

Can ESG Performance Reduce Financial Distress? The Mediating Role of Firm Age in Indonesian Energy Companies

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Abstract

The study aims to analyze the effect of Environmental, Social, and Governance (ESG) performance in financial distress and to examine the role of firm age as a mediating variable among energy sector companies listed on the Indonesia Stock Exchange (IDX). The study employs a quantitative approach using secondary data obtained from companies' annual reports and sustainability reports. The research sample consists of 51 companies with 102 observations. Data analysis was conducted using Structural Equation Modeling-Partial Least Squares (SEM-PLS) through structural model testing and path analysis. The results show that ESG performance has a path coefficient of 0,165 for Firm Age, indicating a positive relationship; however, this relationship does not show a significant effect. The findings indicate that ESG performance during the observation period does not directly determine firm age, as firm age is a historical characteristic that has been established since the company's inception. Furthermore, Firm Age has a coefficient of -0,071 with respect to Financial Distress, indicating a negative relationship; thus, an increase in firm age tends to be associated with a decrease in the level of financial distress, although the strength of this relationship is relatively weak. ESG performance also shows a coefficient of 0,263 with respect to Financial Distress as a direct effect. Meanwhile, the indirect effect of ESG performance on Financial Distress through Firm Age is -0,012, derived from the product of the path coefficients $0,165 \times -0,071$. The research findings imply that a company's historical characteristics must be considered when understanding the relationship between ESG performance and financial distress in Indonesian energy companies.

Keywords: ESG Performance, Financial Distress, Firm Age, Energy Sector, Indonesia.

1. Introduction

Corporate financial stability has become increasingly difficult to maintain as firms face simultaneous economic, environmental, and social pressures. This challenge is particularly evident in the energy industry, where business activities are closely associated with environmental impacts, substantial capital requirements, commodity-price fluctuations, regulatory intervention, and the global transition toward sustainable energy. These conditions create a distinctive financial-risk environment in which conventional financial indicators may not fully capture the factors that determine whether a company can withstand financial pressure. Consequently, increasing attention has been directed toward non-financial characteristics, particularly Environmental, Social, and Governance (ESG) performance. As potential determinants of corporate financial resilience.

Financial distress is an important manifestation of declining corporate resilience. It occurs when a firm's financial capacity becomes insufficient to sustain its obligations and normal business activities and may precede more serious financial failure. For managers, investors, creditors, and regulators, understanding the factors associated with financial distress is therefore essential. Traditional financial distress models generally emphasize accounting-based indicators such as profitability, liquidity, leverage, and cash flow. However, companies increasingly operate in an environment in which environmental liabilities, stakeholder expectations, governance quality, reputational, exposure, and social responsibility can also influence corporate risk. Consequently, ESG performance may provide complementary information for understanding financial vulnerability.

The importance of ESG has increased substantially because sustainability considerations are increasingly incorporated into decision-making and investment evaluation. ESG performance represents the extent to which a company manages environmental impacts, social responsibilities, and governance mechanisms. Strong performance in these dimensions may generate several organizational benefits. Environmental initiatives can reduce exposure to environmental liabilities and regulatory penalties, social practices can strengthen relationship with employees, communities, customers, and suppliers; while effective governance can improve monitoring, accountability, and managerial decision-making. These mechanisms potentially strengthen the firm's ability to manage unexpected shocks and maintain financial stability. The relationship between ESG performance and financial distress can be explained through Stakeholder Theory. (Freeman, 1984) stakeholder perspective emphasizes that organizational success depends not only on shareholders but also on relationships with parties that affect or are affected by corporate activities. ESG practices provide a mechanism through which firms respond to stakeholder expectations. When stakeholders perceive a company as responsible and transparent, the firm may obtain stronger legitimacy, trust, cooperation, and access to critical resources. Such stakeholders support can become particularly valuable when a company experiences financial pressure. Thus, superior ESG performance may contribute to financial resilience by strengthening the firm's relationship with its broader stakeholder environment.

