

# The Effect of Environmental, Social, and Governance (ESG) Disclosure and Intellectual Capital on the Financial Performance of Energy Sector Companies Listed on the Indonesian Stock Exchange (IDX) for the 2022–2024 Period

Nadiyah Kharisma Ataya\*, Henryanto Wijaya

Universitas Tarumanagara, Indonesia

Email: [atheeeya@gmail.com](mailto:atheeeya@gmail.com)\*, [henryanto.skripsi@gmail.com](mailto:henryanto.skripsi@gmail.com)

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**Keywords:**

esg disclosure; intellectual capital; value added intellectual coefficient; return on assets; energy sector.

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**Abstract**

This study aims to obtain empirical evidence on the effect of ESG disclosure and Intellectual Capital on the financial performance of energy sector companies listed on the IDX for 2022–2024. A quantitative causal design was applied to 22 companies selected through purposive sampling, yielding 66 firm-year observations. Financial performance was measured using Return on Assets (ROA), ESG disclosure using the Global Reporting Initiative (GRI) index, and Intellectual Capital using the Value-Added Intellectual Coefficient (VAIC), analyzed through panel data regression with the Fixed Effect Model. Results show ESG disclosure has a negative, insignificant effect on ROA, while Intellectual Capital has a positive and significant effect. The findings indicate ESG disclosure is still treated as a compliance cost, whereas efficient intellectual capital management is a key driver of profitability in the energy sector. The global business paradigm has shifted from a purely profit-oriented focus toward integrating sustainability and intangible value-creation factors into corporate performance assessment. ESG disclosure and Intellectual Capital (IC) have become increasingly relevant non-financial indicators, particularly for energy sector companies that face high environmental and social risk exposure, yet prior studies on their relationship with financial performance remain inconsistent, and evidence specific to the energy sector on the Indonesia Stock Exchange (IDX) in recent periods is still limited.

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## INTRODUCTION

The development of the business world and the global financial market shows a paradigm shift in assessing company performance and value (Ernst & Gleißner, 2022; Luo, 2024; Mer & Viridi, 2023). Companies are no longer only oriented towards achieving profits, but are also required to pay attention to the impact of their operational activities on the environment, society, and organizational governance (Safriani & Utomo, 2020). This orientation encourages companies to carry out business activities more responsibly and sustainably.

In line with these developments, the approach in financial and investment practices has also changed (Ernst & Gleißner, 2022; Luo, 2024; Mer & Viridi, 2023). The assessment that previously focused on financial indicators is now developing by including the sustainability aspect as one of the main considerations in investment decision-making (Larasati & Nafiati, 2025). Investors and stakeholders not only assess the company's performance in terms of profitability, but also from how the company manages long-term risks that are non-financial in nature.

One of the frameworks used to assess the sustainability dimension of a company is Environmental, Social, and Governance (ESG). ESG is a non-financial performance assessment concept that includes environmental, social, and corporate governance aspects (Antonius & Ida, 2023). The ESG framework is used to evaluate the extent to which companies are executing responsible, transparent, and long-term oriented business practices through the disclosure of sustainability information to stakeholders.

Companies that place ESG aspects as a priority in their operations tend to have a positive impact on their business sustainability, while reducing the potential negative impact on the environment and society. The commitment to sustainability practices is a positive signal regarding the quality of the company's risk management in the eyes of the market and investors. This transparency will reduce information asymmetry, which ultimately has the potential to contribute to improving efficiency and company performance (Kim & Pae, 2024).

The energy sector includes various business entities engaged in the provision of commodities and services based on energy resources, both derived from fossil energy such as oil, gas, and coal, as well as renewable energy such as solar, wind, water, and biomass power. This industry has a very strategic position because it plays a role in ensuring the availability of energy supply which is a fundamental need for industrial, transportation, household, and infrastructure development in a country (Palupi & Adi, 2026).

In an effort to maintain a balance between economic, environmental, and social interests in business activities, the government as a regulator through the Financial Services Authority in 2017 stipulated Financial Services Authority Regulation Number 51/POJK.03/2017 concerning the Implementation of Sustainable Finance for Financial Services Institutions, issuers, and public companies. The provision confirms that financial services institutions, issuers, and public companies are required to prepare Sustainability Reports as part of corporate reporting practices. The implementation of sustainability reporting obligations has been implemented gradually since 2019. Through the report, the company is expected to be able to transparently convey business performance as well as the impact resulting from its operational activities to stakeholders (OJK, 2017).

In addition to the sustainability and transparency aspects reflected through ESG disclosures, the company's performance assessment also needs to consider internal factors that are intangible. One of the approaches used to assess such non-physical assets is the concept *intellectual capital*. IC is seen as one of the important indicators in assessing companies that apply the concept *Knowledge-based business*, which is a company that relies on the competence of human resources, skill levels, and the ability to innovate in creating value. Optimal use of intellectual capital is a strategic element in building a sustainable competitive advantage and supporting the company's economic growth and development (Antonius & Ida, 2023). According to Nurhayati, 2017 (in Antonius and Ida 2023), *Intellectual Capital* constitute *Intangible Assets* which has an important role in driving the improvement of the company's performance and profitability. Effective intellectual capital management can increase productivity and operational efficiency, while strengthening the company's competitiveness and innovation capacity, thereby contributing to the achievement of more optimal performance.

Intellectual capital performance (*Intellectual Capital Performance*) describes the company's ability to utilize its intellectual resources through the synergy between physical and human capital. Human capital as part of intellectual capital plays a role in managing knowledge,

expertise, and competence, while physical capital provides supporting means in operational processes. These two elements complement each other in the company's production and value creation activities. The contribution of human capital is significant in generating added value, but it still requires physical capital support so that it can be implemented effectively. Therefore, the measurement of intellectual capital performance cannot be separated from the relationship between the two types of capital (Afiad et al., 2023).

