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The Influence of Corporate Social and Governance Pillars on Green Innovation in Southeast Asian Energy Sector Public Companies

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Abstract: This research aims to analyze the relationship between Corporate Social and Governance pillars and green innovation in the Southeast Asian energy sector. It is a quantitative study that relies on secondary data from Refinitiv Eikon and relevant websites, analyzed using panel data regression with STATA 14 software. The research focuses on public companies in the Southeast Asian energy sector, using purposive sampling based on specific criteria, including operating between 2020-2023, having complete ESG data, and issuing financial statements during this period. This research provides a structured approach to understanding the impact of corporate social pillar includes workforce, human rights, community, and product responsibility, while the governance pillar comprises management, shareholders, and CSR strategies on green innovation in the Southeast Asian energy sector. The results of the study indicate a significant relationship between company performance and green innovation in the ASEAN energy sector. Analysis of sustainable performance variables, based on the ESG categories from the Refinitiv Eikon Database, reveals that social and governance-related scores influence green innovation in companies. Specifically, the workforce score, human rights score, and product responsibility score have a positive and significant relationship with the company's green innovation, while the community score shows a negative and significant relationship. In terms of governance, the management score has a negative and significant relationship with green innovation, whereas the shareholder score is positively and significantly related to green innovation. The CSR strategy score, although positive, does not have a significant relationship with green innovation in the ASEAN energy sector. This study highlights the importance of social and governance factors in driving green innovation and the need to pay close attention to specific elements that can support the successful implementation of green innovation in this sector.

Keyword: Social Pillar, Governance Pillars, Green Innovation, Southeast Asia, Energy Sector

INTRODUCTION

The recent global warming is caused by the increased use of carbon dioxide (CO2), greenhouse gas emissions and excessive pollution (Husnaini & Tjahjadi, 2021). The World Meteorological Agency said that 2023 was recorded as the hottest year in the history of instrumental observations, the global average temperature anomaly reaching 1.40 degrees Celsius above pre-industrial times. The ASEAN region is also experiencing a change in the earth's climate, which has recently experienced an increase in the earth's temperature that has been felt in the last decade (Fahruddin & A'yun, Indanazulfa, 2024). Mitigation efforts in key sectors, including the energy sector in ASEAN, are very important, due to the high carbon footprint in the sector with the increasing energy demand in ASEAN and the country's dependence on fossil fuel energy, on par with the carbon-intensive growth in ASEAN. The amount of carbon dioxide (CO2) emissions in the ASEAN region is presented in the following figure :

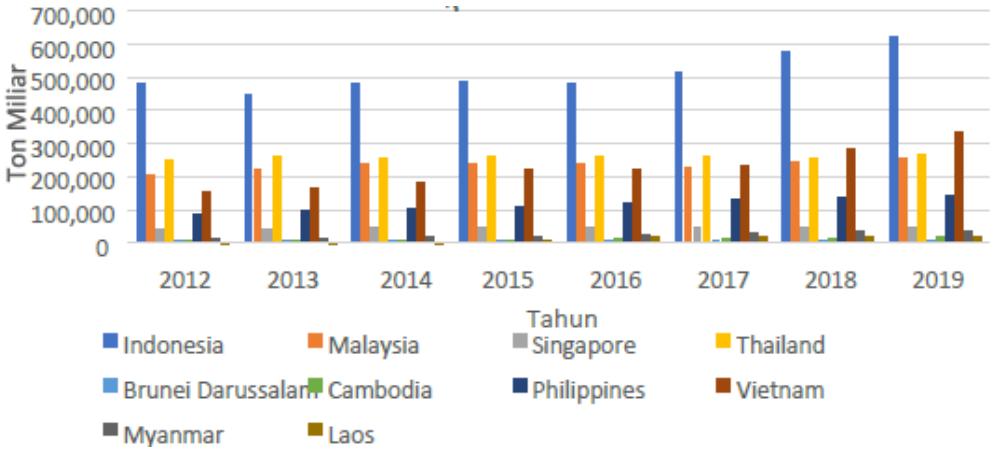


Figure 1. Data Emisi CO2 di Negara Asean pada 2012-2019 (Fahruddin & A'yun, Indanazulfa, 2024)

From figure 1 Carbon dioxide (CO2) emissions of countries in ASEAN explain that Indonesia occupies the top position in producing carbon dioxide (CO2) emission gas from year to year has increased quite high. According to data from the World Bank in 2019, the country that produces 619,840 hundred tons of emissions is Indonesia, which means that with this figure Indonesia is the country with the highest CO2 emission gas of the countries in the ASEAN region. Thailand is the second country that produces the highest CO2 emissions with a value of 267,090 hundred tons in 2019, which means that from 2012 to 2019 CO2 emissions continue to increase every year. Meanwhile, Malaysia has a value that reaches 205,801 to 253,270 thousand tons from 2012 to 2019. Then Brunei Darussalam is a country with a low emission level of 6,900 tons in 2019. The high level of CO2 emissions in several ASEAN member countries shows that the factors driving emissions are still being implemented. One of the factors that is thought to increase CO2 emissions is the increase in the use of fossil energy. In research (Fasikha & Yuliadi, 2018) The main cause of pollution and deteriorating air quality is the energy sector.

Indonesia's dependence on fossil energy, especially coal, is still very high. According to the Ministry of Energy and Mineral Resources (EMR), around 60-70% of electricity generation in Indonesia in 2023 will still come from coal. This causes high carbon emissions and increases the environmental burden, especially in the midst of an increasingly severe global warming trend. However, Indonesia has shown its commitment to make an energy transition to renewable energy through a *net zero emission* program targeted to be achieved by 2060. Several strategic measures such as increasing the use of renewable energy (e.g., solar and wind) as well as the B35 biodiesel program have begun to be implemented. However, major

challenges such as high investment, dependence on imported technology, and bureaucracy still hinder the acceleration of the transition.

With increasing awareness of environmental impacts, companies in various sectors including energy are now encouraged to innovate in an environmentally friendly way. Climate change due to the increase in the concentration of greenhouse gases in the atmosphere caused by the burning of fossil fuels, deforestation and unsustainable industrial practices has prompted an increase in the demand of companies to develop sustainability technologies and innovations to reduce the impact of global warming. Green innovation can be a strategic solution to face this challenge, because it offers a more environmentally friendly approach to industrial activities. Green innovation helps reduce the negative impact of industrial activities on the environment such as air pollution, air pollution, water pollution and industrial waste (Liao et al., 2019). This most relevant for the energy sector in ASEAN, including Indonesia, which is still very dependent on fossil fuels. With innovations that support energy-saving technologies, pollution prevention and waste management, companies can improve their environmental efficiency.

Green innovation not only contributes to environmental sustainability but also improves the competitiveness of the company. Research Chen et al. (2018) shows that companies that implement green innovation can improve their reputation, attract consumers who care about the environment and meet increasingly stringent government regulations. This provides a competitive advantage for companies, especially in the energy sector which faces pressure from various parties, including investors and consumers to be more environmentally responsible. Green innovation also contributes to the achievement of global sustainability goals such as the Sustainable Development Goals (SDGs). As one of the steps to reduce carbon emissions, this innovation supports the energy transition to renewable energy which is Indonesia's commitment through the net zero emission program by 2060. Therefore, the implementation of green innovarion is not only morally responsible, but also a strategic need to create a more sustainable future.

Green innovation is seen as a manifestation of the theory of legitimacy, which requires companies to act in accordance with societal values and norms (Husnaini & Tjahjadi, 2021). Pressure from various parties forces companies to care about and take responsibility for the environmental conditions in which they operate, as well as encourage them to take strategic risks, such as investing in green innovation. The company realizes that consumers are more interested in eco-friendly products, even though the price is higher (Tan & Zhu, 2022). Green innovation is an important tool to ensure long-term sustainability (Usman et al., 2020).