The proposed relationship can also be supported by Signaling Theory. Corporate managers possess considerably more information about internal capabilities, risk management, and future prospects than external investors and creditors. ESG information can reduce this information asymmetry by communicating observable signals concerning managerial quality, organizational responsibility, and long-term strategic orientation. Sustainability disclosure may therefore influence how external stakeholders assess corporate risk. Previous research has demonstrated that sustainability-related information can operate as a signal through which firms communicate otherwise difficult-to-observe organizational characteristic (López-Santamaría et al., 2021). Accordingly, higher ESG performance may be interpreted as evidence of stronger management quality and potentially lower financial vulnerability. Nevertheless, the proposition that ESG performance automatically reduces financial distress remains empirically unsettled. Evidence from the international literature suggests that ESG information can contribute to financial-risk assessment. (Harymawan et al., 2021), for example, demonstrate that ESG-report information contains predictive information concerning financial distress among energy enterprises. Their study shows that textual characteristics of ESG reports, together with other corporate information, can improve the prediction of financial distress. This evidence is important because it establishes the relevance of ESG information in an industry that is particularly exposed to sustainability-related risk.

The Indonesian context, however, presents a more complex picture. (Liwa et al., 2024) found that financially distressed Indonesian firms tend to have lower-quality ESG disclosure than non-distressed firms. Their findings suggest that financial pressure can constrain a firm's ability to provide high-quality sustainability information because ESG reporting and related practices require organizational and financial resources. This finding introduces an important possibility: the relationship between ESG and financial distress may not necessarily be a simple one-directional relationship in which ESG performance produces better financial conditions. Financial conditions themselves may influence the extent and quality of ESG activities. Further evidence also demonstrates that the relationship remains context dependent. Research on Indonesian companies has examined ESG disclosure in relation to financial distress risk while incorporating industry sensitivity as a moderating condition. (Lhantiraa & Dewi, 2024) other Indonesian research specifically examines ESG disclosure, firm life cycle, and financial distress among energy companies listed on Indonesia Stock Exchange (IDX), demonstrating that the energy sector has already become an important setting for investigating the relationship between sustainability and financial vulnerability. (Lhantiraa & Dewi, 2024) these studies confirm the relevance of the topic while simultaneously indicating that additional organizational mechanisms remain worthy of investigation.

This issue is particularly important because the energy industry cannot be treated as an ordinary industry when evaluating ESG-related financial risk. Energy companies face direct exposure to environmental regulation and climate-related expectations while also requiring substantial investment in assets and infrastructure. Changes in energy processes, technological transformation, carbon-related policies, and investor expectations can simultaneously affect their operating and financial conditions. Consequently, ESG performance may have different financial implications

for energy firms than for companies operating in less environmentally sensitive industries. Although previous studies have examined ESG performance or ESG disclosure in relation to financial distress, an important gap remains concerning the organizational mechanism that may explain this relationship. Existing studies have commonly examined ESG as a direct explanatory variable or have introduced external conditions such as industry sensitivity. Other research has incorporated firm characteristics such as leverage, ownership, size, or life-cycle stage. The present study takes a different perspective by examining firm age as a proposed mediating variable.

Firm age is potentially relevant because organizational longevity can represent accumulated experience, organizational knowledge, established stakeholder relationship, reputation, and familiarity with changing market conditions. Companies that have operated for a longer period may have experienced multiple economic cycles and consequently developed routines for responding to financial and operational shocks. Long-established firms may also possess more developed relationships with financial institutions, suppliers, regulators, investors, and customers. These accumulated organizational resources could strengthen the ability of a firm to transform sustainability practices into greater financial distress. However, the relationship between firm age and financial distress should not be assumed to be uniformly beneficial. Organizational longevity can also create structural rigidity, legacy costs, resistance to technological change, and dependence on established business models. Such disadvantages may be especially relevant in the energy sector, where technological innovation and sustainability transitions can rapidly alter competitive conditions. Empirical research in Indonesia likewise produces mixed evidence concerning firm age and financial distress. Studies have investigated firm age as one of several predictors of financial distress, while recent evidence has also reported that company age may have no significant effect on financial distress. (Coad et al., 2013). These inconsistencies indicate that firm age deserves further investigation rather than being treated as an automatically protective characteristic.