One of the commonly used methods to measure the performance of intellectual capital is the value-added *intellectual coefficient* (VAIC). VAIC is a method introduced by (Pulic, 1998) as a tool to assess the company's intellectual capital performance quantitatively. This model is used to evaluate the extent to which the company is able to create added value through the use of its resources. The VAIC approach is composed of three main components, namely *value added of capital employed* (VACA) which reflects the capital contribution used, *value added human capital* (VAHU) which shows the role of human resources in creating added value, and *Structural capital value added* (STVA) which describes the company's structural capital contribution. The three components are used in an integrated manner to measure the level of effectiveness of intellectual capital management in supporting company performance.

The company's financial performance is an important indicator to assess the effectiveness of management in managing all its resources to generate profits. The assessment of the company's financial performance is carried out through various measures, one of which is using profitability indicators. The profitability ratio is used to assess a company's ability to generate profits from its resources. One of the ratios that is often used in financial performance evaluation is *return on assets* (ROA). ROA shows the level of profit that a company is able to generate from the total assets used in operational activities. This ratio provides an overview of the level of effectiveness of asset utilization in creating profits. The increase in the value of ROA reflects the more efficient and effective the company in managing its assets to generate profits, so that ROA is considered relevant as the main indicator of financial performance in this study.

Although attention to ESG disclosure and intellectual capital management is increasing, the results of previous research on the relationship between Environmental, Social, Governance (ESG) and intellectual capital disclosure to company performance still show inconsistent findings. Research conducted by (Larasati & Nafiati, 2025) in companies with high levels of environmental risk such as the energy sector, *Basic Material*, and *Consumer Non-Cyclical* shows that *Intellectual Capital* have a positive effect on the company's performance, while ESG disclosure does not have a significant impact. The results also suggest that environmental risks can weaken the relationship between *Intellectual Capital* and the company's performance. On the other hand, research by (Antonius & Ida, 2023) found that ESG disclosures and *Intellectual Capital* has an influence on the company's performance, although the degree of significance of each variable component shows variation depending on the model and performance measurement indicators used.

Furthermore, research by (Larasati & Nafiati, 2025) shows that *ESG disclosure and intellectual capital* simultaneously related to the company's performance or value, with an approach to measuring intellectual capital using the VIC method. The differences in research results, variations in sample sectors, and differences in performance measurement indicators show that there are still research gaps. Until now, there are still limited studies that examine the

effects of ESG disclosure and *Intellectual Capital* VAIC based on financial performance measured using *return on assets* (ROA) in energy sector companies on the Indonesia Stock Exchange in the latest observation period. Therefore, this study was conducted to provide more sectoral and methodologically specific empirical evidence.

Based on the background description, several problems relevant to this research can be identified. The development of the global business paradigm shows that the assessment of company performance no longer only focuses on financial aspects, but also includes sustainability aspects through *environmental, social, governance* (ESG) disclosure. However, in practice, the level of ESG disclosure between companies still shows considerable variation, including in energy sector companies that have relatively large environmental and social risks.

The energy sector is a sector with significant environmental and social impacts, so the demand for transparency and sustainability practices is getting stronger. Nonetheless, not all energy sector companies have demonstrated adequate quality and consistency of ESG disclosure. This raises questions about the extent to which ESG disclosures are really related to improving the company's financial performance.

In addition to sustainability factors, the company's performance is also influenced by the ability to manage intangible assets through *intellectual capital*. Effective *intellectual capital* management is believed to be able to create added value and increase the company's competitiveness. However, the measurement and utilization of *intellectual capital* between companies is still uneven, and has not been fully integrated in financial performance analysis.

Previous research examining the influence of ESG and *intellectual capital* on company performance has also shown inconsistent results. Some studies have found a positive effect on performance, while others have shown a weak or insignificant effect. These differences are influenced by variations in research sectors, observation periods, and differences in financial performance measurement indicators used.

In addition, there is still limited research that specifically examines the influence of ESG and *intellectual capital* disclosure on the financial performance of energy sector companies in Indonesia using an asset-based profitability indicator, namely *return on assets* (ROA), in the most recent observation period. Therefore, further research is needed to obtain more specific and comprehensive empirical evidence on the energy sector.

The main focus of this study is to analyze the influence of *environmental, social, governance* (ESG) and *intellectual capital* disclosures on the financial performance of energy sector companies on the Indonesia Stock Exchange with an observation period of three years, from 2022 to 2024. The independent variables in this study were limited to ESG and VAIC disclosures. Meanwhile, financial performance as a dependent variable is only measured through *the return on assets* (ROA) indicator to assess the efficiency of the company's asset utilization. The data used is secondary data sourced from financial *statements* and *sustainability reports*.

The urgency of this research is underscored by the energy sector's significant environmental and social impacts, the increasing demand for transparency and sustainability practices, and the inconsistent findings in prior research. The novelty of this study lies in its examination of both ESG disclosure and Intellectual Capital (measured using VAIC) on financial performance (measured using ROA) specifically in the energy sector during the 2022-2024 period, providing a focused and recent empirical analysis.

Thus, this study formulates the following questions: 1) Is there an effect of *Environmental, Social, and Governance* (ESG) disclosure on the financial performance of energy sector companies listed on the Indonesia Stock Exchange for the 2022-2024 period? 2) Is there an influence of *intellectual capital* on the financial performance of energy sector companies listed on the Indonesia Stock Exchange for the 2022-2024 period?

Based on the formulation of the problem that has been determined, the objectives to be achieved in this study are: 1) To obtain empirical evidence regarding the influence of *environmental, social, and governance* (ESG) disclosures on financial performance in energy sector companies listed on the Indonesia Stock Exchange for the 2022-2024 period. 2) To obtain empirical evidence regarding the influence of *Intellectual Capital* on financial performance in energy sector companies listed on the Indonesia Stock Exchange for the 2022-2024 period.

## **RESEARCH METHOD**

### **Research Design**

This study used a quantitative approach with a causal research design. The quantitative approach aims to test the relationship between variables that can be measured numerically and analyzed using inferential statistical techniques. Causal design is used to analyze the influence of independent variables, namely *environmental, social, and governance* (ESG) and *intellectual capital* (IC) disclosures, on dependent variables in the form of financial performance measured using *return on assets* (ROA).