The main goal of green innovation is to reduce the negative impact of industrial activities on the environment (Liao et al., 2019). This green innovation is divided into an environmental pillar score and an environmental innovation score (Makpotche et al., 2024). These include innovations in energy-saving technologies, pollution prevention, waste recycling, eco-friendly product design, and environmental management (Zhang et al., 2019). Thus, the company leverages innovation to achieve environmental efficiency while improving financial performance. According to Chen et al. (2018), Green innovation has a positive impact on the competitiveness of companies. Companies that implement green innovation can reduce production waste, improve reputation and ultimately strengthen competitiveness amid consumer pressure and government regulations. Therefore, successful green innovation supports companies in strengthening core competencies and enhancing their green image.

Companies are increasingly required to focus on green innovation because it is more environmentally friendly and can be a solution to overcome pollution (Chen et al., 2018). This demand has made several companies start to disclose their green innovations, as seen in figure 2 which shows that Indonesian companies in the energy sector such as Bukit Asam Tbk, United Tractors Tbk and Adaro Energi Indonesia Tbk show green innovation disclosures worth 50%.

Meanwhile, the companies AKR Corporindo Tbk and Indo Tambangraya Megah Tbk still have a green innovation value of 0. This data shows that there is a gap in the disclosure of green innovation in the energy sector, so it is necessary to know the factors that can affect this disclosure.

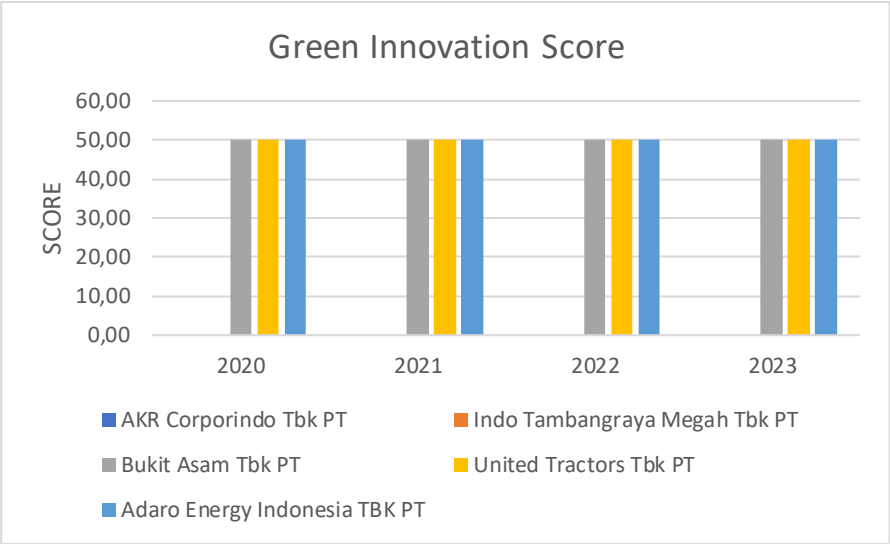


Figure 2. Green Innovation Indonesian Companies in Energy Sector

However, in realizing green innovation, companies not only need technological support and resources, but also a conducive social and governance environment (Mohy-ud-Din, 2024). The corporate social pillar based on refinitiv reflects the company's commitment to social aspects such as labor welfare, respect for human rights, community involvement and product responsibility. This pillar plays an important role in creating an inclusive work environment, fostering innovation and meeting stakeholder expectations. In the research Syafri et al.(2021) which shows that a skilled and diverse workforce contributes significantly to the development of green innovation. Data from Refinitiv also supports that one of the components of the corporate social pillar, namely the workforce, may affect the disclosure of green innovation. In Figure 3, which shows that energy companies with high workforce scores such as Bukit Asam Tbk have a workforce disclosure score of 93.27 tend to have better green innovation disclosure, which is 50 compared to companies with low workforce scores such as Indo Tambangraya Megah Tbk. This confirms that effective workforce management, as one of the important components of the social pillar, may play an important role in driving green innovation. The company's social pillars provide the foundation to support the adoption of green technologies and promote sustainability.

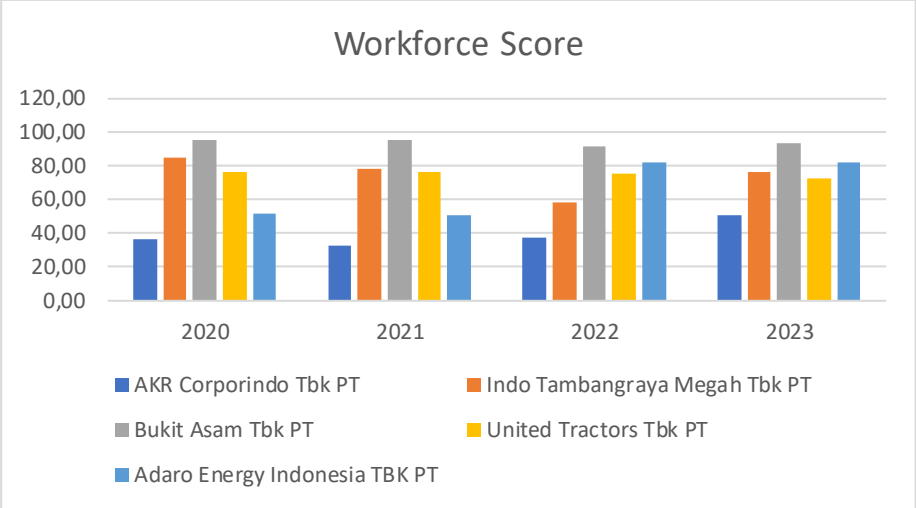


Figure 3. Workforce Indonesian Companies in Energy Sector

The corporate governance pillar reflects the quality of corporate governance in ensuring transparency, accountability and sustainability. These pillars based on refinitiv include management, shareholder participation and CSR strategies designed to support ethical and strategic decision-making. The CSR strategy component in good corporate governance creates an environment that supports innovation, including green innovation. Research Makpotche et al. (2024) shows that companies with integrated CSR strategies are able to invest better in green technology than companies that only focus on short-term profits. Refinitiv data also supports this finding, in Figure 4 shows that companies in the energy sector that have a high CSR strategy score such as Bukit Asam Tbk with a CSR strategy disclosure score of 89.66 tend to have better green innovation disclosure of 50 compared to companies with low CSR Strategy scores such as AKR Corporindo Tbk. This confirms that effective CSR strategy management, As one of the important components of the Governance pillar, it may play an important role in driving green innovation. The corporate governance pillar provides the foundation to support the adoption of green technologies and promote sustainability.

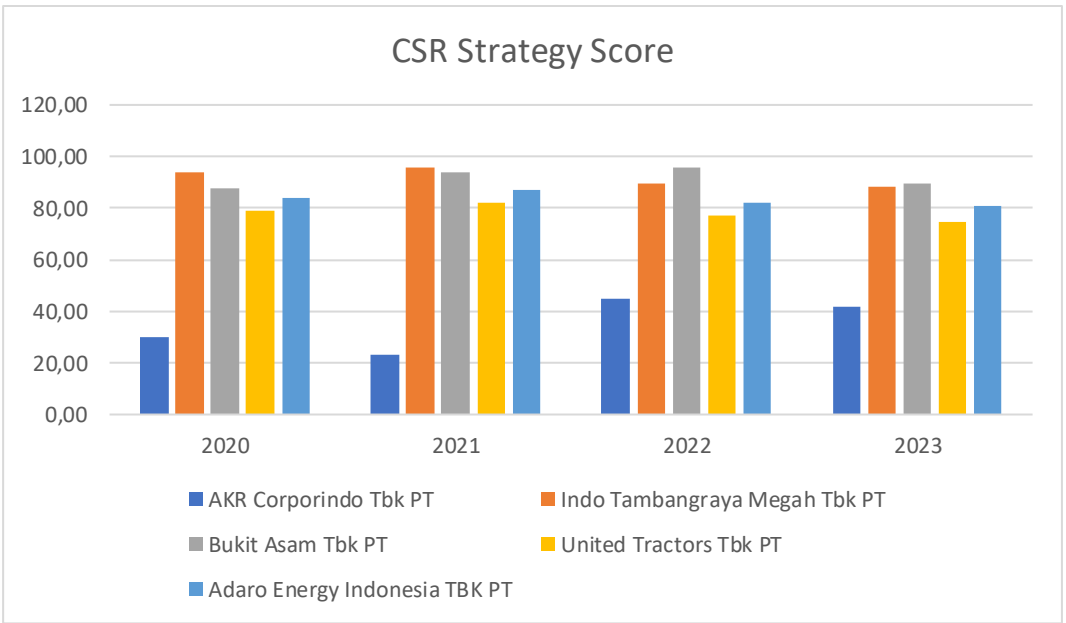


Figure 4. CSR Strategy Indonesian Companies Energy Sector

In this study, researchers grouped social companies based on refinive sources, using 10 key indicators of ESG scores To find out more deeply the influence of each component of the social and governance pillars on green innovation. The company's social pillar is used as an independent variable that covers four main categories: workforce, human rights, community and product responsibility. Dessler (2016) Defines workforce which refers to the entire group of workers in an organization or company involved in achieving company goals. Refinitiv defines workforce scores based on a company's effectiveness in job satisfaction, a healthy and safe workplace, maintaining diversity and equality of opportunity, and development opportunities for its workforce. Syafri et al. (2021) found that organizations that have skilled employees are more likely to develop and implement green innovation effectively.