The central research problem therefore concerns whether ESG performance is actually capable of reducing financial distress in Indonesian energy companies and, more specifically, whether organizational age provides an additional explanation for this relationship. This question is important because ESG investments may require considerable resources, whereas their financial benefits may not materialize immediately. If ESG performance is associated with lower financial distress, companies may have a stronger strategic rationale for integrating sustainability into financial-risk management. Conversely, if the relationship is weak or insignificant, ESG initiatives should not be regarded as a substitute for conventional financial risk-management mechanisms.

The present study builds upon previous research in several ways. First, it focuses on financial distress rather than conventional measures of financial performance or firm value, thereby emphasizing the downside-risk implications of ESG performance. Second, it concentrates specifically on energy companies listed on the Indonesia Stock Exchange, a sector where ESG considerations are especially material. Third, it introduces firm age into the ESG-financial

distress framework as a mediating variable, rather than treating organizational age merely as a control variable. This approach attempts to extend existing literature from a direct-effect perspective toward an organizational-mechanism perspective. The theoretical framework combines Stakeholder Theory and Signaling Theory. Stakeholder Theory explains why ESG performance may strengthen corporate relationship and organizational resilience, while Signaling Theory explains how ESG performance may communicate information about managerial quality and corporate responsibility to external stakeholder relationship. Through this framework, the study investigates whether ESG performance is related to financial distress directly and whether the proposed indirect pathway through firm age provides additional explanatory power.

The study contributes to the literature in three principal ways. First, its theoretical contribution lies in extending the discussion of ESG and financial distress beyond a direct relationship by introducing an organizational characteristic into the analytical framework. The integration of Stakeholder Theory and Signaling Theory provides a theoretical basis for explaining why ESG performance may have financial consequences through stakeholder confidence, information quality, and organizational capability. Second, its empirical contribution derives from the Indonesian energy-sector setting. Existing Indonesian research has established that ESG and financial distress are relevant areas of investigation, but findings remain heterogeneous. Research focusing specifically on energy companies has examined ESG disclosure and financial distress, while other studies have considered ESG disclosure as a moderator of financial distress relationship. (Dilla & Ramadhea Jr, 2026) The present study extends this literature by investigating whether firm age can provide an additional explanation for the ESG-financial distress relationship. Third, the study has practical implications for corporate managers, investors, creditors, and policymakers. For managers, the findings may indicate whether ESG should be integrated into corporate financial-risk management rather than being treated solely as a reporting or reputational activity. Investors and creditors may use the findings to assess whether ESG information contains relevant signals concerning financial vulnerability. For policymakers, the results may provide evidence regarding whether sustainability practices are associated with stronger financial resilience within a strategically important and environmentally sensitive industry.

Overall, the study is motivated by the recognition that ESG performance should not be evaluated solely from the perspective of sustainability achievement. Its potential contribution to corporate financial resilience is equally important. By examining ESG performance, financial distress, and firm age within a single empirical framework, this research seeks to provide a more comprehensive understanding of whether sustainability practices can contribute to the financial survival of Indonesian energy companies.

2. Literature Review and Hypothesis Development

a. Stakeholder Theory and Signaling Theory as Theoretical Foundations

Stakeholder Theory, developed by (Freeman, 1984), provides a fundamental theoretical basis for explaining the relationship between Environmental, Social, and Governance (ESG) performance

and financial distress. From a stakeholder perspective, a firm's long-term sustainability depends on its ability to manage relationships with various stakeholder groups, including investors, creditors, employees, customers, suppliers, regulators, governments, and local communities. ESG performance can be understood as a mechanism through which companies respond to the interests and expectations of these stakeholders. Responsible environmental practices can reduce conflicts with regulators and local communities, while socially responsible practices can strengthen relationships with employees and communities. Furthermore, effective corporate governance can enhance investor and creditor confidence. Consequently, stronger ESG performance may increase stakeholder support, reduce conflicts, and improve access to critical resources. During periods of financial pressure, these resources can help companies maintain operational continuity and reduce their vulnerability to financial distress. Recent literature also highlights the continued relevance of Stakeholder Theory in ESG research (Martiny et al., 2024) identify Stakeholder Theory as one of the principal theoretical frameworks used to explain ESG performance. A second relevant theoretical perspective is Signaling Theory. This theory explains the existence of information asymmetry between corporate management and external stakeholders. Managers generally possess more information about a firm's internal conditions and future prospects than investors and creditors. ESG performance can therefore serve as a signal of corporate quality. Companies demonstrating strong ESG performance may signal that their management possesses a long-term strategic orientation, effective internal control systems, and a commitment to managing non-financial risks. In the context of the Indonesian capital market, ESG information can provide investors with additional insights when evaluating companies. Recent Indonesian research has also explicitly employed Signaling Theory to explain the relevance of ESG performance to investment decisions and firm value (Rossalina et al., 2025). Accordingly, Stakeholder Theory explains how ESG performance can strengthen stakeholder relationships and improve access to organizational resources, whereas Signaling Theory explains how ESG performance communicates information about corporate quality to external stakeholders. Together, these two theoretical perspectives provide a foundation for examining the potential relationship between ESG performance and financial distress.