Based on the research objectives that have been formulated, this research is included in the category of *explanatory research*. Explanatory research aims to explain the cause-and-effect relationship between variables by testing hypotheses that have been prepared based on theoretical foundations and previous research results. In this context, the study seeks to provide an empirical explanation of whether and to what extent ESG and *intellectual capital disclosure* affects the financial performance of energy sector companies on the Indonesia Stock Exchange.

Reviewed from the source and type of data, this study uses secondary data obtained from the annual financial statements and sustainability reports of energy sector companies listed on the Indonesia Stock Exchange for the period 2022–2024. The data is used to measure the level of ESG disclosure, the value of VAIC as an indicator of *intellectual capital measurement*, and ROA as an indicator of financial performance. The selection of the observation period was carried out to capture the latest conditions of sustainable finance implementation after the enactment of sustainability reporting regulations in Indonesia.

This research is non-experimental because the researcher does not intervene or manipulate variables, but only observes and processes data that has been published by the company. The relationship between variables was tested through statistical analysis with regression models, so that the design of this study is expected to be able to provide objective empirical evidence on the influence of ESG and *intellectual capital disclosure* on the financial performance of energy sector companies in Indonesia.

### **Population, Sample Selection Techniques, and Sample Size**

#### **Research Subject**

The subject of this study is an energy sector company listed on the Indonesia Stock Exchange (IDX) that publishes a complete annual report and sustainability report for the 2022–2024 period. Based on the sample selection criteria set, this study uses 22 eligible energy sector

companies during the 2022–2024 period. Thus, the total observation units used in this study are 66 observations. The companies that were the subject of the study were selected because they had published the data required for the measurement of ESG disclosures, *intellectual capital* with VAIC value proxies, and financial performance measured using *return on assets* (ROA) during the observation period.

### **Data Collection Techniques**

This research uses secondary data sourced from official reports that have been published by the company and the Indonesia Stock Exchange. Secondary data was chosen because all research variables, namely ESG disclosure, *intellectual capital* with VAIC value proxy, and financial performance with ROA value proxy, can be measured based on quantitative and qualitative information available in the company's reports. ESG disclosure data is obtained from sustainability reports downloaded through the official *website* of each energy sector company. The level of ESG disclosure is measured using the GRI content index (GRI disclosure index) listed in the company's sustainability report.

Financial statement data is obtained from the official website of the Indonesia Stock Exchange in the form of audited annual financial statements for the 2022–2024 period. This audited financial statement is used to calculate ROA as an indicator of financial performance, as well as to obtain the data needed in the calculation of *intellectual capital* using the VIC method.

## **RESULTS AND DISCUSSION**

### **Description of Research Subject**

The subjects in this study are companies in the energy *sector* and officially listed on the Indonesia Stock Exchange (IDX) during the observation period from 2022 to 2024. The energy sector was chosen as the subject of the research because this industry has operational characteristics that directly intersect with the use of natural resources, so it has high exposure to environmental and social risks. This requires companies to be more transparent in disclosing *environmental, social, and governance* (ESG) and more efficient in managing *intellectual capital* to maintain their financial performance.

The population in this study includes all entities of energy sector companies listed on the IDX. To obtain relevant and representative research subjects, sample withdrawal is carried out using *the purposive sampling* method, which is a sample determination technique with certain considerations or criteria that have been set by the researcher. The sample withdrawal criteria used in this study are as follows:

1. Energy sector companies listed on the Indonesia Stock Exchange (IDX) for the period 2022–2024.
2. Companies that publish annual *reports* and sustainability *reports* in full and accessible to the public during the observation period of 2022 to 2024.
3. Companies that publish ESG disclosures based on the GRI index and have the completeness of financial statement data needed to calculate *value added intellectual coefficient* (VAIC) and financial performance measurement indicators in the form of *return on assets* (ROA) consecutively during the 2022–2024 period.

Of the total initial population of 71 energy sector companies on the IDX, there are 49 companies that were excluded from the study. This exclusion is made because these companies

do not publish Sustainability Reports consistently, do not present ESG disclosures based on GRI guidelines, or do not have the completeness of the data components in the financial statements needed for the measurement of research variables. Through the screening process, the final results were obtained for 22 companies that consistently met all consecutive sample criteria during 2022, 2023, and 2024, resulting in a total of 66 panel observation units.

All observation data used related to the research subject are secondary data. The data is obtained indirectly through official publications provided by the Indonesia Stock Exchange and the official *websites* of each company. In detail, data on the level of ESG disclosure is identified and extracted using the GRI completeness index through sustainability reports. Meanwhile, historical data related to the calculation of *intellectual capital* and financial performance are obtained from the audited annual financial statements for the 2022–2024 period accessed through the official website of [www.idx.co.id](http://www.idx.co.id).

### Description of Research Object

The description of the research object aims to provide an overview or profile of the data characteristics of each variable observed in this study. The objects in this study include financial performance (measured using ROA) as a dependent variable, as well as ESG and *intellectual capital* disclosure (measured using VAIC) as independent variables. The data characteristics of the three variables were described through descriptive statistical testing using STATA 17.0 software. The results of this test will display the number of observations (N), lowest value (*minimum*), highest value (*maximum*), mean value (*mean*), and standard deviation (*standard deviation*) from 66 observation data of energy sector companies during the 2022–2024 period. The following is a summary of the results of the descriptive statistical test for all research variables:

