0 = No explanation
6	Carbon information quantification standard	Is the quantification of carbon information quantitative and standardized? 2 = There is a description of the calculation method used and appropriate data. 1 = Data is presented using common standards, but calculation methods are not described. 0 = No calculation method or relevant data available.
7	Carbon reduction strategy	Is there a description of carbon reduction in the planning strategy? 2 = Contains a description of concrete and specific measures to reduce carbon emissions. 1 = General plan description or outline without detailed explanation 0 = No description
8	Carbon reduction target	Is there a description of carbon reduction targets? 2 = Qualitative and quantitative description 1 = Only qualitative or quantitative description 0 = No description
9	Carbon reduction management	Is there a description of the establishment of reduction agents, emission reduction management system and other management measures for carbon reduction? 2 = Mention the establishment of a team or agent for carbon reduction 1 = Only mentions management measures for carbon reduction. 0 = No description
10	Carbon reduction risk	Is there a description of carbon reduction risks, such as non-reduction risks caused by government regulations, operation risks caused by climate change, and possible economic losses due to emission reductions? 2 = Identifies various risks related to carbon reduction in detail 1 = Mentions risks in general terms without explaining their impacts in detail. 0 = No description
11	Carbon reduction investment	Is there disclosure of carbon investments, such as in technical improvements, carbon abatement, or abatement project investments, as well as payment of waste fees, fines, etc.? 2 = Qualitative and quantitative description 1 = Only qualitative or quantitative description 0 = No description
12	Government subsidies for carbon reduction	Is there a description of government subsidies and rewards for carbon reduction? 2 = Provides information on the type of subsidies or rewards received 1 = There are subsidies or rewards from the government 0 = No description
13	Accounting for carbon reduction	Are there carbon accounting disclosures, such as energy savings and carbon reduction? 2 = Qualitative and quantitative description 1 = Only qualitative or quantitative description 0 = No description
14	Carbon reduction performance	Is there disclosure of carbon performance, such as economic benefits, environmental benefits, social benefits, and rewards resulting from carbon reduction? 2 = Qualitative and quantitative description

		1 = Only qualitative or quantitative description 0 = No description.

The formula used to calculate the carbon emission disclosure ratio is as follows:

$$Carbon\ Emission\ Disclosure = \frac{Total\ Disclosure\ Score}{26}$$

c. Green Transformational Leadership

This green transformational leadership variable will be measured using content analysis referring to the company's annual report or sustainability report by scoring 6 indicators based on research conducted by Singh et al. (2020) [49].

Table 2: Scoring Method Green Transformational Leadership Index

NO	Indicator	Scoring Criteria
1	The project leader inspires team members with an environmental plan.	Explanation related to plans, strategies or programs designed to achieve sustainability goals. 2 = There are strategies or programs that support 1 = Only plans for sustainability 0 = No description
2	The project leader provides a clear environmental vision for team members to follow.	Statements or expressions of leaders (Board of Directors) related to the company's environmental sustainability vision and goals 2 = There is an explanation of the vision 1 = Only mentions the environmental vision 0 = No description
3	The project manager leads the team in achieving shared environmental objectives.	Explanation of the company's efforts to support cooperation or collaboration to build the company's environment 2 = There is collaboration or cooperation with other parties 1 = Only mentions efforts to encourage collaboration 0 = No description
4	The project leader encourages team members to achieve environmental goals by adding features related to green product/service development.	Development or innovation of products/services based on green or environmentally friendly technology 2 = If both are used 1 = If only one is used 0 = No description
5	The project leader acts with environmental beliefs in mind.	Strategic decisions or commitments are aligned with environmental values. 2 = There is a commitment taken by the company to maintain environmental sustainability, 1 = There is a sentence about the company's strategic decisions/commitments. 0 = No description
6	The project leader always encourages team members to add green ideas.	Disclosure of initiatives to encourage team members to come up with environmentally friendly ideas 2 = There is a program to facilitate environmentally friendly ideas 1 = There is a description of company leaders encouraging team members to come up with green ideas 0 = No description

The formula used to calculate the green transformational leadership ratio is as follows:

$$Green\ Transformational\ Leadership = \frac{Total\ Disclosure\ Score}{12}$$

d. Eco-Efficiency

Eco-efficiency in this study is measured using a dummy variable based on the ownership of ISO 14001 certification owned by the company. The company will be given a value of "1" if it has an ISO 14001 certificate and a value of "0" if it does not have it [50]. The ISO 14001 certificate is a standard that sets out an approach to environmental management systems. When a company seeks to implement ISO 14001, it has demonstrated a commitment to improve its environmental performance continuously.