b. ESG Performance and Firm Age

Firm age represents more than the chronological duration of a company's existence. In organizational research, age reflects accumulated experience, knowledge, routines, stakeholder relationships, and institutional legitimacy. Therefore, firm age is often associated with organizational maturity and the development of capabilities for responding to external stakeholder expectations. These characteristics are relevant to ESG performance because environmental, social, and governance practices require organizational capabilities developed through learning, adaptation, and long-term stakeholder engagement. The relationship between firm age and ESG practices can be explained through organizational learning. Firms operating for longer periods have greater exposure to regulatory changes, stakeholder demands, environmental challenges, and social expectations. Such experience may enable mature firms to develop systematic approaches to sustainability management. Evidence from more than 26,000 firm-year observations over 21 years indicates that mature firms invest significantly more in corporate social responsibility, particularly in diversity and environmental awareness

(Withisuphakorn & Jiraporn, 2016). This finding suggests that organizational maturity can support sustainability-oriented practices. Stakeholder theory provides another explanation. Older firms generally maintain longer relationships with investors, creditors, employees, regulators, suppliers, customers, and communities. Maintaining these relationships may encourage firms to respond to stakeholder expectations through environmental responsibility, social engagement, transparency, and effective governance. ESG practices can therefore become an instrument for maintaining stakeholder trust and organizational legitimacy. Recent studies further indicate that firm age is relevant to the economic consequences of ESG. Research using emerging-market data shows that corporate maturity and organizational life cycle can influence the value relevance of ESG disclosures, while Indonesian evidence indicates that firm age can moderate the relationship between ESG disclosure and financial performance. These findings highlight firm age as an important organizational characteristic in ESG research. In this study, firm age is conceptualized as an observable indicator of organizational maturity and accumulated experience. It does not imply that ESG performance determines chronological age. Rather, ESG orientation and organizational maturity may jointly explain differences in financial resilience. Accordingly, the study examines whether ESG performance, firm age, and financial distress are statistically interconnected within the proposed mediation framework.

H1: ESG performance has a negative effect on Firm Age among Indonesian energy companies.

c. Firm Age and Financial Distress

Firm age represents more than the chronological duration of a company's existence. Longevity may reflect accumulated knowledge, managerial experience, routines, reputation, and stakeholder relationships. Firms that survive longer are exposed to market conditions and economic cycles, enabling stronger planning, control, and risk-management capabilities. Organizational learning and resource accumulation perspectives suggest that accumulated experience can strengthen financial resilience. Older firms may possess market knowledge, routines, and stronger mechanisms for responding to adverse conditions. Evidence from corporate bankruptcy research indicates that older firms are less likely to fail because of insufficient equity, suggesting that accumulated capabilities contribute to resilience (Kücher et al., 2020). Firm age may also influence access to external financing. Younger firms often have limited operating histories, increasing information asymmetry and lender uncertainty. Over time, firms can build reputational capital that reduces information uncertainty and borrowing costs. Evidence from Japanese small firms shows that borrowing costs decline as firms become older, supporting the reputation hypothesis (Sakai et al., 2010). These arguments imply that organizational longevity may reduce financial distress by improving managerial capabilities, strengthening reputation, facilitating financing access, and supporting liquidity and continuity. However, firm age may also create structural rigidity, bureaucratic procedures, legacy costs, and dependence on established business models. Mature firms may therefore face difficulties adapting to technological change, economic downturns, and competitive pressures. Empirical evidence from Ethiopian insurance companies indicates that firm age does not have a statistically significant effect on financial distress. Thus, the effect remains an empirical question. For