**Table 1 Descriptive Statistical Test Results**

Variable	Obs	Mean	Std. dev.	Min	Max
KODE	0	-	-	-	-
TAHUN	66	2023	0.8227534	2022	2024
E	66	21.9697	6.856709	8	31
S	66	24.28788	9.053287	4	36
G	66	27.12121	5.728512	11	30
ESG	66	73.37879	19.79337	26	97
ROA	66	0.124425	0.1167497	0.0018573	0.4029965
ESGScore	66	0.7605436	0.194908	0.3608247	1
VAIC	66	7.816353	6.348712	1.791028	24.7531
VACA	66	0.4324892	0.5089852	0.0256239	3.706086
VAHU	66	7.151925	7.952793	0.7977538	48.31728
STVA	66	0.6705842	0.287825	-0.2535195	0.9793035
id	66	11.5	6.392905	1	22
est fe	66	1	0	1	1
est re	66	1	0	1	1
res	66	-8.82e-12	0.0514089	-0.1548395	0.1310003

(Source: Secondary data processed with STATA 17.0, 2026)

Based on Table 1 above, the description of the characteristics of each variable of the research object is as follows:

## Financial Performance

Financial performance proxied by the *return on assets* (ROA) ratio is a crucial indicator to measure the effectiveness and efficiency of the company's management in utilizing all its assets to generate net profit. In energy sector companies that have capital-intensive characteristics, this rate of return on assets is a fundamental benchmark for operational continuity and investment attractiveness.

Based on the results of descriptive statistical testing of 66 observations, the ROA variable has a minimum value of 0.0019 (0.19%) and a maximum value of 0.4030 (40.30%). This positive minimum value indicates that all sample companies did not record severe net losses, all sample companies were at least able to survive and score profitability even with thin margins. On the other hand, the maximum value of 40.30% highlights the existence of energy companies that are able to book a high level of profitability. This is very natural considering that the observation period (2022–2024) coincides with the momentum of fluctuations and a surge in global energy commodity prices post-pandemic, which provides *windfall profits* for some companies.

In aggregate, the average ROA value of the sample company was at the level of 0.1244 (12.44%). This average achievement is classified as very healthy and solid for the size of heavy industry, which means that the average energy sector company in Indonesia is able to generate a net profit of IDR 12.44 from every IDR 100.00 total assets under management. Meanwhile, the standard deviation level (standard deviation) was recorded at 0.1167. Because the standard deviation value is smaller than the average value ( $0.1167 < 0.1244$ ), it can be concluded that the distribution of company profitability data is stable, well distributed around the average value, and does not have a biased deviation.

## 2. Environmental, Social, and Governance (ESG) Disclosure

ESG disclosure is a manifestation of the level of transparency and accountability of companies in communicating their sustainability practices to *stakeholders*. For energy sector companies, this disclosure has a very high urgency considering the operational characteristics of this industry which are directly intersecting with the exploitation of natural resources, carbon emissions, and social friction with the community around the operating area.

Based on the results of statistical testing, the total ESG disclosure variable measured using the ESG Score showed a *mean* value of 0.7605 or 76.05%. This figure indicates that in aggregate, the compliance and proactivity of energy sector issuers in Indonesia in presenting sustainability reports is very good. This high average is in line with the theory of legitimacy and the company's response to the Financial Services Authority Regulation (POJK No. 51/POJK.03/2017) which requires sustainability reporting. A minimum value of 0.3608 indicates that there are still issuers with very minimal disclosure (*laggards*), while a maximum value of 1.0000 (or 100%) proves that there are leading energy companies that have implemented full disclosure and are fully compliant with all *required Global Reporting Initiative* (GRI) indicator items.

If dissected deeper into its three forming pillars, the disclosure characteristics of an energy company can be elaborated as follows:

- a. Environmental Pillar: This component measures the extent of a company's transparency regarding environmental impact management, such as energy efficiency, waste management, and emission reduction. Of the 66 observations, the environmental disclosure

item had a score range between 8 to 31, with an average of 21.97. The standard deviation rate of 6.85 (smaller than the average) indicates that the majority of energy companies have a relatively uniform and standardized level of awareness in reporting environmental conservation issues, which is a major highlight (*materiality*) for this extractive sector.

- b. **Social Pillar:** The social component highlights aspects of employment, occupational safety and health (K3), human rights, and local community empowerment (CSR). The value of social disclosure recorded the most extreme range compared to the other pillars, namely with a minimum value of 4 and a maximum of 36. Although the average value is quite high (24.29), the standard deviation is the largest among all components, at 9.05. The high variation and distribution of this data hints at massive inequality between energy companies. Some companies are very comprehensive in reporting their social and CSR programs, while others still consider social reporting to be a mere formality.
- c. **Pillars of Governance:** The governance component reflects the transparency of the board structure, business ethics, anti-corruption, and legal compliance. Interestingly, this pillar recorded the highest average score (27.12) as well as the lowest standard deviation (5.73) compared to the environmental and social pillars. The score range also tends to be tight, which is between 11 and 30. Empirically, this proves that governance practices and reporting in the energy sector are very *mature* and evenly distributed in almost all sample companies. This condition is driven by the strict regulations on the listing on the Indonesia Stock Exchange and legal instruments related to corporate governance that have been *binding* for a long time, long before the popular sustainability issue was echoed.

### ***Intellectual Capital***

*Intellectual capital* (IC) measured using *the value-added intellectual coefficient* (VAIC) method represents how efficient the company is in managing resources in the form of physical capital and intangible assets such as knowledge, employee expertise, and organizational systems to create economic added value. Based on the results of descriptive statistical testing from 66 observations, the total variable of VAIC has a minimum value of 1.7910 and a maximum value of 24.7531. This very large range results in an average value of 7.8164 with a standard deviation of 6.3487. The high standard deviation rate confirms that there is a very massive disparity in ability between energy companies in Indonesia in optimizing the potential of their intellectual resources.

To understand the anatomy of added value creation more comprehensively, the efficiency of *intellectual capital* can be dissected into three main components of its support, namely:

- a. **Value Added Capital Employed (VACA):**

VACA measures the amount of added value that can be generated from each unit of fund invested in physical and financial capital. In the highly capital-intensive energy sector, the management of physical assets (such as refineries, heavy equipment, and concession land) is the main operational foundation. From the test results, the VACA value has an average of 0.4325, with a value range between 0.0256 to 3.7061. The relatively small average figure is very logical for the energy sector, given that the depreciation and maintenance burden of a giant physical asset takes up a very large portion of the cost, so the efficiency of the pure added value of its physical capital looks depressed.