e. Firm Value

In calculating firm value, firm value is measured by Tobin's Q, which Tobin's Q is more effective in explaining company activities in the context of cross-sectional investment and diversification decision-making, as well as the relationship between ownership and performance, performance and acquisition relationships, funding policies, dividend policies, and compensation policies [51]. Measurement using Tobin's Q is done with the equation:

$$Tobins'Q = \frac{Market\ value\ of\ all\ outstanding\ shares + Total\ Liabilities}{Total\ Asset}$$

f. Firm Size

In this study, firm size is measured using the natural logarithm of total assets owned by the company, as stated in research [52]. In simple terms, firm size is expressed in the formula.

$$Firm\ Size = Ln\ (Total\ Asset)$$

B) Results and Discussion

The population in this study focuses on companies operating in the energy sector in Indonesia as listed on the Indonesia Stock Exchange (IDX). This study chose companies in the energy sector because this sector is one of the sectors that contributes to the impact of environmental damage. In the process of determining the sample, some companies did not meet the predetermined criteria, so they were excluded from the research sample. As a result, 36 companies were selected as research samples from the population of companies in Indonesia. This study uses the panel data analysis method, with data collected from 36 companies during the period 2018-2023. The total observation data in this study amounted to 216. However, the normality test results show that the data is not normally distributed. Therefore, data transformation was carried out by eliminating outlier data. A total of 8 observation data were identified as outliers and excluded, bringing the total observation data used in this study to 208.

Table 3: Descriptive Statistics

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Firm Value	208	0,161	6,185	1,120	0,767
Green Accounting	208	0,000	27,752	16,364	9,483
Carbon Emission Disclosure	208	0,000	1,000	0,389	0,294
Green Transformational Leadership	208	0,083	1,000	0,514	0,209
Eco-Efficiency	208	0,000	1,000	0,721	0,450
Firm Size	208	26,620	32,780	29,484	1,585

The results of the analysis using descriptive statistics show that the lowest value of the Company Value is 0.161, while the highest value is 6.185. The average Company Value is 1.120, with a standard deviation of 0.767. Most of the companies in the sample have a Tobin's Q value> 1, which means that the market values the company higher than the book value of its assets; this reflects the positive expectations of investors on the company's future prospects, which usually indicates good performance or high growth potential.

The lowest value of Green Accounting is 0.000, while the highest value is 27.752; this indicates that some companies do not disclose environmental costs in their reports. The mean value of 16.364 indicates a fairly good level of environmental disclosure in general. However, the sizable standard deviation of 9.483 indicates that there are significant differences between companies in the application of Green Accounting.

Carbon Emissions Disclosure has the lowest value of 0.000, which indicates that there are still companies that have not disclosed carbon emissions in their reports. In contrast, the maximum value of 1 reflects a fairly good disclosure of carbon emissions. The average disclosure of 0.389 with a standard deviation of 0.294 indicates that the level of carbon emissions disclosure between companies varies significantly, with most falling below the average and some companies achieving high levels of disclosure.

The results of the analysis show that the Green Transformational Leadership variable has the lowest value of 0.083, which reflects the lack of disclosure about commitment and leadership that supports a sustainable environment within the company. In contrast, the highest value of 1 indicates a strong commitment and leadership in supporting environmental sustainability. The average disclosure score for this variable is 0.514, with a standard deviation of 0.209, indicating a significant variation in disclosure of green transformational leadership among the companies analyzed.

The analysis shows that the variable Eco-Efficiency as moderation has the lowest value of 0, which indicates that some companies do not yet have ISO 14001 certification, reflecting a lack of commitment and a strong environmental management system. In contrast, the maximum value of 1 indicates that some companies already have such certification, signalling awareness and compliance with environmental management. The average value of Eco-Efficiency is 0.722, with a standard deviation of 0.449, indicating that most companies tend to have the certification, although there is quite a small variation between companies.

The lowest value for Firm Size is 26.620, while the highest value was recorded for PT Delta Dunia Makmur Tbk in 2018, which was 32.780. The average firm size is 29.484, with a standard deviation of 1.585, which indicates a relatively small

variation in firm size in the sample analyzed. Most companies tend to have sizes that are around this average value.