Indonesian energy companies, this relationship is relevant because established firms may benefit from accumulated knowledge and stakeholder relationships while facing technological transformation, changing energy policies, and sustainability requirements. Based on organizational learning, resource accumulation, and reputation arguments, the following hypothesis is proposed:

H2: Firm Age a positive relationship with Financial Distress among Indonesian energy companies

d. ESG Performance and financial distress

Environmental, social, and governance (ESG) performance has increasingly become an important determinant of corporate resilience because sustainability practices influence how firms manage operational, reputational, financing, and governance risks. Financial distress reflects the deterioration of a firm's financial condition and its increasing difficulty in meeting financial obligations. Thus, effective ESG practices may strengthen firms' ability to absorb financial and non-financial shocks and reduce the likelihood of financial distress. Stakeholder theory provides a fundamental explanation for this relationship. Firms operate within a network of stakeholders, including investors, creditors, employees, suppliers, customers, regulators, and communities. Strong ESG performance can strengthen stakeholder relationships through responsible environmental practices, social accountability, transparency, and effective governance. These relationships may reduce conflicts, reputational losses, regulatory exposure, and operational disruptions, ultimately improving financial resilience. The relationship can also be explained through the resource-based view (RBV). ESG capabilities may represent valuable organizational resources because firms that integrate sustainability into their operations can develop reputational capital, stakeholder trust, risk-management capabilities, and organizational knowledge. These resources may enhance firms' capacity to withstand financial pressures and maintain access to external resources. Recent empirical evidence supports this argument. (Song et al., 2024) (Sun et al., 2026) (Seefloth et al., 2025), demonstrate that ESG-related information can contribute to predicting financial distress, particularly among energy enterprises facing substantial environmental, regulatory, financing, and transition risks. Other recent evidence suggests that stronger ESG performance is associated with lower financial distress through mechanisms such as reduced financing constraints, operational risks, and agency costs. However, this relationship may vary according to economic conditions, governance quality, industry characteristics, and ESG information quality. Reverse causality may also arise because financially distressed firms could increase ESG disclosure to maintain stakeholder confidence. Based on stakeholder theory, RBV, and empirical evidence, this study expects that stronger ESG performance is associated with lower financial distress among Indonesian energy companies. Therefore, the proposed hypothesis is:

H3: ESG performance has a negative effect on financial distress among Indonesian energy companies.

e. Firm Age as a Mediating Mechanism

Firm age provides information about an organization beyond its existence. The length of time a firm operates may reflect accumulated organizational knowledge, managerial experience, routines, stakeholder relationships, and reputational capital. (Kücher et al., 2020) demonstrate that failure causes differ across organizational age stages, suggesting that age is relevant to how firms accumulate resources while facing different vulnerabilities. Organizational maturity may influence access to external financing. (Sakai et al., 2010) , using firms, find that borrowing costs tend to decline as firms become older. Similarly, (Martinelli, 1997) argues that newly established firms face greater borrowing constraints because lenders possess limited information about their quality. As firms develop track records and reputation, information asymmetry and financing constraints may decrease. Thus, organizational maturity can strengthen financial resilience through improved access to resources. However, the effect of firm age on financial distress is not universal. Mature firms may benefit from accumulated knowledge, routines, reputation, and relationships that support risk management, but they may also experience rigidity and difficulties adapting to technological and market changes. Evidence from Ethiopian insurance companies indicates that firm age does not significantly affect financial distress, highlighting institutional and industry-specific conditions. The ESG literature supports incorporating firm age into the financial distress framework. ESG performance reflects environmental responsibility, stakeholder management, governance quality, transparency, and sustainability. Strong ESG practices may reduce vulnerability by strengthening stakeholder relationships, improving risk management, and facilitating resource access. This is particularly relevant to energy companies exposed to environmental regulation, transition risks, reputational pressures, and financing requirements. (Song et al., 2024) show that ESG-related information improves prediction of financial distress among energy enterprises. (Nurahman & Hersugondo, 2026) find that firm age moderates the relationship between ESG disclosure and financial performance. Accordingly, this study examines whether firm age mediates the relationship between ESG performance and financial distress in this framework. The mediation represents an empirical association between sustainability orientation, organizational maturity, and financial resilience, rather than a claim that ESG determines chronological age.