In the Universal Declaration of Human Rights (DUHAM) adopted by the United Nations General Assembly in 1948, human rights are defined as fundamental rights that are possessed by every individual from birth, regardless of race, color, sex, language, religion, political views, national origin or other social status. These rights are inalienable rights, which everyone has only because they are human and aim to guarantee dignity, freedom and equality. Refinitiv defines a human rights score based on a company's effectiveness in respecting basic human rights conventions. Bai et al. (2019) observed that companies operating in countries with strong commitments to human rights are more likely to undertake green innovations in response to environmental regulations and consumer demands. The right to a healthy environment is one of the main motivators for companies to adopt environmentally friendly technologies.

Companies and communities can create shared value through mutually beneficial interactions. Porter & Mark (2011) Calling the community a group that has a common interest that can be strengthened through responsible business activities. Refinitiv defines community scores based on a company's commitment to being a good citizen, protecting public health and respecting business ethics. Badruzzuhad & Firmansyah(2023) shows that the community can play a role in the formation of green innovation areas through collaboration between research centers, educational institutions and communities. Communities can also contribute to raising environmental awareness and facilitating green innovation.

White et al. (1999), product responsibility refers to the concept where manufacturers and suppliers take ownership of the environmental and societal impacts of their products throughout their entire life cycle, from design and production to usage and eventual disposal. This involves ensuring that products are designed and produced in ways that minimize harm and maximize beneficial reuse, recycling, or proper disposal. Refinitiv define product responsibility scores based on a company's capacity to produce quality goods and services integrating the customer's health and safety, integrity and data privacy. Padilla-Lozano & Collazzo (2022) finded the integration of product responsibility into CSR strategies encourages businesses to invest in green innovations. Companies that actively promote their commitment to sustainability through responsible practices can improve their public image and attract investors, thereby enhancing profitability

In this study, researchers group corporate governance based on sources from refinitv, using 10 key indicators of ESG scores. The pillars of corporate governance are used as independent variables, which include three main categories: management, shareholders and CSR strategy. Lina (2024) Explain management as the process of planning, organizing, directing and controlling resources, including human, financial and material to achieve organizational goals effectively and efficiently. Refinitiv breaks down management into two categories, namely structure and compensation which include aspects of independence, diversity and commitment. Makpotche et al. (2024) found that good corporate governance practices, such as non-duality of CEOs, the establishment of ESG committees and gender diversity in God, correlated with better environmental performance.

Shareholders are the owners of the company who have certain rights and responsibilities. Good corporate governance should provide space for shareholders to contribute effectively to corporate governance, while still applying high standards of conduct without being involved in the company's day-to-day operations (Amore & Bennedsen, 2016). When shareholders are not involved, agency issues can arise if the interests of the company's agents or representatives conflict with the interests of the shareholders. According to Amore & Bennedsen (2016), Shareholders often delegate their authority and responsibilities to the directors, who are then responsible for the company's strategy and operations. This puts the board and management in an accountable position to shareholders. Research by Makpotche et al. (2024) shows that shareholders have a significant influence on the disclosure of green innovation. Liu & Lyu (2022) states that companies with high environmental responsibility are valued by investors.

The next category is CSR strategies that are closely related to environmental performance. Social and environmental responsibility is an external factor that companies consider in running their business to support sustainability. The application of corporate social responsibility has been regulated in law number 40 of 2007 concerning limited liability companies, where article 74 paragraph 1 states that "companies that carry out their business in and/or related to natural resources are obliged to carry out social and environmental responsibilities". According to Fraderick, CSR is that the company must take full responsibility for the consequences caused to the community and the environment in which the company is located. In the research Makpotche et al. (2024) It was found that CSR strategy has a significant influence on green innovation.

Green innovation in companies involves processes, products, or strategies that aim to reduce environmental impact while creating economic value. In this context, the components of the social pillars (workforce, human rights, community, and product responsibility) and governance (management, shareholder, and CSR strategy) were chosen because of their important role in supporting environmentally friendly innovation. The social component creates an environment conducive to innovation through improved workforce well-being, human rights protection, community engagement, and product responsibility, all of which can encourage companies to adopt green solutions (Hossain et al., 2021). Meanwhile, good governance through strategic management, shareholder engagement, and CSR strategies ensure the company has a structure that supports sustainability. Thus, social and governance aspects act as drivers, while green innovation measured through the environmental innovation score reflects the results of these influences (Khan et al., 2022). This approach avoids duplication with environmental pillar components, while highlighting the relationship between non-environmental aspects and green innovation, especially in the context of companies in ASEAN.

The literature shows that there are internal and external factors that affect the company's green innovation. Internal factors include government regulations, pressure from stakeholders (D. Zhang et al., 2019), Market Competition (Chen et al., 2018), and the availability of financial resources (Amore & Bennedsen, 2016). Internal factors include characteristics of the board of directors such as gender diversity (Liao et al., 2019), Geographical diversity (Usman et al., 2020) and institutional investor involvement on the board (Amore & Bennedsen, 2016). Most of this research was only conducted on companies in China and the main challenge faced was the problem of endogenicity. In this context, Amore & Bennedsen (2016) leverage corporate governance changes and green innovations related to anti-expropriation laws in the U.S. in the late 1980s as an exogenous shock to the threat of hostile expropriation (external governance) to address endogeniousness. Using a sample of U.S. companies, they found that companies with weaker governance generated fewer green patents than companies with better governance. However, their study only covers the period 1976-1995 and the shocks used in their research date back to the late 1980s, while environmental issues have become more urgent in recent

years. For example, green innovation experienced significant growth after 2015 (Karimi Takalo et al., 2021). Therefore, it is important to examine the relationship between internal governance mechanisms and green innovation using different approaches.

Research conducted Xu et al. (2021) Regarding the contribution of ESG ratings to corporate innovation in developing countries, it was found that ESG ratings with high financial investment increased corporate innovation. Tan & Zhu (2022) found that environmental awareness managers strengthen the relationship between ESG awareness and green innovation in developing countries. Moreover Liu & Lyu (2022) stated that the institutional environment greatly influences the company's ESG contribution to green innovation in companies listed on the China Stock Exchange. However, there is still no attention to the interests of stakeholders.

The COVID-19 pandemic, which was first detected in Wuhan, China, in December 2019, has triggered major changes in various aspects of global life. The transmission of this virus quickly spread around the world, and in March 2020, the World Health Organization (WHO) officially declared COVID-19 a pandemic. The economic impact of this pandemic is significant; Many countries experienced a sharp decline in economic activity due to the implementation of restrictive measures such as lockdowns and social distancing. According to a study, COVID-19 has led to a decline in companies' financial performance across various sectors, with reports showing that many companies have experienced drastic declines in revenue and profits (P. Ramadhan et al., 2023). In addition, data from Indonesia's Central Statistics Agency (BPS) showed a contraction in economic growth from the fourth quarter of 2019 to the first quarter of 2020, where household consumption decreased from 2.71% to 1.56%, reflecting the direct impact of the pandemic on the economy. So researcher is interested in researching the influence of the corporate social and governance pillar on green innovation after the announcement of Covid-19, namely from 2020 to 2023.

