Green Investment, Green Technology Innovation On Green House Gas Emission: The Moderating Role of Female CEO in ASEAN

Tabah Rizki

Horizon University, Indonesia
E-mail: tabah.rizki.krw@horizon.ac.id

Abstract. *This study aims to investigate the effect of Green Investment (GI) and Green Technology Innovation (GTI) on Green House Gas Emission (GHG) and explore the moderating role of Female CEO. The research data using from 665 observations of public Energy and Mining companies in ASEAN during the period 2019-2023. Data processing using a panel data approach and multiple regression. The results of the study show that Green Investment (GI) can significantly increase the disclosure of green house gas emission (GHG) performance. The same results are also shown by Green Technology Innovation (GTI) which also has a significant positive effect on green house gas emission (GHG). Female CEO are proven to have a moderating role. The presence of a Female CEO is proven to significantly strengthen the positive influence of Green Investment (GI) and Green Technology Innovation (GTI) on Green House Gas Emission (GHG). Overall, the findings of this study provide motivation and encouragement for companies to increase their Green Investment (GI) and Green Technology Innovation (GTI) as part of the company's superiority strategy towards ecological environmental issues and disclosure of environmental information which will later be able to improve the performance of Green House Gas Emission (GHG) disclosure.*

Keywords**:** *Green Investment; Green Technology Innovation; GHG; Female CEO; ASEAN*

I. INTRODUCTION

Over the past few decades, climate change has become one of the most important issues in the world. The main reason for this is the massive use of energy resources. The main catalysts of climate change include the increasing volume of greenhouse gas emissions (Rahman et al., 2022)World experts have tried to address this problem by making commitments through the Green Deal Policy aimed at decarbonizing the economy by reducing greenhouse gas emissions (GHG emissions) by implementing smart technology, green energy, and expanding the principles of a green economy (Adamowicz, 2022)In fulfilling environmental responsibilities to achieve peak carbon levels by 2030 and achieving carbon neutrality by 2060, a special strategy is needed for environmental management (Wang et al., 2021).To achieve a low-carbon economy, efforts are needed through Green House Gas Emission (GHG).

The problem of Green House Gas Emission (GHG) has become a concern for researchers, policy makers, and national and international organizations to improve environmental quality for future generations (Meng & Qu, 2022).Therefore, to prevent the increase of GHG, companies and governments need to make a series of commitments and plans to encourage a comprehensive transition in socio-economic development to an environmentally friendly development model. The action plan can be carried out through green investment and green technology innovation. Green investment and green technology innovation are important contents of the social responsibility report.

Green investment as an investment in a new way for companies to allocate resources and put them into environmentally friendly development and renewable resources (Fan et al., 2023).Ahmed et al., (2024) emphasize the importance of green investment and encourage environmentally friendly projects to achieve the 2030 SDGs to maintain climate stability and transition to a carbon-neutral economy. In this case, the Green Climate Fund can help reduce carbon output and adapt to climate change (Filipović et al., 2022). In addition, green investment can advocate the expansion of renewable energy sources and related infrastructure, thereby contributing to the achievement of SDG 7(Zhan & Santos-Paulino, 2021). Based on signaling theory, green investment can signal that companies are interested in carrying out social responsibility, and bring a good external reputation to the company, thereby contributing to improving economic performance(Chen & Ma, 2021a). This is also reflected in the fact that companies pay more attention to economic, institutional, and social sustainability, and are more willing to invest in environmentally friendly innovation (Padilla-Lozano & Collazzo, 2022)Previous research using signaling theory found that the implementation of green investment in companies has a positive and significant relationship with GHG performance. Green Investment also significantly shows the advantages of environmental protection practices in reducing pollution (W. Zhang & Li, 2022)Green investment can also increase the proportion of renewable energy to total energy use while reducing greenhouse gas emissions (Huang et al., 2021).However, several studies have found that green investment has a negative impact on financial performance. Most companies make green investments under the pressure of environmental regulations, which leads to high private costs for companies, and lack of resource investment in profitable commercial projects and a sharp decline in corporate profits and capital (Han et al., 2022; Wan et al., 2022)

In addition, another strategy that needs to be implemented is green technology innovation (GTI). So far, research on GHG factors has focused more on technological innovation and ignored GTI which is more closely related to reducing carbon emissions. In fact, GTI as a new innovative method that highlights green environmental protection can not only achieve economic growth, but also effectively reduce the double pressure from the environment. Based on the resource-based view theory, Accelerating GTI and transforming the economic development mode have become important means to achieve the goals of carbon peak and carbon neutrality in achieving sustainable economic development (Fan & Xiao, 2021)Research from (Rizki et al., 2023; Xu et al., 2023)found that GTI can also contribute positively to carbon emission efficiency. Research (Miśkiewicz, 2021)confirms that GTI in its development has a positive impact on long-term economic growth (Arshad et al., n.d.)