H4: Firm Age mediates the relationship between ESG performance and financial distress among Indonesian energy companies.

2. Method

This study employs a quantitative approach with an explanatory research design to analyze the relationship between Environmental, Social, and Governance (ESG) performance and financial distress, as well as to test the role of firm age as a mediating variable among energy sector companies listed on the Indonesia Stock Exchange (IDX). An explanatory design was chosen because the study aims not only to describe company characteristics but also to test the relationships among variables formulated based on theoretical foundations and prior research. The research model consists of ESG performance as the independent variable, financial distress as the dependent variable, and firm age as the mediating variable. The selection of the energi is

based on the characteristics of an industry that has relatively high exposure to environmental issues, natural resources use, regulations, emissions, the energy transition, and stakeholder demands. Thus, ESG performance has strategic relevance to a company's ability to manage operational, reputational, regulatory, and financial risks. Previous research on energy companies has shown that ESG information can be used to predict financial distress, while higher ESG performance has also been found to be associated with a reduction in financial risk. This study uses secondary data obtained from companies' annual report, sustainability reports, and financial statements. This data is used to obtain information on ESG performance, the company's founding data or age, and the financial information necessary to measure financial distress. The study employs purposive sampling, a non-probability sampling technique in which observations are selected according to predetermined criteria that are directly related to the research objectives. Purposive sampling is appropriate because the study requires complete information concerning ESG performance, annual financial statements, sustainability reports, reporting currency, probability, and company establishment year. Companies that do not provide sufficient information cannot be consistently included in the calculation on the research variables. From the initial population of 91 energy companies, 51 companies satisfy all predetermined selection criteria and constitute the final sample.

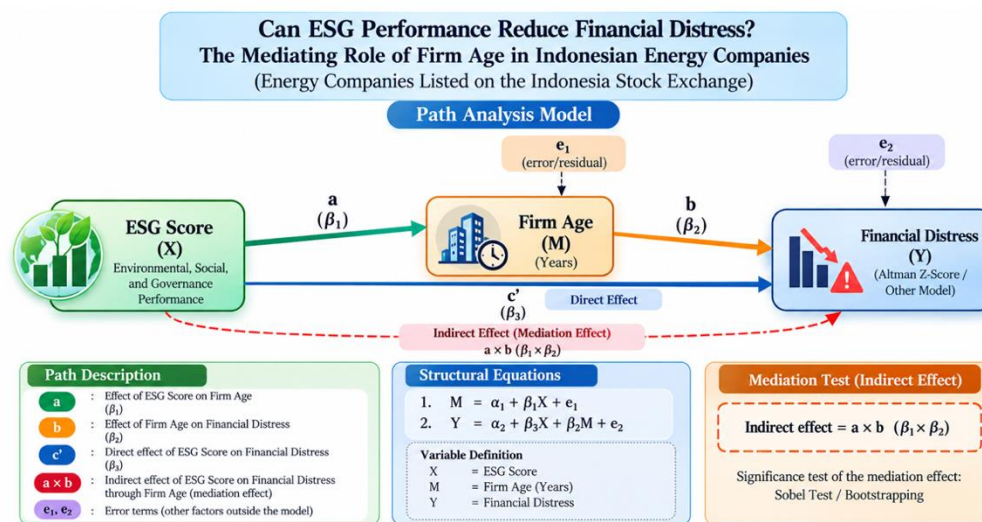
Table 1. The sample-selection procedure is summarized below

No	Sample selection criterion	Result
1	Energy Companies listed on the IDX	91
2	Companies without available/complete sustainability report	70
3	Companies without complete annual report	64
4	Companies reporting not losses according to the specified criterion	51
	Total sample (51 x 2 years)	102