Although several previous literature has identified the relationship between corporate governance and green innovation, there have not been many studies that explore how corporate social pillars affect green innovation, especially in Southeast Asian public companies and explore after Covid-19 announced. The objectives of this study are derived from the problem formulation, aiming to explore several key factors that influence green innovation in public companies within the Indonesian energy sector. Specifically, the study seeks to examine the impact of the workforce on green innovation, the role of human rights in driving innovation, and the influence of the community. Additionally, it aims to analyze how product responsibility contributes to green innovation, the effect of management practices, and the role of shareholders in fostering innovation. Finally, the study intends to assess how the implementation of CSR strategies influences green innovation in these companies.

METHOD

This research is designed to conduct a structured, systematic, and objective analysis of the hypotheses related to green innovation in the Southeast Asian energy sector. It is categorized as quantitative research due to its reliance on numerical data and statistical analysis to test the proposed hypotheses. The primary objective is to explore the relationship between the independent variables, such as the pillars of Corporate Social and Governance, and their impact on green innovation. The data for this study is secondary in nature, sourced from Refinitiv Eikon and relevant websites, and analyzed using panel data regression techniques with STATA 14 software. The population for this study consists of public companies in the Southeast Asian energy sector, as defined by Sekaran (2016). These companies serve as the subject of investigation, providing the data needed to draw meaningful conclusions. For the sample, purposive sampling was employed, targeting public companies within the Southeast Asian energy sector that meet specific criteria: (1) companies operating between 2020-2023, (2) possessing complete Environmental, Social, and Governance (ESG) data for this period,

and (3) issuing financial statements during the same timeframe. Data for the research is drawn from secondary sources, including company records, government publications, and industry analyses. This data is collected from various online platforms such as Refinitiv Eikon, which offers comprehensive ESG data, along with financial reports and other relevant information accessible through websites, journals, and books. To gather the necessary data, documentation methods are used, involving the collection, recording, and review of secondary data. Additionally, literature studies are employed to gather theoretical insights and concepts related to the research topic, sourced from academic journals, e-books, and internet resources.

In this research, various data analysis techniques are employed to interpret and evaluate the gathered data. Descriptive statistics are first used to summarize the data, providing insights into its central tendency and variability. The mean is calculated to find the average value of the data, while the maximum and minimum values help identify the extremes within the dataset. Standard deviation is also used to measure the extent of variability from the mean value. For analyzing the relationship between variables, panel data analysis is employed, which integrates both cross-sectional and time series data. Three panel data models are considered: the Common Effect Model, which assumes constant intercepts and slopes across all observations; the Fixed Effect Model, which allows for individual-specific intercepts while maintaining the same slope across observations; and the Random Effect Model, which assumes a fixed slope but introduces random variations in the intercepts. The appropriate model is selected through a series of tests. To determine the best model, several diagnostic tests are applied. The Chow test is used to compare the Fixed Effect and Pooled Least Square models, with the F-statistic helping to decide the most appropriate model. The Hausman test further distinguishes between the Random Effect and Fixed Effect models by comparing the estimated coefficients, with a focus on the significance level. The Lagrange Multiplier (LM) test is then conducted to determine whether the Random Effect or Pooled Least Square model is more suitable. The classical assumption tests are crucial for ensuring the validity of the regression model. The normality test checks if the data follows a normal distribution, with significance values greater than 0.05 indicating normality. Multicollinearity is tested to identify any correlations among the independent variables, using Variance Inflation Factor (VIF) values below 10 to confirm the absence of multicollinearity. The heteroscedasticity test checks if the residuals have constant variance, with a p-value greater than 0.05 indicating the absence of heteroscedasticity. Hypothesis testing is conducted through partial (t-tests) and simultaneous (F-tests) methods. The t-test assesses the significance of each independent variable's influence on the dependent variable, while the F-test evaluates the overall significance of the model. Finally, the coefficient of determination (R^2) measures how well the independent and control variables explain the variance in the dependent variable, providing an indication of the model's explanatory power.

RESULTS AND DISCUSSION

Normality Test

The purpose of the normality test is to see if the perturbating or residual variables in the regression model are normally distributed. The following are the results of the normality test of the study using the normal probability plot graph.

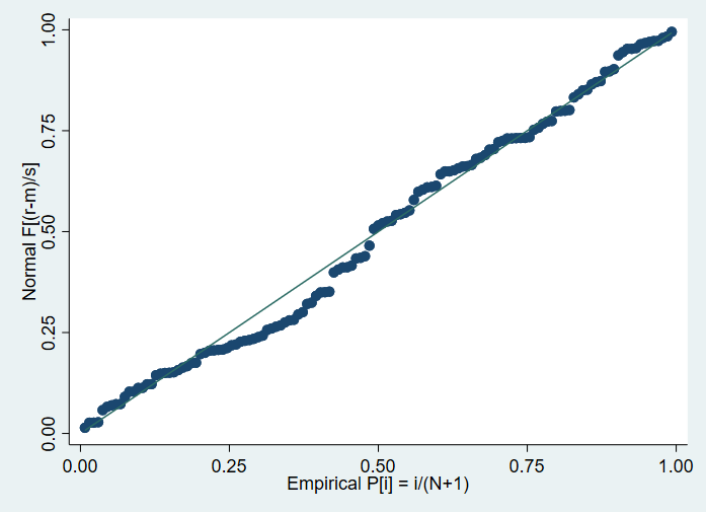


Figure 5. Plot Probability Graph

Based on the results of the normality test above, it can be seen that the existing plot follows the fit line. This means that all variable data in this study have been distributed normally. And to re-confirm the normal distributed data numerically, the Saphiro-Wilk W test was carried out, as follows:

Table 1. Normality Test Results

Variable	Obs	W	V	z	Prob>z
r	133	0.98425	1.653	1.133	0.12868

Data Source: Data Processed Using STATA (2024)

Based on the results of the Sahpiro-Wilk W test, it can be seen that Prob>z > 0.05 so it can be said that the data has been distributed normally. Thus, the normality test of this study is fulfilled because the data of this study has a normal data distribution.

Multicollinearity Test

To find out if there is an error from the multicollinearity hypothesis is the goal of the multicoliearity test. The absence of multicollinearity is a condition that must be met in a regression model. The following are the results of the multicollinearity test in this study.

Table 2. Multicollinearity Test Results

Variable	VIF	1/VIF
CSR	3.33	0.300236
WF	3.01	0.331908
C	2.31	0.432702
FS	1.91	0.522285
HR	1.86	0.538624
M	1.64	0.608895
PR	1.47	0.681117
FA	1.30	0.771350
SH	1.27	0.784641
ROA	1.08	0.926902
Mean VIF	1.92	

Data Source: Data Processed Using STATA 17 (2024)

Based on the results of the multicollinearity test above, it can be seen that all variables in this study have a VIF value of < 10. Not only that, the Mean VIF value for this study also has a < value of 10, which is 1.92. Thus the selected model does not experience multicollinearity problems.

Heterokedasticity Test

Heteroscedasticity is a state when the residue of a regression equation undergoes changes in a certain data range (Ekananda, 2019). This study uses the Breusch-Pagan/Cook-Weisberg test for Heteroskedasticity to test heteroscedasticity in this study. If the value (Prob>chi2) > 10%, this means that there is no heteroscedasticity problem. But on the other hand, if (Prob>chi2) < 10%, it indicates that there is a heteroscedasticity problem in the study. The following are the results of the heteroscedasticity test contained in this study.

Table 3. Heterokedasticity Test Results

Breusch–Pagan/Cook–Weisberg test for heteroskedasticity
Assumption: Normal error terms
Variable: Fitted values of GI
H0: Constant variance
chi2(1) = 1,27
Prob > chi2 = 0,2605

Data Source: Data Processed Using STATA 17 (2024)

From the results of the heteroscedasticity test above, it can be seen that (Prob > chi2) of 0.2605 means that it has a value smaller than the Alpha determination of the study1.27. Thus, it can be concluded that there is no problem of heteroscedasticity.