Another thing to note is the importance of corporate decision-making to address the consequences and complexities of the corporate environment through the role of female CEO(Gull et al., 2023). The perspective of the upper echelon theory explains that business leaders significantly influence organizational policies, including environmental policies (Javed et al., 2023). In particular, the literature shows that women are more concerned, more sensitive to environmental topics. Therefore, the presence of female CEOs is more aware of environmental issues and will contribute to promoting cleaner energy and sustainable environmental approaches to address climate change and sustainable issues of SDGs 2030 (Al-Najjar & Salama, 2022). Therefore, identifying the role of female CEO in GHG is important to determine the existence of clearer environmental management practices and strategic management. In this regard, the role of female CEO has a significant positive effect on GHG which will have an impact on sustainable performance. This explains that the higher the role of female CEOs in the company, the higher the implementation of GI and GTI in reducing the company's GHG.

Based on this statement, this study is important to be carried out, especially in the ASEAN region. ASEAN was chosen because its practices are still rarely carried out by business entities. Based on data (Chien et al., 2023).ASEAN has become the largest producer of CO2 emissions. In 2022, eleven countries in ASEAN contributed 38%. The level of CO2 emissions in ASEAN will continue to increase because it is currently in the process of industrialization so that it will require a lot of energy and support the production process in industry. The increasingly rapid economic growth in ASEAN can be a threat to the environment and the sustainability of natural resources so that it is predicted that in a period of 20 years ASEAN countries will contribute 44% of global CO2 emissions. In ASEAN countries, the energy sector is the largest contributor to producing CO2 with a contribution of 49% or around 1,325.01 MtCO2. Energy companies also support the economy and industrial growth, but also have a negative impact on public health. The environmental challenges faced by companies are getting worse, with an increase in greenhouse gas (GHG) emissions ranging from 14,080 kilotons (kt) of CO2 equivalent to 198,970 kt of CO2 equivalent in 2018

Therefore, Given these issues, this study aims to provide new evidence on the relationship between green investment, green technology innovation and green house gas emissions moderated by female board directors in energy and mining companies in ASEAN. This study is important to do. First, because environmental violations that often occur in ASEAN not only have a significant impact on society, but can also cause major losses to shareholder value. Second, Given the increasing importance of corporate environmental responsibility, this study's investigation of the relationship between gender diversity, especially in terms of female CEO of companies in directing corporate policies to reduce exposure to the environment and third as a way to address companies in violating environmental laws is timely and significant.

Green Investment on Green House Gas Emission

Environmental degradation that has occurred recently has damaged sustainable economic growth and social welfare, and finally companies must take actions that play an active role in environmental protection efforts. Companies should gradually improve environmental quality and make environmentally friendly investments an integral part of driving sustainable development. Green investment is one of the main measures for companies as a proactive environmental management strategy to gain competitive advantage. (Zhang et al., 2023)showed that an increase in spending in the form of green investment in controlling environmental pollution can improve green economic development indicators.

Based on signaling theory, green investment can provide a signal that the company is interested in carrying out social responsibility, and bring a good external reputation to the company, thus contributing to improving economic performance (Indriastuti & Chariri, 2021; Shabbir & Wisdom, 2020). Several studies have shown that green investment has a positive effect on environmental performance, which shows the superiority of environmental protection practices in reducing pollution (Han et al., 2022; Hu & Yang, 2021; Zhang et al., 2023)Thus, the existence of green investment in a company can reduce the company's carbon emissions, thereby increasing the performance of green house gas emissions

H1: Green investment has a positive effect on green house gas emissions performance.