Table 4: The result of the Adjusted R Square test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,347	0,120	0,090	0,498

Based on Table 4, the Adjusted R Square value is 0.090, which means that the variability of green accounting variables, disclosure of carbon emissions, and green transformational leadership on firm value can only explain 9% of the variation in the dependent variable. In comparison, other factors influence the remaining 91%. This shows that the factors tested in the model have a relatively small contribution to changes in firm value, and there is a high probability that there are other variables that have not been included in the model that can explain greater variations in firm value.

Table 5: The result of F test

Model		*Sum of Squares*	F	Sig.
1	*Regression*	6,803	3,910	0,001
	Residual	49,713		
	Total	56,515		

From the results of the F test in Table 4.9, it is known that the calculated F value is 3.910 with 208 research samples; the value of the F significance level is smaller than 0.005 (0.001 < 0.05). It can be concluded that there is a joint or simultaneous influence on the firm value variable.

Table 6: The result of the Hypothesis Test

Variable	Prediction	Unstandardized Coefficients		t	Sig	Conclusion
		B	Std. Error			
(Constant)		-0,518	0,707	-0,733	0,465	
GA	Positive	0,023	0,006	4,008	0,000	H1 Accepted
CED	Positive	-0,496	0,185	-2,676	0,008	H2 Rejected
GTL	Positive	0,396	0,255	1,551	0,122	H3 Rejected
GA*Eco	Strengthen	-0,021	0,006	-3,489	0,001	H4 Rejected
CED*Eco	Strengthen	0,365	0,122	2,998	0,003	H5 Accepted
GTL*Eco	Strengthen	0,000	0,123	0,001	0,999	H6 Rejected
Firm Size		0,009	0,024	0,361	0,718	

1) Hypothesis 1: Green Accounting has a positive effect on Firm Value

Based on Table 6, it is known that the t-value is 4.008 with a significance value of 0.00. So, it can be interpreted that Green Accounting has a positive effect on Firm Value. The application of green accounting, as measured by the company's total environmental costs, reflects the company's commitment to maintaining harmonious relationships with stakeholders through transparent and responsible management of environmental impacts [53]. When stakeholders see that the company is committed to sustainability, their perception of the company becomes more positive [54]. This increases the company's reputation, trust, and attractiveness in the eyes of investors and the market, ultimately increasing the company's value [47]. The results of this study are in line with research conducted by Sukmadilaga et al. (2023) and Anggita et al. (2022), which show that Green Accounting practices have a significant positive effect on firm value [55], [43].

2) Hypothesis 2: Carbon Emission Disclosure has a positive effect on Firm Value

Based on Table 6, it is known that the t value is -2.676 with a significance value of 0.008. So, it can be interpreted that Carbon Emission Disclosure has a negative effect on firm value; therefore, H2 is rejected. This means that high disclosure of carbon emissions can highlight the negative impact of company activities on the environment, so the results of this study contradict the legitimacy theory [56]. Although this disclosure is important to demonstrate the company's commitment to the environment, there are several reasons why it can reduce the value of the company. Houten and Wedari (2023) said that carbon disclosures that have no impact on market value may indicate that investors are more focused on environmental management outcomes than detailed information about carbon emissions themselves [57]. This study is in line with the research of Sicard et al . (2023) and Marlina & Herawaty (2024), which show that disclosure of carbon emissions has a negative effect on firm value [58], [59].

3) Hypothesis 3: Green Transformational Leadership has a positive effect on Firm Value

Based on Table 6, it is known that the calculated t-value is 1.551 with a significance value of 0.122. So, it can be interpreted that Green Transformational Leadership has no effect on Firm Value; it can be concluded that H3 is rejected. This suggests that green transformational leadership has not fully become a strategic resource capable of providing sustainable competitive advantage. The effect of green transformational leadership on firm value is highly dependent on how the company manages and translates the vision into concrete operational strategies [60]. If sustainability initiatives are only symbolic or do not contribute directly to asset efficiency or liability management, then investors and markets tend not to appreciate these efforts in the form of increased stock prices or net asset values [61].