- b. *Value Added Human Capital (VAHU)*:  
VAHU measures the contribution of compensation (salaries and benefits) of labor to the creation of added value. Interestingly, this pillar recorded the highest average value, which was 7.1519, with a very fantastic maximum value touching 48.3173. This proves that even though the energy sector is driven by heavy equipment, the main driver of his company's added value comes from *human capital*. The sector employs experts with very high specific specifications (such as petroleum engineers, geologists, and K3 experts). The high compensation given to these experts has proven to be worth it and is able to generate an exponential increase in economic added value for the company.
- c. *Structural Capital Value Added (STVA)*:  
STVA represents the portion of added value generated by structural capital such as database systems, patents, organizational culture, and managerial routines after deducting the burden of human capital. The STVA value recorded an average of 0.6706 with a standard deviation of 0.2878. The minimum value on this pillar shows a negative number, which is -0.2535. This negative value occurs when the human capital burden turns out to be greater than the total added value that the company has managed to create. This phenomenon indicates that in some sample energy companies, their systems and organizational structures are still inefficient, or the company is facing a condition where high salary and operational expenses are not balanced by adequate income generation due to fluctuations in commodity prices.

### Results of the Data Analysis Assumption Test

Testing of classical assumptions in panel data regression is carried out to ensure that the estimation model used meets the rules. Based on previous tests, this study determined FEM as the most appropriate estimation model. Given that the FEM model uses the *Ordinary Least Square* (OLS) approach, a series of classical assumption tests are still needed to detect potential statistical deviations that can cause bias in the estimation results.

The series of classical assumption testing in this study includes normality tests, multicollinearity tests, heteroscedasticity tests, and autocorrelation tests, as follows:

#### Normality Test

The normality test aims to test whether the residual values in the regression model have a normal distribution. A good regression model is a model that has a normally distributed residual value, so that the results of hypothesis testing (t-test and F-test) are valid. This test was carried out using the Skewness and Kurtosis test for normality (sktest) method through the STATA 17.0 software. The basis for decision-making is carried out by looking at the probability value (Prob > chi2); If the probability value is greater than 0.05, then the data is declared to be normally distributed.

**Table 2 Results of the Normality Test (*Skewness and Kurtosis Test*)**

Variable	Obs	Pr(skewness)	Pr(kurtosis)	Adj chi2(2)	Prob>chi2
res2	66	0.3502	0.0810	4.08	0.1297

(Source: Secondary data processed with STATA 17.0, 2026)

Based on Table 2, the results of the distribution dimension decomposition show that the value of the probability of Skewness is 0.3502 (> 0.05) and the probability of Kurtosis is 0.0810

(> 0.05). This indicates that the residual distribution of this model has a proportional proportion of the symmetry of the curve and a proportional rate of peak collapse.

Simultaneously, the overall probability value (Prob>chi2) recorded a figure of 0.1297. Since the probability value is much greater than the alpha significance level of 0.05, the statistical decision is to accept H0.

Thus, it can be empirically concluded that the residual values of the regression model have been distributed normally.

**Multicollinearity Test**

The multicollinearity test aims to detect whether or not there is a high correlation between independent variables in the regression model. The detection of symptoms of multicollinearity in this study was carried out by looking at the value of the *Variance Inflation Factor* (VIF). The test criterion is that if the tolerance value is more than 0.10 and the VIF value is less than 10 (VIF < 10), then it is stated that there is no problem of multicollinearity between independent variables.

**Table 3 Results of the Multicollinearity Test (*Variance Inflation Factor*)**

Variable	VIF	1/VIF
ESGScore	1.01	0.985715
VAIC	1.01	0.985715
Mean VIF	1.01	—

(Source: Secondary data processed with STATA 17.0, 2026)

Based on Table 3 above, it can be seen that the ESG Disclosure (ESGScore) and Intellectual Capital (VAIC) variables each have a very low VIF value, which is 1.01. This value is far below the maximum required threshold (1.01 < 10). In line with this, the Tolerance value for both variables shows a figure of 0.9857, which is far above the minimum limit (0.9857 > 0.10).

Theoretically and empirically, these results prove that there is no symptom of multicollinearity between independent variables in this study model. This makes perfect sense given that ESG and VAIC Disclosures essentially measure two entirely different dimensions of governance. ESG disclosures represent a company's transparency reporting strategy and sustainability responsibilities to external parties, while VAIC measures a company's internal efficiency metrics in utilizing physical capital and human resources. Because there is no overlap of information between the two variables, the ability of each variable to predict Financial Performance is pure and unbiased.

**Heteroscedasticity Test**

The heteroscedasticity test is part of the classical assumption test which aims to detect whether there is an unequal variance of the residual values between observations in the regression model. One of the main prerequisites for the regression model to meet the *Best Linear Unbiased Estimator* (BLUE) rule is the fulfillment of the assumption of homoskedasticity, which is a condition in which the residual variance is constant or equal for all observations. If this assumption is violated, the resulting regression coefficient parameter is no longer efficient (although it remains unbiased), so that the standard error estimate becomes distorted and has the potential to mislead the significance test results.

**Table 4 Heteroscedasticity Test Results**

Statistic	Nilai
Chi-square ( $\chi^2$ ) (22)	217748.83
Prob > $\chi^2$	0.0000

(Source: Secondary data processed with STATA 17.0, 2026)

Based on Table 4 above, the results of the *Modified Wald Test* produce a probability value (Prob >) of 0.0000. Given that the probability value is empirically much smaller than the set significance level of  $\alpha = 0.05$  ( $0.0000 < 0.05$ ), the statistical decision is to reject H0 and accept H1. This is statistical evidence that the estimation model in this study has a heteroscedasticity problem.  $X^2 > \chi^2_{\alpha}$

The occurrence of this variance inequality is a very logical phenomenon and can be fundamentally justified in the data of the energy industry panel. The energy sector in Indonesia has a very asymmetrical market structure, covering a wide spectrum of corporations ranging from state-owned enterprises and giant multinationals with market capitalization and total assets of hundreds of trillions, to medium-scale issuers. This fundamental scale disparity directly triggers a very drastic range of profitability volatility, forcing the remaining variance in the model to be non-uniform across cross-sections.