Green Technology Innovation on Green House Gas Emission

The Green Deal policy aims to mobilize and encourage innovation in decarbonizing the economy for sustainable development in the future. The application of innovative technology in the company's environmentally friendly development can support the transition to a carbon-free economy (Zhironkin & Cehlár, 2022)Green technology innovation is the most effective instrument in achieving economic growth. However, the application of

green technology innovation will burden production costs and hinder the progress of innovative research and development (Habiba et al., 2022; Xu et al., 2023)However, if green technology innovation becomes part of the company's strategy, it can certainly improve the company's environmental performance (Farzaa et al., 2021; Zhang et al., 2023)This is emphasized by Shan et al., (2021)who emphasized that spending on research and development and ICT infrastructure has a statistically significant positive impact on long-term economic growth. (Huang et al., 2021)proved that the application of green technology innovation in green infrastructure has a positive effect on the performance of green house gas emissions (GHG). Therefore, the hypothesis in this study is

H2: green technology innovation has a positive effect on green house gas emissions performance

Female CEO on the influence of green investment and green technology innovation and Green House Gas Emission

Women in a business can prove uniquely suited to act as environmental stewards in their professional lives and to innovate in environmentally friendly policies(Issa & Hanaysha, 2023). Based on the upper echelon theory, it provides a different perspective on women's rights and environmental degradation. Ecofeminists argue that women have a unique ability to fight environmental degradation (Kim, 2022)Women are better able to protect the environment in their work and create environmentally friendly policies (Mansour et al., 2024)The presence of female CEOs is a strong signal for investors who want to carry out environmentally conscious corporate social responsibility. The representation of female CEOs has a strong influence on the company's green investment(Hu & Yang, 2021). In addition, top management is mostly able to make decisions based on behavior and mobility so that the presence of female CEOs can benefit between CSR and green investment driven by top management (Al-Najjar & Salama, 2022)Female CEOs on green investment are more visible in large companies and are included in environmentally sensitive industries. So that the presence of female CEOs can strengthen the influence between green investment on GHG.

Then, Chiţimiea et al., (2021)study surveyed a large panel of US-based companies to assess the role of green technology innovation in improving corporate performance by promoting gender diversity on corporate boards to gain long-term benefits. These findings confirm the positive relationship between board gender diversity and green technology innovation and the processes that support women's environmentally conscious actions(Al-Qahtani & Elgharbawy, 2020). From an executive gender perspective, the presence of female CEO representation has a strong influence on corporate green innovation (Homroy, 2023;Javed et al., 2023) investigated whether the inclusion of women on corporate boards affects corporate GHG reductionRahman et al., (2022)determined that women are more likely to engage in environmental management practices that integrate carbon disclosure information and corporate values. In terms of business ethics, shareholders tend to value corporate sustainability reports. In line with (Wang et al., 2021)found that women's equal access to education and representation in government contribute to reducing carbon emissions from trade. Therefore, the hypothesis in this study is

H3: Female CEO strengthen the positive influence on the relationship between green investment and green house gas emissions

H4: Female CEO strengthen the positive influence on the relationship between green technology innovation and green house gas emissionsnamely: (1) Sales Growth; (2) Customer Growth; and (3) Profit Growth.

II. RESEARCH METHOD

Result

The implementation method in this study was carried out empirically with a quantitative approach. The data collected is secondary using sustainability reports and annual reports and the Thomson Reuters database. Then, the data also uses the official website of the ASEAN stock exchange, especially for energy and mining companies during 2018-2023. The sampling technique in this study is the purposive sampling method.

The data was tested according to the research hypothesis, namely the direct influence of green investment and green technology innovation on GHG and the moderating role of female CEOs. The green investment variable will be calculated using capital expenditures related to environmental protection. While the green technology innovation and GHG variables use content analysis with a ratio scale. Then, the female CEO variable uses a dummy scale

The research hypothesis will use a model to test and identify the results obtained. The model can be in the form of: Model 1: Direct influence of Green Investment and Green Technology Innovation on GHG $ze\ i,t + \beta 4\ leverage\ i,t + \beta 5\ ROA\ i,t + \beta 6\ AGE\ i,t + \beta 7\ GDP\ i,t + \varepsilon\ i,t$ Model 2: Moderating influence of female CEOs on Green Investment and Green Technology Innovation on GHG $GHG\ i,t = \alpha + \beta 1\ GI\ i,t + \beta 2\ GIT\ i,t + \beta 3\ GI * FC + \beta 4\ GIT * FC\ i,t + \beta 5\ size\ i,t + \beta 6\ leverage\ i,t + \beta 7\ ROA\ i,t + \beta 8\ AGE\ i,t + \beta 9\ GDP\ i,t + \varepsilon\ i,t$