Panel Data Regression Model Testing

The purpose of testing this panel data regression model is to select the most appropriate regression model for the panel data to be used in this study. Before conducting the right panel data regression test, the researcher made a data panel declaration which aims to form a time series panel dataset so that panel data testing can be carried out. The results of the panel data declaration are as follows:

Panel variable	: Code (unbalanced)
Time variable	: YEAR, 2020 to 2023
Delta	: 1 unit

Based on the results of the data declaration above, it can be seen that this study is unbalanced panel data, which means that the data has a different number of time units for each individual. This is due to the existence of unavailable data. The next step is to test the panel data in choosing the regression model to use. This test has 3 stages, namely the chow test, the hausman test and the Langrange Multiplier test.

Uji Chow

Chow testing is used to determine the best model to use between the Fixed Effect model versus the Pooled Least Square model. If the result of the Fixed Effect regression shows that the result of the Prob>F value is less than 0.05 then H0 is rejected and the best option is Fixed Effect (FE). Meanwhile, if the value of Prob > F is greater than 0.05, then H0 is accepted and the regression chosen is Common Effect (OLS). The results of the chow test are as follows:

Table 4. Chow Test Results

Test	Test Indicators		Information
Uji Chow	F(10,82)	0.65	Model terpilih *Common Effect Model (OLS)*
	Prob > F	0.7680	

Based on the results of the Fixed Effect (FE) test above, the value of Prob > F is greater than 0.1, which is 0.7680. So from these results, the best choice is obtained namely the Common Effect Model (OLS) rather than the Fixed Effect Model. The next step is to conduct a hausman test.

Lagrange Multipler

Lagrange Multipler testing is used to determine which estimation model should be used between the Common Effect Model (OLS) or Random Effect. If the statistical value of the LM test is less than 0.1, then H0 is rejected and the correct model is the Random Effect model, while if the statistical value of the LM Test is greater than 0.1, then the correct model is the Common Effect Model (OLS). The results of the LM test are as follows:

Table 5. Hasil Uji Lagrange Multiplier

Uji	Indikator Uji		Keterangan
LM Test	Chibar2 (01)	10.57	Model terpilih Common Effect Model (OLS)
	Prob > F	0.1286	

Based on the criteria that have been determined, namely if (Prob > F) < 0.1, then H0 is rejected and the best option is Random Effect. From the results of the Lagrange Multiplier test above, the LM test result is 0.1286 and greater than 0.1 so the best option is the Common Effect Model (CEM). So that the panel data regression model that can be used for research is the Common Effect Model (CEM).

Hypothesis Test Results

The hypothesis test in this study was carried out with three tests, namely the t-test, the F-test and the R2 test. Below are the results of testing research hypotheses that have been carried out using STATA 17.

Results of the Partial Regression Coefficient Test (t-Test)

The t-test in the study serves to test the parameters of the estimated results (unrestricted) for certain calculations (restriced) (Ekananda, 2019). In addition, the t-test aims to identify the significance of each independent variable to the dependent variable. For the level of significance is used as α = 10%. As for the t-test, the criteria used are that if a research hypothesis has a t-count < t-table, then the research hypothesis is rejected, and vice versa. This means that individual independent variables do not have a large influence on dependent variables, and vice versa.

Apart from these criteria, the conclusion of the significance of each variable in the partial t test can be known from the prob value of > |t|, provided that if the value of α < is 0.1, Ha is accepted and vice versa. This means that independent variables have a large influence on dependent variables and vice versa. The following are the results of the t-test in this study.

Table 6. T-test Result

GI	Coefficient	Std. err.	t	P> |t|	[95% conf. interval]	
WF	.348027	.124866	2.79	0.006	.1008423	.5952116
HR	.2058227	.0830606	2.48	0.015	.0413959	.3702495
C	-.4805522	.1163869	-4.13	0.000	-.710851	-.250152
PR	.1429701	.0805638	1.77	0.078	-.016514	.30245401
M	-.2306663	.0848487	-2.72	0.008	-.398632	-.0626997
SH	.1294801	.0658302	1.97	0.051	-.000837	.2597975
CSR	.0910054	.1198747	0.76	0.449	-.146299	.3283093
FS	7.722556	1.463317	5.28	0.000	4.825774	10.61934
FA	-.1719849	.1791736	-0.98	0.339	-.526677	.1827071
ROA	13.75366	15.52669	0.89	0.337	-16.9829	44.4903
_cons	-138.7374	0.461037	5.52	0.000	-.373691	-2.04566

Data Source: Data Processed Using STATA 17 (2024)

Based on table 6 above, it can be seen that P>|t| of the Workforce variable is 0.006. In addition, Workforce has a positive coefficient value of .34802. This means that Workforce has a positive and significant influence on the dependent variable of this study, namely green innovation measured by the environmental innovation score. This is because the value of P>|t| which is owned by this variable is smaller than the Alpha value owned by the study, which is 0.1 and the coefficacyient of the variable has a positive value. Furthermore, the second independent variable – Human Right – also has a value of P>|t| smaller than the Alpha value of the study which has a value of 0.1. The value of P>|t| of this variable is 0.015. In addition, Human Rights has a positive coefficient value of .2058227. Thus, this variable has a positive and significant effect on the dependent variables of the study. The third independent variable – community – has a value of P|t| which is smaller than the research's Alpha value of 0.1. As seen in table 9 above, the value of P|t| from the community, which is 0.000. Then the community has a negative coeffient value of -.4805522. This means that this variable has a negative and significant influence on the dependent variable. The fourth independent variable – product responsibility – has a value of P|t| which is smaller than the research's Alpha value of 0.1. The value of P|t| This variable is 0.000. In addition, product responsibility has a positive coefficient value of .1429701. Thus, this variable has a positive and significant effect on the dependent variables of the study. The fifth independent variable – management – has a value of P|t| which is smaller than the research's Alpha value of 0.1. The value of P|t| This variable is 0.008. In addition, management has a negative coefficient value of -.2306663. Thus, this variable has a negative and significant effect on the dependent variable. The sixth independent variable – shareholder – has a value of P|t| which is smaller than the Alpha value of the study which is 0.1. The value of P|t| This variable is 0.051. In addition, shareholders have a positive coefficient value of .1294801. Thus, this variable has a positive and significant effect on the

dependent variable. The seventh variable – CSR strategy – has a value of P|t| which is greater than the Alpha value of the study, which is 0.1. The value of P|t| This variable is 0.449. In addition, CSR Strategy has a positive coefficient value of .0910054. Thus, this variable has a positive and insignificant effect on the dependent variable.

Table 6 also lists the results of the t-test for the control variables of the study. The first control variable is firm size, which has a value of P|t| which is smaller than the Alpha value of the study. The value of P|t| From a firm size of 0.000, then this variable has a positive coeffient value of 7.722556. This means that this variable has a positive and significant influence on the dependent variables owned by the research. Following the results of the t-test for the firm age variable has a value of P|t| by 0.339. this means that the value of P|t| greater than the Alpha value of the study which is 0.1. Meanwhile, firm age has a negative coefficient value of -.1719849. This means that this variable has a negative and insignificant influence on the dependent variables owned by the research. Furthermore, the t-test results for the ROA variable have a value of P|t| by 0.337. This means that the value is greater than the Alpha of the study with a value of 0.1. While the coeffient nilia of ROA is 13.75366. With demilk, ROA had a positive and insignificant effect on the dependent variables of the study.