## Data Analysis Results

### Panel Data Estimation Model Selection Test

This study uses panel data regression which is a combination of *cross-section* data (22 companies) and *time-series* (3 years of observation). To obtain the most appropriate regression model in estimating the influence of ESG and *intellectual capital* (VAIC) disclosure on financial performance (ROA), three stages of testing were carried out, namely the Chow Test, the Hausman Test, and the *Lagrange Multiplier* (LM) Test.

The following is a description of the results of each model selection test that has been processed using the STATA 17.0 application:

#### Chow Test

The Chow test was conducted to determine a more precise model between the *Common Effect Model* (CEM) and the *Fixed Effect Model* (FEM). The basis for the decision is that if the probability value of *Cross-section F* is less than 0.05, then the FEM model is chosen. Conversely, if it is greater than 0.05, then CEM is chosen.

**Table 5 Chow Test Results**

Statistics	Value
Model	Fixed-effects (Within) Regression
Number of observations	66
Number of groups	22
Group variables	id
R-squared (Within)	0.5644
R-squared (Between)	0.6502
R-squared (Overall)	0.5940
corr(u <sub>i</sub> , X <sub>b</sub> )	0.4147
F(2,42)	27.21
Prob > F	0.0000

Statistics	Value
Minimum	3
Average	3.0
Maximum	3
Testing	Value
F test that all $u_i = 0$	F(21, 42) = 8.07
Prob > F	0.0000

(Source: Secondary data processed with STATA 17.0, 2026)

Based on Table 5 the results of the Chow Test show that the probability value of the F test (Prob > F) is 0.0000. Given that the probability value is much smaller than the alpha significance level of 0.05 ( $0.0000 < 0.05$ ), the null hypothesis ( $H_0$ ) is conclusively rejected and the alternative hypothesis ( $H_1$ ) is accepted.

Statistically and empirically, this rejection of  $H_0$  proves that the Fixed Effect Model (FEM) is much more appropriate to use than the Common Effect Model (CEM). The selection of this FEM model is very rational and in line with the real conditions of the research object. The use of the FEM approach accommodates the fact that the 22 sample companies in the energy sector have heterogeneity or individual characteristics that are very diverse from each other and are time-invariant. These differences in individual characteristics can take the form of differences in business scale, sub-sector specialization (coal, oil, gas, or geothermal), the geographical location of the mining operational area, to the culture and quality of management governance of each company. Given that these differentiating factors have a specific influence on the company's ability to produce Financial Performance, the merging of all company data into one equal model (CEM) will result in biased estimates. Therefore, the FEM approach that provides different intercept values for each corporate entity is the most valid and representative estimation method.

### Hausman Test

Since the FEM model was selected in the Chow Test, the next stage was to conduct the Hausman Test to compare which model was more appropriate between *the Fixed Effect Model* (FEM) and *the Random Effect Model* (REM). The basis for making the decision is that if the probability value of *the Cross-section random* is less than 0.05, then the FEM is chosen. If it is greater than 0.05, then REM is selected.

**Table 6 Hausman Test Results**

Hausman Test Results				
Variable	Fixed (b)	Random (B)	Difference (b - B)	Std. Error
ESGScore	-0.0886856	-0.0379439	-0.0507417	0.054819
VAIC	0.0092793	0.0111377	-0.0018584	0.0006865

### Hausman Test Summary

Statistics	Value
Null Hypothesis ( $H_0$ )	Unsystematic coefficient difference
Chi-square ( $\chi^2$ )	10.10
Degrees of Freedom (df)	2
Prob > $\chi^2$	0.0064

### Information

Symbol	Meaning
<b>b</b>	Estimated coefficients from the Fixed Effects Model (FEM)

<b>B</b>	Estimated coefficients from the Random Effects Model (REM)
<b>b – B</b>	Difference in coefficients between FEM and REM
<b>Std. Error</b>	Standard error of the difference in coefficients

(Source: Secondary data processed with STATA 17.0, 2026)

Based on Table 4.5, the results of the Hausman Test show that the probability value (Prob > chi2) is 0.0064. Since the probability value is smaller than the alpha significance level of 0.05 (0.0064 < 0.05), the decision is to reject H0 and accept H1. Therefore, it can be conclusively concluded that the Fixed Effect Model (FEM) is a more appropriate estimation model to use compared to REM.

Theoretically, the rejection of the REM model and the selection of FEM are very justifiable. The REM model demands very strict assumptions, namely that a company's unique characteristics such as managerial qualities, organizational culture, and political relations should not have a correlation with ESG or *Intellectual Capital* (VAIC) disclosures. In the industry reality of the energy sector, such assumptions are almost impossible to meet because the unique characteristics (quality of management) of a company inevitably influence their decisions in drafting ESG strategies and managing its intellectual assets. Therefore, the use of the FEM approach that allows the existence of correlation is the most rational, objective, and free from the threat of estimation bias. Since FEM has been proven to be statistically superior to the other two alternative models, the LM Test is no longer necessary.

### Hypothesis Testing

After the model is declared to meet all the criteria of the classical assumption test, the next stage is to test the hypothesis to prove the direction and magnitude of the influence of independent variables on the dependent variables. Based on the model selection hierarchy test, the most statistically appropriate and valid approach to be used in this study is FEM. Furthermore, in order to mitigate heteroscedasticity anomalies in the data panel, the model estimation was executed by applying the Cluster-Robust Standard Errors method.