The collected data that is in accordance with the model will be tested using panel data regression analysis and processed using Stata software. This study was processed with an initial stage in the form of a classical assumption test through a model that meets the Best, Linear, Unbiased, Estimator (BLUE) criteria. The BLUE rule includes multicollinearity test, heteroscedasticity test and autocorrelation test. Multicollinearity test can be detected by looking at the VIF (Variance Inflation Factor) and tolerance numbers. The limit of tolerance value is 0.10. Heteroscedasticity test is done by performing Breusch-Pagan/Cook-Weisberg test or White test. The basis for decision making is to see prob>chi>0.05. Then the autocorrelation test by performing Durbin-Watson Test (DW test) sees the DW value which must meet the requirements dU <DW <4-dU. Finally, hypothesis testing is carried out by looking at the Determination Coefficient

(R2) and Simultaneous Significance Test (F) with alpha value or significant level set at 1%, 5%, and 10%. Testing is carried out by analyzing the Hausman test model and Breusch-Pagan LM test to choose the right method between random effect, fixed effect or PLS.

III. RESEARCH RESULT AND DISCUSSION

Results

The population of this study was taken based on data from the Indonesia Stock Exchange by taking Public energy and mining companies in ASEAN during the 2019-2023 period. A total of 665 companies were obtained from the database and then adjusted according to predetermined criteria. The total sample used in this study for Public energy and mining companies in ASEAN was 133 observations using a balanced panel approach.

Descriptive Statistics

Descriptive statistics are data presented in a simple form. While descriptive statistical analysis will present an overall picture of the variables in the form of the number of observations, average value, standard deviation, minimum value and maximum value so that the existing data can be more easily understood and can provide a deeper understanding of the existing data. Descriptive statistics are depicted in Table 1

Table 1. Statistic Descriptive

Variable	N	Mean	Dev Std	Min	Max
GI	665	0,523	0,216	0,192	0,886
GTI	665	0,541	0,297	0,4	0,9
FC	665	0,417	0,381	0	1
GHG	665	0,569	1,573	0,3	1
SIZE	665	10,268	1,231	8,75	14,47
Leverage (LEV)	665	0,452	0,518	0,02	2,7
ROA	665	0,124	0,427	0,38	1,8
AGE	665	3,294	0,756	0,71	4,93
GDP	665	4,648	1,370	1,36	6,89

In this study, the dependent variable is GHG which is measured by the level of carbon information disclosure. The higher the level of disclosure, the more valuable it will be viewed by investors so that the company's image is better. Table 1 shows the results of descriptive statistics of GHG which has an average value of 0.569 with a minimum value of 0.3 and a maximum value of 1 and a standard deviation of 1.573. This indicates that the disclosure of GHG Energy and Mining in ASEAN of 56.9% of environmental responsibility disclosure has been achieved. Furthermore, GI as the amount of investment issued by the company in managing environmental issues has an average value of 0.523 with a minimum value of 0.192 and a maximum value of 0.886. Then GTI is an environmentally friendly technique and process through the disclosure of indicators from ASSET4 and annual reports has an average value of 0.541 which means that 54.1% of disclosure indicators have been achieved, a minimum value of 0.4 and a maximum value of 0.9 and a standard deviation of 0.297. This indicates that 6 out of 10 GTI indicators have been disclosed by the company in carrying out its operational activities. It can mean that the GTI carried out by Energy and Mining companies in ASEAN is quite good in its implementation. Then the presence of female CEOs has an average of 41.7% which means that in ASEAN female leaders are still relatively few in carrying out business strategies.

This study also uses several control variables in the form of Size, Leverage, ROA, AGE, GDP. Size (Company size) with the measurement of the natural logarithm of the company's total assets. From the table it can be seen that the average total assets of the company are 10.268, with the lowest total asset value being 8.75 and the highest asset value being 14.47. Then leverage in the form of the company's debt ratio in the current year. In the table, the average leverage value is 0.452 which means that the company is financed by debt with a value of 45.2 percent of total assets. The lowest leverage value is 0.02 and the maximum value is 2.7. Next is Return on Assets (ROA), with the results in the table of the average value of the company's profitability level of 32.94 percent, which means that the sample company has the ability to generate profits from each asset. standard deviation of 0.427 In addition, the highest ROA value is 180%, and the lowest ROA is 38% Then AGE which is in the form of a natural logarithm of the age of the company since it was founded. AGE has an average of 3.294 standard deviation of 0.756 minimum value of 0.71, The next variable is GDP growth or GDP growth, this variable is used as a country control, because the sample of this study consists of several different countries, the data for this variable is obtained from the World Bank. The figures shown in the table are the average GDP growth is 46.48% per capita, with the highest growth value being 68.9% and the lowest GDP growth being 13.6%.