4) Hypothesis 4: Eco-efficiency moderates the effect of Green Accounting on Firm Value

Based on Table 8, it is known that the t value is -3.489 with a significance value of 0.001. So, it can be interpreted that Eco-Efficiency has a significant and negative effect as a moderating variable and weakens the relationship between Green Accounting and Firm Value, so H4 is rejected. Eco-efficiency, as measured through ISO 14001 certificate ownership, may not strengthen the effect of green accounting on firm value because ISO 14001 certificates focus on environmental management systems, not direct environmental performance, so they do not necessarily reflect resource efficiency or positive impact on the environment. According to stakeholder theory, companies seek to fulfill the interests of various stakeholders [20]. If the ISO 14001 certificate is not considered important or relevant by key stakeholders, for example, investors or consumers, then its benefit to firm value is small. In this situation, eco-efficiency measured using ISO 14001 fails to create the positive views needed to strengthen the relationship between green accounting and firm value.

5) Hypothesis 5: Eco-efficiency moderates the effect of Carbon Emission Disclosure on Firm Value

Based on Table 8, it is known that the t value is 1.017 with a significance value of 0.00. So it can be interpreted that the Eco-Efficiency variable as moderation has a significant effect and is proven to strengthen the effect of Carbon Emission Disclosure on Firm Value, so H5 is accepted. Eco-efficiency measured through ISO 14001 certification strengthens the impact of carbon emission disclosure on firm value because this certification shows the seriousness of the company in managing its impact on the environment. Clear carbon emission disclosures become more credible when supported by ISO 14001 certification, as this certification shows that the company has a standardized environmental management system. This will increase the confidence of stakeholders, including investors and the public, in the company's commitment to the environment.

6) Hypothesis 6: Eco-Efficiency moderates the effect of Green Transformational Leadership on Firm Value

Based on Table 8, it is known that the t value is 1.748 with a significance value of 0.16. So, it can be interpreted that the Eco-Efficiency variable has not been proven to moderate the Green Transformational Leadership variable on Firm Value, so H6 is rejected. Measuring eco-efficiency using ISO 14001 certificates, which focus on environmental management systems, does not adequately reflect resource efficiency or tangible environmental performance outcomes. ISO 14001 focuses more on environmental management processes rather than tangible, measurable outcomes, such as energy use efficiency or waste reduction. From an RBV perspective, these certifications may lack relevance, so their impact on a company's competitive advantage and firm value is limited. Therefore, even if a company has an ISO 14001 certificate, this does not necessarily indicate that the company has achieved a high level of efficiency in resource use or made a direct positive impact on environmental performance.

7) Firm size as a control variable plays an important role as it influences a company's ability to adopt sustainability practices. Large companies tend to have better resources to implement sustainability strategies. Large companies tend to get more attention from investors, regulators and the public, which makes their sustainability efforts more exposed. The results of this study indicate that firm size as a control variable has no significant effect on firm value. This suggests that business scale is not a significant factor in determining the effectiveness of sustainability strategies, meaning that factors such as green accounting, carbon emissions disclosure, and green transformational leadership can consistently affect firm value regardless of firm size. This situation may occur if the market, stakeholders, or regulators assess sustainability based on the quality of its implementation rather than the scale of the company. Research by Ningrum also supports this finding, where firm size does not show a significant influence on firm value, although capital structure and liquidity have a greater role (Ningrum, 2024).

IV. CONCLUSION

Based on the results of the test analysis and discussion in this study regarding the effect of Green Accounting, Disclosure of Carbon Emissions, and Green Transformational Leadership as independent variables on Firm Value as the dependent variable and Eco-Efficiency as a moderating variable, as well as Firm Size as a control variable in energy sector companies in 2018-2023, the following results were obtained: (1) Green Accounting Implementation has a positive effect on

Firm Value. (2) Disclosure of Carbon Emissions has a negative effect on Firm Value. (3) Green Transformational Leadership does not affect Firm Value. (4) Eco-efficiency weakens the relationship between Green Accounting and Firm Value. (5) Eco-efficiency strengthens the relationship between Carbon Emission Disclosure and Firm Value. (6) Eco-efficiency cannot moderate the relationship between Green Transformational Leadership and Firm Value. Overall, the results of this study indicate that Green Accounting practices and eco-efficiency can enhance firm value, while carbon emission disclosure has a negative impact, with limited influence from Green Transformational Leadership. This research provides valuable insights for companies to optimize environmental strategies to boost their firm value.

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