### Panel Data Regression Equation

Based on the results of data processing using STATA 17.0 software, the following multiple linear regression equations were obtained:

$$ROA_{it} = 0,1193 - 0,0887ESG_{it} + 0,0093VAIC_{it} + \varepsilon_{it}$$

The regression equation can be interpreted as follows:

- Constant Value ( ) of 0.1193: Indicates that if the ESG and Intellectual Capital Disclosure (VAIC) variable is constant or equal to 0 (zero), then the average Financial Performance level of an energy sector company is 0.1193 (or 11.93%). $\alpha$
- ESG Disclosure regression coefficient of -0.0887: Indicates that any increase in the ESG Disclosure rate of 1 unit will result in a decrease in Financial Performance by 0.0887 units, assuming other independent variables are of fixed value (ceteris paribus).
- Intellectual Capital regression coefficient (VAIC) of 0.0093: Indicates that any increase in Intellectual Capital efficiency by 1 unit will have an impact on an increase in Financial Performance by 0.0093 units, assuming other independent variables are of fixed value (ceteris paribus).

Each stage of hypothesis testing is as follows:

**Coefficient of Determination Test (R-Squared)**

The determination coefficient test was carried out to measure how far the regression model is able to explain the variation in fluctuations of dependent variables. Given that this study uses FEM, the most relevant indicator to interpret is the R-squared Within value, as this metric focuses on the ability of independent variables to explain performance variations within individual corporate entities over time.

Based on the regression results, the R-squared Within value was obtained of 0.5644. This shows that 56.44% of the variation in the financial performance of energy sector companies can be explained together by the ESG and Intellectual Capital (VAIC) Disclosure variables. Meanwhile, the remaining 43.56% is explained by other fundamental factors that are beyond the scope of this research model.

**Simultaneous Significance Test (Wald Test / F Test)**

The model feasibility test (F test) aims to test whether all independent variables that are included in the model simultaneously have an influence on the dependent variables, as well as determine whether the goodness of fit model is to predict the phenomenon.

Based on the results of the robust regression, an F-statistical value of 8.06 was obtained with a probability value (Prob > F) of 0.0025. Given that the probability value is well below the significance level of 0.05 ( $0.0025 < 0.05$ ), it can be concluded that ESG and Intellectual Capital Disclosures together have a significant effect on Financial Performance. These results definitively confirm that this regression model is declared feasible for use.

**Partial Test (t-test)**

The t-statistical test is used to test the significance of the influence of each independent variable partially in explaining the variation of the dependent variable. The significance level used is  $= 0.05$ . If the probability (p-value)  $< 0.05$ , then an alternative hypothesis is accepted.  $\alpha$

**Table 7 Partial Hypothesis Test Results (t-test)**

Variable	Coefficients	t-Statistic	Probability	Verdict
ESG disclosures	-0,0886	-1,05	0,307	H1 Rejected
Intellectual Capital	0,0092	3,88	0,001	H2 Accepted

(Source: Secondary data processed with STATA 17.0, 2026)

Based on the explanation of Table 4.9 above, the elaboration of hypothesis proof is as follows:

**First Hypothesis Testing (H1): The Effect of ESG Disclosure on ROA**

The results of the partial test for the ESG Disclosure variable showed a negative regression coefficient value of -0.0886 with a probability level of 0.307. Given that the probability value is greater than the significance level of 0.05 ( $0.307 > 0.05$ ), the First Hypothesis (H1) is rejected. This means that ESG disclosure has not been empirically tested to have a significant effect on the Financial Performance of energy sector companies.

The implications of these findings indicate that sustainability (ESG) implementation and reporting in the energy sector is still being responded to by markets and internal financial

structures as a short-term burden of operating costs and compliance that erodes profitability, rather than as a profit-driving asset.

### **Second Hypothesis Testing (H2): The Influence of *Intellectual Capital* on ROA**

The results of the partial test for the Intellectual Capital variable (VAIC) showed a positive regression coefficient value of 0.0092 with a probability level of 0.001. Since the probability value is convincingly smaller than 0.05 ( $0.001 < 0.05$ ) and has a positive coefficient direction, the Second Hypothesis (H2) is accepted. This means that Intellectual Capital has been empirically tested to have a positive and significant effect on Financial Performance.

The implications of this finding are in line with RBV theory. Energy companies that are able to utilize their human resource capabilities, manage their physical assets efficiently, and have excellent structural capital will gain a competitive advantage that directly boosts the company's value creation and profitability.

Based on the results of statistical testing that have been described in the previous subchapter, this section will discuss in depth the interpretation and suitability of the results with previous theories and research.

### **The Effect of *Environmental, Social, and Governance (ESG) Disclosure* on Financial Performance**

Based on the results of partial hypothesis testing (t-test), the regression coefficient value for the ESG Disclosure variable was -0.0886 with a probability value of 0.307. Because the probability value is greater than the significance level of 0.05, the first hypothesis (H1) that ESG Disclosure has a positive effect on Financial Performance is rejected. These results empirically confirm that the extensiveness of ESG disclosure has not been proven to be a determinant that can have a significant impact on increasing the profitability of companies in the energy sector in Indonesia.

The inability of ESG disclosure to significantly predict the performance of an issuer's current profit can be justified in depth through the integration of theory and reality of real accounting mechanics. Viewed through the lens of *Signaling Theory*, the disclosure of non-financial information ideally serves as a positive signaling instrument from management to suppress information asymmetry and build a reputation in the eyes of the market. However, in the context of emerging capital markets, especially in the extractive commodity industry, the effectiveness of ESG as a signaling mechanism has been weakened due to *noise dilution*. The structure of investors in the energy sector in Indonesia is still mostly pragmatic and short-term oriented. Market participants respond much more aggressively to direct macro fundamental signals such as fluctuations in world coal and crude oil prices, daily production capacity volumes, and certainty of dividend distribution compared to abstract environmental and social sustainability signals. As a result, ESG disclosure signals fail to be appreciated by the market into real economic premiums that can boost corporate financial income instantly.