Table 2 Regression Test Results (H1, H2)

Variable	Expectation	Coefficient	P-Value
Green Investment (GI)	+	1.327107	0.039**
Green Technology Innovation (GTI)	+	1.40121	0.047**
Size	+	0.0265914	0.532
Leverage	+	0.0763180	0.413
ROA	+	1.634982	0.000***
AGE	+	-0.1716614	0.482
GDP	+	-0.1571206	0.003***
Constants		6.568297	0.000***
N		665	
Adj.R^2		0.2389 (23.89%)	
Prob > F		0.0000	

Description:
GHG: GHG as the number of items disclosed in carbon disclosure divided by the total number of items = 18 (maximum score) in year t, GI: Natural Logarithm of the Total Capital Expenditure related to environmental protection in year t; GTI: GTI as the amount disclosed in the GI indicator is evaluated

from ASSET4 to determine the level of green innovation intensity. Number of items = 10 (maximum score) in year t, , FC: Dummy variable, SIZE: Natural Logarithm of Total Assets in year t, LEV: Ratio of Total Debt divided by Total Assets in year t, ROA: Ratio of net profit divided by total assets in year t; AGE: Natural logarithm of Company Age; GDP: Per Capita Growth Ratio of each country,
***significant at α level = 1% (0.01) **significant at α level = 5% (0.05) *significant at α level = 10% (0.1)

Table 3. Regression Test Results (H3, H4)

Variable	Expectation	Coefficient	P-Value
Green Investment (GI)	+	1.170364	0.040**
Green Technology Innovation (GTI)	+	1.921379	0.012**
FC*GI	+	0.2803617	0.051*
FC*GTI	+	0.5190176	0.087*
Size	+	0.0192014	0.349
Lev	+	0.0722911	0.401
ROA	+	1.8907125	0.000 ***
AGE	+	-0.07530912	0.472
GDP	+	-0.1631148	0.027**
Constants		6.5918467	0.000 ***
N		665	
Adj.R^2		0.2748 (27.48%)	
Prob > F		0.0000	

Description:
GHG: GHG as the number of items disclosed in carbon disclosure divided by the total number of items = 18 (maximum score) in year t, **GI**: Natural Logarithm of the Total Capital Expenditure related to environmental protection in year t; **GTI**: GTI as the amount disclosed in the GI indicator is evaluated from ASSET4 to determine the level of green innovation intensity. Number of items = 10 (maximum score) in year t, , **FC**: Dummy variable, **SIZE**: Natural Logarithm of Total Assets in year t, **LEV**: Ratio of Total Debt divided by Total Assets in year t, **ROA**: Ratio of net profit divided by total assets in year t; **AGE**: Natural logarithm of Company Age; **GDP**: Per Capita Growth Ratio of each country,
***significant at α level = 1% (0.01) **significant at α level = 5% (0.05) *significant at α level = 10% (0.1)

Discussion

The results of the study show that green investment can also increase the proportion of renewable energy to total energy use while reducing greenhouse gas emissions (Ye & Dela, 2023)Based on signaling theory, green investment can provide a signal that the company is interested in carrying out social responsibility, and bring a good external reputation to the company, thereby contributing to improving economic performance (Shabbir & Wisdom, 2020)This is also reflected in the fact that companies pay more attention to economic, institutional, and social sustainability, and are more willing to invest in environmentally friendly innovations (Chen & Ma, 2021b)This means that the presence of green investment in energy and mining companies in ASEAN can be used as a proactive environmental management strategy to gain competitive advantage. This statement is in line with research by Huang et al., (2021); Zheng & Jin, (2023)showing that an increase in spending in the form of green investment in controlling environmental pollution can improve green economic development indicators that can reduce the company's carbon emissions, thereby improving the performance of green house gas emissions.