This study uses three main variables: ESG performance as the independent variable, financial distress as the dependent variable, and firm age as the mediating variable. ESG performance is an independent variable that reflects a company's performance in the Environmental, Social, and Governance dimensions. ESG performance can be measured using ESG scores available from a consistent ESG data source for the entire sample. If complete external ESG scores are not available, the study may use an ESG disclosure index constructed based on the company's sustainability report. Financial distress is a condition in which a company experiences financial pressure that increases the likelihood of difficulty in meeting its financial obligations. Financial distress is measured using the Altman Z-Score or a financial distress measure appropriate for the characteristics of non-financial companies. For non-manufacturing companies, the study uses the following formula: $X1 = \text{working capital} / \text{total assets}$; $X2 = \text{retained earnings} / \text{total assets}$; $X3 = \text{EBIT} / \text{total assets}$; $X4 = \text{book value of equity} / \text{total liabilities}$. Firm age is used as a mediating variable and represents organizational maturity, experience, accumulated knowledge, and the

length of time the company has been in operation. Firm age is calculated based on:
 $AGE_{it} = Year_i - Founded_i$

Data analysis was conducted in stages to ensure that the data met the requirements for analysis and that the research model could be systematically tested, including descriptive analysis, data screening, and multicollinearity testing using the Variance Inflation Factor (VIF). Hypothesis testing was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM) or PLS path analysis. Significance testing was conducted using the bootstrapping procedure because the indirect effect in a mediation model should not be determined solely through the normal theory approach. The research model can be formulated as follows:



3. Results

a. Descriptive Statistical Analysis

Descriptive statistical analysis is used to determine the mean, maximum, minimum, and standard deviation for each variable. In this study, the discussion of descriptive statistical analysis is based on data that has been normalized. This study used 102 observations from companies in the energy sector. The following are the results of the descriptive statistical analysis:

Table 2. Results of the descriptive statistical analysis

Indicators	Min	Max	Mean	Median	Standard Deviasi	Kurtosis
ESG Score (x)	-2,723	1,282	0,000	0,220	1,000	0,337
Financial Distress (Y)	-1,136	5,858	0,000	-0,115	1,000	20,690
Firm Age (M)	-0,458	4,487	0,000	-0,365	1,000	8,061

(Source: processed data, 2026)

Based on tabel 2, this study used 102 observations of energy sector companies listed on the IDX, the following is an interpretation on the data:

1. ESG Score (X): **Mean and Dispersion:** The standardized mean value for ESG performance is **0.000** with a standard deviation of **1.000**, reflecting z-score standardization of the composite indicators, **Range:** The values range from a minimum of **-2.723** to a maximum of **1.282**. This substantial spread highlights a wide disparity in ESG disclosure and implementation practices among Indonesian energy firms. While several firms exhibit advanced sustainability commitments and corporate governance structures, others remain in the nascent stages of ESG integration, **Distributional Characteristics:** The median value of **0.220** (slightly above the mean) along with an excess kurtosis of **0.337** indicates a relatively balanced and near-normal distribution of ESG scores without extreme outliers
2. Financial distress (Y): **Mean and Dispersion:** Financial Distress displays a standardized mean of **0.000** and a standard deviation of **1.000**. In the context of composite financial health indicators (e.g., Altman Z-Score models), higher standardized scores represent stronger financial stability and a reduced likelihood of distress. **Range:** Scores range between **-0.458** and **4.487**. The lower bound represents firms experiencing heightened financial vulnerability or distress risks, whereas the upper bound reflects financially robust energy firms with strong solvency profiles. **Distributional Characteristics:** An excess kurtosis of **8.061** denotes a moderate concentration around the median financial health score, with specific well-capitalized firms exhibiting exceptional financial solvency.
3. Firm Age (M): **Mean and Dispersion:** Similarly, Firm Age exhibits a standardized mean of **0.000** and a standard deviation of **1.000**. **Range:** The variable spans from **-1.136** to **5.858**, pointing to significant heterogeneity in firm operational longevity within the sample. The dataset encompasses both newly listed/established energy ventures and long-standing mature companies that have operated for several decades. **Distributional Characteristics:** The high excess kurtosis of **20.690** reflects a leptokurtic distribution. This is expected in empirical corporate finance settings where a majority of listed firms fall within a concentrated age band, whereas a few long-established firms occupy the upper tail of the distribution.

b. Structural Model Evaluation (Inner Model)

Structural Model evaluation is conducted to test the model's fit using the R-Squared (R^2) and f-squared (f^2) values, and to test for multicollinearity using the Variance Inflation Factor (VIF).