The failure to convert this transparency value is also in line with the RBV Theory, which emphasizes that the internal resources of corporations are only able to create a competitive advantage that leads to profits above the industry average if they meet the VRIN criteria. The empirical fact that ESG disclosures are not yet managed as a core capability that is unique, strategically valuable, or difficult to replicate by competitors. The market evaluates that these environmental and social programs are purely carried out as a form of generic resources in order

to abort regulatory compliance obligations with the Financial Services Authority Regulation (POJK No. 51/POJK.03/2017) to maintain the social legitimacy of the operation alone.

In accounting technicalities, this phenomenon of non-significant negative direction is caused by the incompatibility of the time horizon. Issuers' investments to implement substantive ESG practices such as infrastructure decarbonization, post-mining area reclamation, and green technology transition require a very massive injection of capital expenditure at the outset. The addition of this sustainability infrastructure component directly increases the total value of assets, while the recognition of compliance cost burdens directly erodes current net profit. The economic benefits of green financing are long-term and asymptotic, while the operating costs must be recognized in *real-time* in the current year's financial statements, thus distorting the profitability efficiency of the company's short-term assets.

The findings of this study empirically reinforce and are consistent with the results of a previous study conducted by Larasati & Nafiati (2025) which stated that untested sustainability reporting disclosure has a significant influence on corporate profitability in industries with high environmental risks. However, the results of this study reject or are not in line with the findings of Palupi & Adi (2026), Antonius & Ida (2023), and Chen & Xie (2022) who in their observations found the positive strengthening effect of environmental governance variables on the company's financial performance.

### **The Influence of Intellectual Capital on Financial Performance**

Based on the results of partial hypothesis testing (t-test), the value of the regression coefficient for the Intellectual Capital variable was obtained with a positive value of 0.0092 with a probability of 0.001. Given that the probability value is convincingly much smaller than the alpha significance level of 0.05 and has a positive coefficient direction, the Second Hypothesis (H2) which states that *Intellectual Capital* has a positive effect on Financial Performance is accepted. These findings provide a solid empirical justification that the company's capabilities in managing and utilizing *intangible assets* are an essential determinant in accelerating profitability in the energy sector in Indonesia.

Theoretically, the significance of the influence of *Intellectual Capital* on the creation of financial value is an absolute manifestation of the RBV paradigm. From the perspective of RBV theory, the energy industry is actually a very capital-intensive sector, where the control of massive physical assets such as mining infrastructure, refineries, and heavy equipment is only able to provide competitive parity or competitiveness at the standard level. To disrupt the market and achieve a sustainable competitive advantage, companies absolutely need strategic resources that meet the VRIN criteria.

In accordance with the results of the descriptive statistical description of the components that form the VAIC coefficient, the human capital pillar (Value Added Human Capital / VAHU) recorded the highest average value contribution for sample issuers. This proves that the expenditure of compensation expenses in the form of salaries, allowances, and training programs allocated to high-level special specification experts is not an element of the cost burden of conventional profit deductions. These expenditures have been proven to work as a form of productive intellectual asset investment that triggers exponential growth in economic added value. The synergy between adaptive human competence, mastery of exploration technology databases, organizational culture, and a qualified managerial structure successfully

mitigates the risk of operational failure and creates radical efficiencies in the production cost structure, ultimately directly escalating the acquisition of ROA.

Externally, this phenomenon of financial strengthening is fully supported by the mechanism of Signaling Theory. In a capital market ecosystem that is dense with information asymmetry, the level of efficiency of *intellectual capital* management as reflected in the VAIC score acts as a strategic signal instrument in the form of very credible good news sent by management to external parties. In contrast to the qualitative narrative disclosure signals of sustainability that the market is prone to suspect as an imaging practice, VAIC quantitative metrics present real evidence of managerial intellectual agility in extracting profits from each unit of working capital invested. In the midst of the energy industry's high vulnerability to the dynamics of global macro commodity price volatility, this signal of intellectual efficiency is captured by institutional investors and creditors as the main guarantee of the company's fundamental resilience. This market confidence effectively reduces agency costs, minimizes the risk of uncertainty, and brings appreciation in the form of easy access to external funding at a much cheaper and more efficient level of capital costs, thereby thickening the company's net profit margin.

Thus, the results of this study provide a solid empirical affirmation of the constellation of previous literature represented by Antonius & Ida (2023) and Larasati & Nafiati (2025), which coherently conclude that high-efficacy intellectual capital management is the main epicenter driving financial performance optimization in natural resource-based corporations.

## CONCLUSION

Based on data collection, statistical analysis, and hypothesis testing on how ESG and Intellectual Capital disclosures affect the financial performance of energy companies listed on the Indonesia Stock Exchange from 2022–2024, the study concludes that ESG disclosure does not have a significant effect on financial performance, mainly because of three reasons: first, sustainability efforts like energy transition and decarbonization create a mismatch in time horizons, since green spending lowers profits now while the benefits only appear later; second, from the Resource-Based View (RBV), most energy companies treat ESG as a regulatory obligation rather than a core business capability, mainly to satisfy stakeholders and maintain legitimacy; and third, based on Signaling Theory, investors in the commodity sector tend to be pragmatic and respond more strongly to macro factors like global energy prices and production volumes than to sustainability reports, meaning ESG spending currently functions more as a compliance cost than as a value-creating investment. In contrast, Intellectual Capital is shown to have a positive and significant effect on financial performance (ROA), confirming that a company's ability to manage intangible assets Human Capital, Structural Capital, and Capital Employed is a key driver of performance in the energy sector. This supports the RBV view that in a capital-intensive industry, physical assets alone only create competitive parity, while real and lasting advantage comes from these intangible, knowledge-based capabilities, which help companies innovate and run more efficiently amid the energy transition. This also aligns with Signaling Theory, since strong intellectual capital performance (shown through a high VAIC score) signals managerial competence to investors, reduces information asymmetry, builds market confidence, and makes it easier for companies to access financing at lower costs. Overall, the combination of strong internal intellectual capital management and effective

external signaling to investors is the main factor driving higher profitability among energy companies.

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