Then green technology innovation can also contribute positively to carbon emission efficiency. (Zhang & Li, 2022)emphasized that green technology in ICT development and infrastructure has a statistically significant positive impact on long-term economic growth. Research byArshad et al., (2022) and Habiba et al.,(2022). In addition, the development of information technology and innovation has a statistically significant impact on GHG emissions. These results indicate that the application of green technology innovation in the company's environmentally friendly development can support the transition to a carbon-free economy. So that energy and mining companies in ASEAN can make green technology innovation the most effective instrument in achieving economic growth. Then, with this treatment, the application of green technology innovation can have a positive effect on the performance of green house gas emissions (GHG) through innovative development (Chien et al., 2023; Xu et al., 2023)

The results of the study show that female CEO have a significant influence and play a unique role in serving the triple bottom line in addressing greenhouse gas emissions with the role of green investment and green technology innovation. Female CEO expand their environmental responsibility behavior to address economic and environmental benefits(Javed et al., 2023). The results of the study are in accordance with the Upper Echelon Theory Perspective which explains that business leaders, especially women, significantly influence organizational policies, including environmental policies (Kakade et al., 2023)It can be concluded that the presence of female CEOs is more attentive to the needs of other stakeholders and shows greater sensitivity to environmental topics. In other words, they are more empathetic and more willing to change. Therefore, the presence of female CEOs is more aware of environmental issues and potential environmental risks. This statement is in accordance with Mansour et al., (2024)who determined that women are more likely to engage in environmental management practices that integrate carbon disclosure information and corporate values. In terms of business ethics, shareholders tend to appreciate corporate sustainability reports. In line with who found that women's equal access to education and representation in government contributed to reducing carbon emissions from trade (Issa & Hanaysha, 2023)

The control variable SIZE shows a positive and insignificant effect, indicating that the larger a company is, the less it affects green house gas emissions. Leverage also shows a positive and insignificant effect. ROA also shows a significant positive effect. The results of this study indicate that the higher the profitability of a company, the higher it will be in disclosing green house gas emissions. Company age (AGE) in this study was found to be negatively and insignificantly related to green house gas emissions. The results of this study can be interpreted that mature companies do not only focus on reducing green house gas emissions but tend to maintain

the company's long-term performance by using their assets to increase productivity and invest in innovation because of the many competing companies. Furthermore, GDP also found negative but significant results on green house gas emissions.

IV. CONCLUSSION

This study aims to examine the effect of GI and GTI on GHG, and to see the effect of Female CEO as a moderating variable on GI and GTI on GHG in Energy and Mining companies in ASEAN. This study refers to several theories, including stakeholder theory, Resource Based View (RBV) theory, Signaling theory and upper echelon theory. The research findings prove that GI and GTI have a positive effect on GHG in Energy and Mining companies in ASEAN countries, making a significant contribution to GHG. The results of the next study showed that the presence of a female CEO can play a role in moderating the relationship between GI and GTI on GHG, where the presence of a Female CEO can strengthen the positive effect of GI and GTI on GHG. Although this study is still limited to the Energy and Mining industry, it can be concluded that in ASEAN there is a phenomenon that GI and GTI can be categorized as an investment and business strategy that can be an advantage for companies in environmentally friendly development activities. This study contributes to the literature related to signaling theory, RBV and upper echelon that the role of GI, GTI practices plays an important role in GHG disclosure performance. Therefore, the Company must actively participate and continue to develop in green practices, incorporate environmental issues into the formulation of corporate strategy through improving environmental performance such as implementing GI and GTI practices, in order to build an environmentally based image and corporate reputation, in achieving financial performance promotion and competitive advantage.

Based on the research process that has been carried out, this study found several limitations that may be useful and beneficial for future research, including: This study only uses secondary data (company reports in the form of annual reports and sustainability reports) where the level of company disclosure is not necessarily the same (identical) to the practices in the company. Subsequent research can use more primary data (eg interviews, questionnaires, observations), not secondary so that it can better reflect the actual conditions. In this study, the number of observations analyzed was still relatively limited, namely from Energy and Mining companies listed on stock exchanges in ASEAN countries. Further research should expand the scope of industry as a sample of observation. So that it can also expand the results of the analysis and conclusions of these issues in the ASEAN region. In this study, the use of keywords for the search process and the scoring process of GHG and GTI practice performance may contain elements of subjectivity in its assessment. Future research may require double checks to identify carefully in order to identify the items in question. Measurement of each variable of previous research, namely GI, GTI and GHG, is still not conclusive. Further research can be conducted using existing measurement alternatives so that it can enrich the results of research in the ASEAN region.

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