Based on the results of the statistical test and the explanation above, the formula that can be concluded for this study is as follows:

$$\boldsymbol{GI = \alpha + \beta_1 WF + \beta_2 HR + \beta_3 C + \beta_4 PR + \beta_5 M + \beta_6 SH + \beta_7 CSR + \beta_8 FS + \beta_9 FA + \beta_{10} ROA}$$

$$\boldsymbol{GI = -138.7374 + .348027 WF + .2058227 HR + (-.4805522) C + .1429701 PR + (-.2306663) M + .1294801 SH + .0910054 CSR + 7.722556 FS + (-.1719849) FA + 13.75366 ROA}$$

This formula has a constant value of -138.7374 which means that if the variable has a value of 1 then the GI will have a value of -138.7374. Negative constants are not a problem and can be ignored as long as the regression model under test meets assumptions (e.g. normality for simple regression) or other classical assumptions for multiple regression. In addition, as long as the slope is not zero, the study does not need to care about this negative constant, negative constants generally occur when there is a large range between X (free variable) and Y (bound variable).

The workforce (WF) variable has a positive coefficient value of .348027 which means that every 1% increase in this variable will increase green innovation (GI) by .348027 assuming the other variables are constant. Then the human right (HR) variable has a positive coefficient value of .2058227. This means that every 1% increase in the HR variable will increase the GI by .2058227 assuming the other variables are constant. The community variable (C) has a negative coefficient of -.4805522. This means that every 1% increase in variable C will decrease the GI by -.4805522 assuming the other variables are constant. the variable product responsibility (PR) had a positive coeffiecient value of .1429701. this means that every 1% increase in the PR variable will increase the GI by .1429701 assuming the other variables are constant. the management variable (M) has a negative coeffiecient of -.2306663. This means that every 1% increase in the M variable will decrease the GI by -.2306663 assuming the other variables are constant. the shareholders variable (SH) had a positive coeffiecient value of .1294801. This means that every 1% increase in the SH variable will increase the GI variable by .1294801 assuming the other variable is constant. the CSR strategy (CSR) variable had a positive coeffiecient value of .0910054. This means that every 1% increase in CSR will increase the GI variable by .0910054 assuming the other variables are constant.

Firm size (FS) has a positive coefficient of 7.722556 which means that every 1% increase in the FS variable will result in a GI variable of 7.722556 assuming that other variables are constant. Firm age (FA) has a negative coefficientient value of -.1719849 and means that every 1% increase in FA will decrease the GI variable by -.1719849 assuming that other variables are constant. Finally, the return on asset (ROA) variable has a positive coefficientient

of 13.75366 which means that every 1% increase in ROA will increase the GI variable by 13.75366 assuming other variables are constant.

Results of the Simultaneous Regression Coefficient Test (F-Test)

The F test has the intention to find out whether independent variables simultaneously have a large influence on dependent variables. The level of significance used in this study is α = 10%. H0 states that all independent variables with the model have no significant effect on the dependent variables, while H1 states that all independent variables have a significant effect on the dependent variables. On the pene hypothesis; If the simultaneous value is >0.1, then the hypothesis cannot be accepted, and vice versa. This means that simultaneously independent variables do not affect dependent variables, and vice versa. Here are the F-Test results for this study.

Table 7. F-Test Results

F (10, 122) = 12.72
Prob > F = 0.0000

Data Source: Data Processing Results Using STATA 17 (2024)

Based on table 10 above, it can be seen that the nilia Prob > F = 0.0000. The Alpha value of the research is 0.1. This means that the nilia Prob > F is smaller than the alpha value of the study. Thus, all independent variables, namely workforce, human rights, community, product responsibility, management, shareholders and CSR strategy and control variables, namely firm size, firm age and ROA, affect the dependent variable, namely Green Innovation simultaneously.

Determination Coefficient Test Results (R2)

The determination coefficient (R2) test shows the percentage variation of all related variables that can be explained by the regression equation (independent variance variation) produced, the rest is explained by other variables outside the model (Ekananda, 2019). If the value (R2) = 0 or approaching zero, this means that the independent variable has a small relationship or effect with the dependent variable. If the value (R2) = 1 or close to one, this means that the independent variable has a perfect relationship or is getting better at it with the dependent variable. Nilia's determination coefficient (R2) ranges between zero and one.

Table 8. Determination Test Result (R2)

R-squared = 0.5105
Adj R-squared = 0.4703

Data Source: Data Processing Results using STATA 17 (2024)

Based on table 8, it can be seen that this study has an R-squared value of 0.5105. This means that the dependent variable – Green Innovation – which is measured using the Environmental Innovation Score can be explained by independent variables - workforce, human rights, community, product responsibility, management, shareholders and CSR strategy and control variables namely firm size, firm age and ROA of 51.05%. Then the remaining 48.95% was explained by other variables outside the study.

Based on the results of the statistical testing of the research, it can be seen that the independent variable has an influence on the dependent variable. The conclusion of the hypothesis test results is described in the following table:

Table 9. Summary of Research Results

Hypothesis	Test Results	Conclusion
H1 : Workforce has a significant positive effect on	Workforce has a positive and significant influence on green	H1 : Accepted

green innovation in Southeast Asia companies in the energy sector	innovation in southeast asia companies in the energy sector	
H2 : Human Rights has a significant positive effect on green innovation in Asian Southeast companies in the energy sector	Human rights have a positive and significant influence on green innovation in southeast companies asia in the energy sector	H2 : Accepted
H3: Community has a significant positive effect on green innovation in Southeast Asia companies in the energy sector	Community has a negative and significant influence on green innovation in southeast asia in the energy sector	H3 : Rejected
H4 : Product responsibility has a positive and significant effect on green innovation in Southeast Asia companies in the energy sector	Product responsibility has a positive and significant influence on green innovation in southeast asia in the energy sector	H4 : Accepted
H5 : Management has a positive and significant effect on green innovation in Southeast Asia companies in the energy sector	Management has a negative and significant influence on green innovation in southeast asia in the energy sector	H5 : Rejected
H6: Shareholders have a significant positive effect on green innovation in Southeast Asia companies in the energy sector	Shareholders memiliki pengaruh positif dan signifikan terhadap green innovation in southeast asia in the energy sector	H6 : Accepted
H7: CSR strategy has a significant positive effect on green innovation in Southeast Asia companies in the energy sector	CSR strategy has a positive and insignificant influence on green innovation in southeast asia in the energy sector	H7 : Rejected

The Influence of Workforce on Corporate Green Innovation

The workforce score describes the effectiveness of a company in terms of providing job satisfaction, a healthy and safe workplace, maintaining diversity and equal opportunities and development opportunities for its workforce (Refinitiv, 2022). Several previous studies that are also related to labor mentioned workforce development and sustainable labor. Siswanto et al. (2022) explained that sustainable workforce refers to human resource management practices that consider social, economic and environmental sustainability in workforce management. Sustainable human resource management aims to create a work environment that supports employee well-being and minimizes negative impacts on the environment (Fahruddin & A'yun, 2024). Research Siswanto et al. (2022) demonstrate that organizations that implement these principles of social sustainability, health and wellbeing and skill development not only achieve better financial performance but also increase employee satisfaction and retention. Thus, sustainable labor is important in the context of sustainable development and corporate social responsibility.

This variable has a value of P|t| of 0.006 with a positive coefficient value of .348027. This means that the labor score (WF) has a positive relationship and has a significant effect on the dependent variable of this study, namely green innovation. This is because the value of P|t| owned by this variable is smaller than the Alpha value owned by the research, which is 0.1 and the variable coefficient is positive. This means that every 1% increase in this variable will increase green innovation (GI) by .348027 assuming other variables are constant.

These results indicate that companies with better labor values also have significantly better innovation. Based on the themes included in the workforce categories consisting of diversity and inclusion, career development and training, working conditions and health and safety, these results appear to be influencing. This is because the results are related to one of the theories used in this study, namely the stakeholder theory. The theory of interest is a theory that states that a company is responsible for respecting all its stakeholders. This is because not only shareholders, but also stakeholders have rights in the company. The results of this study are also in line with the research conducted by (Mohy-ud-Din (2024), Wu et al. (2024) and Chouaibi & Chouaibi (2021) which explains the positive relationship between labor and green innovation.

The Influence of Human Rights on Corporate Green Innovation

The second criterion that regulates the social pillar in ESG is the human rights of the community. Human rights scores describe a company's effectiveness in terms of respecting fundamental human rights conventions (Refinitiv, 2022). According to the United Nations (2022), human rights are rights inherent in all human beings, regardless of race, gender, nationality, ethnicity, language, religion or other status. Human rights include the right to life and freedom, freedom from slavery and slavery, freedom of opinion and expression, the right to work and get an education and many more. Everyone has the right to these rights, without discrimination. Unicef (2022) also states that human rights are standards that recognize and protect the dignity of all human beings. Amnusia human rights govern how individual human beings live in society and with each other, as well as their relationship with the State and the State's obligations to them. Human rights law obliges governments to do some things and prohibits them from doing others. Individuals also have a responsibility in exercising their human rights, they must respect the rights of others. No government, group or individual has the right to do anything that violates the rights of others.

The second variable in this study is the human rights score (HAM) which is also the second category of the social pillar in ESG. This variable has a value of P|t| of 0.015 with a positive coefficient value of .2058227. This means that the human rights (HR) score has a positive and significant effect on the dependent variable of this study, namely green innovation. This is because the value of P|t| which is owned by this variable is smaller than the Alpha value owned by the study, namely 0.1 and the variable coefficient has a positive value. It also means that every 1% increase in this variable will increase green innovation (GI) by .2058227 assuming the other variable is constant.

These results indicate that companies with better human rights scores also have significantly better green innovation. The results of this study are related to several theories used in this study, namely stakeholder theory and legislation theory. Stakeholder theory emphasizes the importance of meeting the needs and expectations of various stakeholders, respect for human rights is often a demand from stakeholders, especially the community and regulators. And the theory of legitimacy refers to the need for a company to obtain social legitimacy in order to continue operating, respect for human rights and the implementation of green innovation give the image that the company acts in accordance with the social values expected by society. The results of this study are also in line with the research conducted by (Mohy-ud-Din (2024) and A. Ramadhan & Widiastuty (2023). The results of the study found that in the ESG component, social performance has a positive relationship with the company's green innovation.

The Influence of Community on Corporate Green Innovation

The community is the third criterion that determines the social pillar in ESG. The community score illustrates a company's commitment to being a good citizen, protecting public health and respecting business ethics (Refintiv, 2022). McMillan and Chavis (1986) define a community as a collection of members who have a sense of belonging, are bound to each other and believe that the needs of members will be met as long as they commit to being together. Therefore, the community creates a sense of belonging and common interests among its members.

Community score (C) is the third independent variable in this study. This variable has a value of P|t| of 0.000 with a negative coefficient value of -.4805522. This means that the community score © has a negative and significant effect on the dependent variable of this study, namely green innovation (GI). This is because the value of P|t| owned by this variable is smaller than the Alpha value owned by the researcher, which is 0.1 and the variable coefficient has a negative value. This means that every 1% increase in this variable will decrease green innovation (GI) by -.4805522 assuming the other variable is constant.

The results of the study show that there is a significant negative influence of the community on green innovation, which is contrary to the Stakeholders theory, because this theory assumes that the community as one of the main stakeholders should encourage green innovation for the sake of sustainability. However, these findings can be explained by the community's resistance to the changes brought about by green innovation, such as threats to traditional jobs or the perception that the benefits of innovation are only felt by companies without providing them with direct benefits. Previous research, such as Zhang (2020), It also found that a lack of effective communication between companies and communities can fuel mistrust, hindering support for innovation. This shows that companies need to be more proactive in building relationships with communities through a participatory approach, transparency, and direct benefit delivery to mitigate such resistance.

Based on the explanation above, the conclusion is that the community score has a negative influence on green innovation which may be caused by several things. Community perception of injustice in the distribution of benefits from green innovation. In many cases, communities feel that green innovations only benefit the company economically or reputationally, while they bear negative impacts such as changes to local jobs or rising costs of living. Because equality is a very important aspect for all groups of society, imbalances in the sharing of benefits can trigger community resistance to green innovation. This emphasizes the importance of fairness in the implementation of green innovation to ensure that all affected parties, including local communities, feel equal benefits.

The Influence of Product Responsibility on Corporate Green Innovation

The product responsibility score measures a company's capacity to produce high-quality goods and services, integrating customer health and safety, data integrity and privacy (Refinitiv, 2022). Iyer and Soberman (2016) conducted research on the relationship between the existence of socially responsible innovation intrinsically and extrinsically. They argue that consumers not only need the economic value of the product, but also a heterogeneous intrinsic need to consume socially responsible products. Corporate social responsibility which consists of five dimensions: legal responsibility, social needs responsibility, product responsibility, environmental responsibility and employee responsibility have a positive effect on corporate innovation (Kotler and Lee, 2006).

This variable has a value of P|t| sebsar 0.078 with a positive coefficient value of .1429701. This means that product responsibility (PR) has a significant positive influence on the dependent variable of this study, namely green innovation (GI). This is because the value of P|t| owned by this variable is smaller than the Alpha value owned by the study, which is 0.1

and the variable coefficient is positive. This also means that every 1% increase in this variable will increase green innovation (GI) by .1429701 assuming the other variables are constant.

These results indicate that companies with better product responsibility scores also have significantly better green innovation. The results of this study are related to the theories used in this study, namely stakeholder theory and RBV theory. From a stakeholder perspective, product responsibility reflects the company's efforts to meet the demands of stakeholders, such as consumers and regulators, who increasingly prioritize environmentally friendly products. This encourages companies to innovate green to maintain stakeholder trust and satisfaction. Meanwhile, according to RBV theory, product responsibility is a strategic advantage by utilizing company resources to produce environmentally responsible products, thereby encouraging sustainable innovation. Research by Chen et.al (2015) and Rao & Holt (2005), shows that product responsibility drives green innovation through sustainable design and regulatory compliance, reinforcing the relevance of these findings.

The Influence of Management on the Company's Green Innovation

The management score reflects the company's commitment and effectiveness in following best practices in corporate governance principles (Refinitiv, 2022). Management is defined as planning, organizing, organizing, controlling, the activities of the members of the organization and activities that use all the resources of the organization to achieve the organization's predetermined goals (Khoirudin et al., 2022). Strategic management focuses on integrating management, marketing, finance and accounting, production and operations, research and development (R&D) and information systems to achieve organizational success.

This variable has a value of P|t| by 0.008 with a negative coefficient nilia -.2306663. This means that the management score (M) has a negative and significant effect on the dependent variable of this study, namely green innovation (GI). This is because the value of P|t| owned by this variable is smaller than the Alpha value of the study, which is 0.1 and the coefficient of the variable is negative. This means that every 1% increase in this variable will decrease green innovation (GI) by -.2306663 assuming the other variable is constant.

These results indicate that a large group of companies with higher green innovation in this study have lower management values. These results also contradict one of the theories used in this study, namely RBV theory, which assumes that management will allocate resources to innovation as a competitive advantage. However, research by Sharma et al. (2020) shows that hierarchical and conservative management structures often hinder decision-making related to green technology investments. This can happen because management prioritizes short-term efficiency more or feels that it lacks the capacity to manage uncertainty in green innovation. Thus, these results can reflect the company's internal challenges in supporting innovations that require a long-term vision.

The Influence of Shareholders on the Company's Green Innovation

Shareholders are the second category in the governance pillar in ESG. A shareholder is a person, company or organization that owns shares of the company. A shareholder must own at least one share or mutual fund of the company to make him a partial owner (Corporate Finance Institute, 2022). The shareholder score describes the effectiveness of the company against equal treatment of shareholders and the use of anti-takeover tools (Refinitiv, 2022). Shareholders contribute to various important aspects such as capital provision, operational oversight, influence on company performance, participation in strategic decisions, and support corporate social responsibility.

This variable has a value of P|t| It is 0.015 with a positive coefficient of .1294801. This means that the shareholder score (SH) has a significant negative influence on the dependent variable of this study, namely green innovation (GI). This is because the value of P|t| owned

by this variable is smaller than the Alpha value of the study, which is 0.1 and the variable coefficient is positive. This also means that every 1% increase in this variable will increase green innovation (GI) by .1294801 assuming the other variable is constant.

These results indicate that some companies with higher green innovation in this study have higher shareholder value. This is relevant to the theory used in this study, namely the stakeholder theory because shareholders are one of the main stakeholders that influence the company's decisions. This theory explains that management tends to respond to shareholder pressures that support sustainability such as investing in green innovation to improve the company's reputation and long-term competitiveness. Research by damert et. (2017) found that pro-environmental investor pressure significantly drives the adoption of green innovation in the corporate sector. These findings are reinforced by the fact that shareholders are increasingly aware of the importance of sustainability as a strategy to reduce environmental risks and increase company value as well as by increasing ESG trends in investment decision-making.

The Influence of CSR Strategy on Corporate Green Innovation

The last criterion in the governance pillar is the CSR strategy. The CSR strategy (CSR) score reflects the company's practice in communicating that the company integrates economic (financial), social, and environmental dimensions into its daily decision-making process (Refinitv, 2022). CSR is defined as a company's commitment to participate in sustainable economic development by improving the quality of life of the community and the environment (Oktina et al., 2020). The implementation of CSR strategies can be done through several approaches such as direct involvement, partnerships with third parties, and sustainable program development (Andi et al., 2020). An effective CSR strategy not only provides social benefits but also improves the company's reputation and financial performance. Companies that consistently implement CSR tend to have better relationships with stakeholders, increase customer loyalty and attract the best talent. In addition, CSR can serve as a tool for innovation and differentiation in the market (Nafi'ul Umam et al., 2024).

This variable has a value of P|t| by 0.449 with a positive coefficient value of .0910054. This means that the CSR strategy (CSR) score has a positive and insignificant effect on the dependent variable of this study, namely green innovation (GI). This is because the value of P|t| owned by this variable is greater than the Alpha value owned by the study, which is 0.1 and the variable coefficient is positive. This means that every 1% increase in this variable will increase green innovation (GI) by .0910054 assuming the other variable is constant.

These results indicate that companies with better CSR strategy scores also have significantly better credit ratings. Based on the themes that fall into this category consisting of – CSR strategy and ESG reporting and transparency – these results appear to be influencing. Stakeholders Theory is often used to explain the relationship between CSR strategy and green innovation, assuming that the company will respond to stakeholder demands for sustainability. However, the results of studies that show a positive but insignificant influence may contradict this theory, indicating that CSR strategies may be directed more towards symbolic activities (such as philanthropy) than direct investment in green innovation. Research by Aragón-Correa et al. (2020) supports these findings, showing that CSR strategies are often not sufficiently focused on green innovation because companies face short-term pressure to meet other stakeholder expectations, such as financial returns. In addition, another reason could be that green innovation requires a long-term commitment and greater allocation of resources, which is not always a priority in the framework of a CSR strategy.

The Influece of Company Size on the Company's Green Innovation

Company size is a value that shows the ratio of the size and size of a company, with categories that include large, medium and small companies (Loekito & Setiawati, 2021). Ming

Chen (2019) interpreting the size of the company through the total asset log as a more stable indicator to reflect the size of the company. There are several studies related to sustainability and green innovation that use company size as a control variable, namely: (Makpotche et al., 2024), (Xu et al., 2021), (Haryanto & Batam, 2024)

This variable has a value of P|t| by 0.000 with a nilia positive coefficient of 7.722556. This means that the size of the company has a positive and significant effect on the dependent variable of the research, namely green innovation. This is because the nilia P|t| This variable is smaller than the Alpha value of 0.1 and the coefficient of the variable is positive. The constant nlia of 7.722556 also means that every 1% increase of this variable will increase the company's green innovation by 7.722556 assuming the other variable is constant.

These results explain that the size of the company shows a positive influence on green innovation, which indicates that companies with high total assets will have better credit ratings. This is because the size of the company in this study is measured by the company's total assets. These results are in line with research conducted by Makpotche et al. (2024) which explains that companies with larger sizes tend to have a better or efficient capacity to adopt new technologies and innovate.

The Influence of Company Age on Corporate Green Innovation

The life of a company is the period of time calculated from the time the company is listed to the present, which reflects the company's ability to survive and operate in the business world. According to Puspitarini & panjaitan (2018), the age of a company shows how far the company can compete and take advantage of the opportunities that exist in the market, as well as how long the company can maintain its existence. In addition, companies that have been operating for a long time tend to have better experience in financial management and management, so they can improve the stability of their profitability compared to new companies. The measurement of the age of a company is usually carried out from the year of establishment or from the time the company is listed on the stock exchange, which indicates that the company has gone public and is obliged to publish its financial statements (Pipit Muliyah, Dyah Aminatun, Sukma Septian Nasution, Tommy Hastomo, Setiana Sri Wahyuni Sitepu, 2020).

This variable has a value of P|t| 0.339 with a negative coefficient value of -.1719849. This means that the age of the company has a negative and insignificant effect on the dependent variable of this study, namely green innovation (GI). This is because the value of P|t| This variable is greater than the Alpha value of the study, which is 0.1 and the variable coefficient is negative. A constant value of -.1719849 also means that every 1% increase in this variable will decrease the company's green innovation by -.1719849 assuming the other variable is constant.

The results of this study show that the age of the company has a negative and insignificant influence on green innovation, which means that the longer a company is established (the older the company), the tendency to innovate in the green aspect (environmentally friendly) decreases, but this relationship is not strong enough to be considered statistically significant. This can be due to a variety of factors, such as rigid bureaucracy, lack of encouragement to change or focus on established traditional business models. The results of this study are in line with research conducted by Damanpour & Gopalakrishnan (2001) which showed that the age of companies can slow down the adaptation of new technologies due to a conservative mindset.

The Influence of Profitability on a Company's Green Innovation

Profitability is the ultimate goal of all businesses because without profitability, businesses cannot survive in the long run. It is important for businesses to calculate current profits and project future profits of the business. This study uses the Return on Asset (ROA) ratio to measure profitability. The selection of this ratio is based on several previous studies

related to sustainable performance and green innovation that use profitability as a control variable.

This variable has a value of P|t| of 0.337 with a positive coefficient value of 13.75366. This means that the size of the company has a positive and insignificant effect on the dependent variable of this study, namely green innovation (GI). This is because the value of P|t| This variable is greater than the Alpha value of the study, which is 0.1 and the coefficient of the variable is positive. A constant value of 13.75366 also means that every 1% increase in this variable will also increase the company's green innovation by 13.75366 assuming the other variable is constant.

These results explain that the company's ROA shows a positive influence on green innovation, which indicates that companies with high ROA will have better green innovation. This is because profitability is measured by ROA. The results of this study are in line with the research conducted by Javeed et al. (2022) which explains that green innovation often requires a large initial investment and its benefits to profitability such as ROA may only be felt in the long term. Strategic green innovation can reduce the environmental burden but does not initially have a direct impact on the company's financial performance.

CONCLUSION

This study explores the relationship between company performance and green innovation in the ASEAN energy sector, focusing on Environmental, Social, and Governance (ESG) variables from the Refinitiv Eikon Database. Green innovation data is similarly sourced, alongside three control variables: company size, age, and profitability. The results, analyzed using STATA 17, reveal that within the Social pillar, workforce, human rights, and product responsibility scores have a positive and significant relationship with green innovation, while community scores negatively and significantly impact green innovation. For the Governance pillar, management scores negatively affect green innovation, shareholder scores have a positive and significant influence, and CSR strategy scores show a positive but insignificant relationship.

This research has theoretical and practical implications. Theoretically, it contributes to academic knowledge and serves as a reference for future studies on sustainability. Practically, it offers insights for companies in crafting sustainability and green innovation policies and provides valuable information for investors to guide investment decisions based on a company's green innovation performance.

The study acknowledges two main limitations: the focus on the Southeast Asian energy sector and reliance solely on green innovation as measured by environmental innovation scores from Refinitiv Eikon. These constraints limit the generalizability of the findings.

For future research, it is recommended to include additional sustainability-related variables, extend the study period to assess temporal variations, investigate other industry sectors for comparative analysis, and explore cross-country comparisons to evaluate differences in sustainability performance and green innovation impacts across regions.

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