Table 3. Structural Model Evaluation (R^2 , f^2 , dan VIF)

Evaluastion Parameter	Variable/Path Relationship	Coefficient/Value	Criterion/Tresh old	Evaluation & Descripton
Coefficient of Determination (R^2)	Financial Distress (Y)	$R^2 = 0,068$ (R^2 Adj= 0,049)	0,67 (substantial) 0,33 (Moderate) 0,19 (weak)	Weak: Esg Score and Firm Age combined explain 6,8% of the variance in financial distress
	Firm Age (M)	$R^2 = 0,027$ (R^2 Adj= 0,017)	-	Very Weak: ESG Score acoounts for 2,7% of variance in Firm Age
Effect Size (f^2)	ESG Score → Financial distress	0,072	0,02 (Small) 0,15 (Medium) 0,35 (Large)	Small to Medium Effect: contributes moderate to explaining Y
	ESG Score → Firm Age	0,028		Small Effect
	Firm Age → Financial Distress	0,005		Negligible/Unimportant Effect
Multicollinearity (VIF)	ESG Score (x)	1,028	VIF < 5,00	Free From multicollinearity. No excessive correlation among predictors
	Firm Age (M)	1,028		Free From Multicollinearity
Model Fit	SRMR	0,000	SRMR ≤ 0,08	Perfect fit
	NFI	1,000	NFI ≥ 0,90	Near Perfect Fit

(Source: processed data, 2026)

Table 4 Summary of Structural Equations and Model Paths

Equation/Structural Sub-Model	Mathematical Structural Equation	Residual Error (e)	Variance Explained
Equation 1 (Sub structure 1)	$M = 0,165x + e^1$	$e_1 = \sqrt{1 - 0,0680} = 0,965$	2,71%
Equation 2 (Sub structure 2)	$Y = 0,262x - 0,071M + e_2$	$e_2 = \sqrt{1 - 0,0680} = 0,965$	6,80%

Based on Table 3, the results can be interpreted as follows:

1. Coefficient of Determination (R^2): The coefficient of determination measures the explanatory power of the structural model. As shown in table 3, the R^2 value for Financial Distress (Y) is 0.068 (R^2 Adjusted = 0.049). This indicates that 6.8% of the total variance in Financial Distress among Indonesian listed energy companies is explained simultaneously by ESG Score and Firm Age. The remaining 93.2% is influenced by external macroeconomic, market-specific, or financial factors not captured in the current model. For Firm Age (M), the R^2 is 0.027 (R^2 Adjusted = 0.017), meaning ESG Score accounts for only 2.7% of the variance in firm longevity. In PLS-SEM benchmarks, these R^2 values fall into the weak range, which is common in corporate finance empirical studies relying on single macro-level governance variables.
2. Effect Size (f^2): The f^2 statistic measure how much an exogenous variable contributes to the R^2 value of an endogeneous variable. The path from ESG Score to Financial Distress yields an f^2 of 0.072, representing a small-to-medium effect. This demonstrates that ESG performance provides a meaningful contribution to mitigating financial distress risks. The path from ESG Score to Firm Age has an f^2 of 0.028 (small effect). The path from Firm Age to Financial Distress shows an f^2 of 0.005, which is below the 0.02 threshold, indicating a negligible impact.
3. Multicollinearity Test (VIF): to ensure the stability of the estimated path coefficients, lateral multicollinearity was evaluated using the Variance Inflation Factor (VIF). Both exogeneous predictors exhibit VIF values of 1.028, well below the conservative cutoff criterion of 5.0 (and even stricter thresholds of 3.3). hence, collinearity is not a concern in this structural model.
4. Model Fit Metrics: model fit evaluation confirm excellent alignment between the empirical covariance matrix and structural model Standardized Root Mean Square residual (SRMR) is 0.000 (below the 0.08 threshold), signifying ideal goodness-of-fit, Normed Fit Index (NFI) is 1.000 (exceeding the 0.90 benchmark), confirming strong overall structural validity.

c. PLS-SEM Structural Model Analysis

Hypothesis testing was conducted using the bootstrapping method (5.000 subsamples) to examine the significance of both direct effects and indirect effects (specific indirect effects/mediation). A hypothesis was considered significant if the T-statistic was greater than 1.96 and P-Value was less than 0.05.

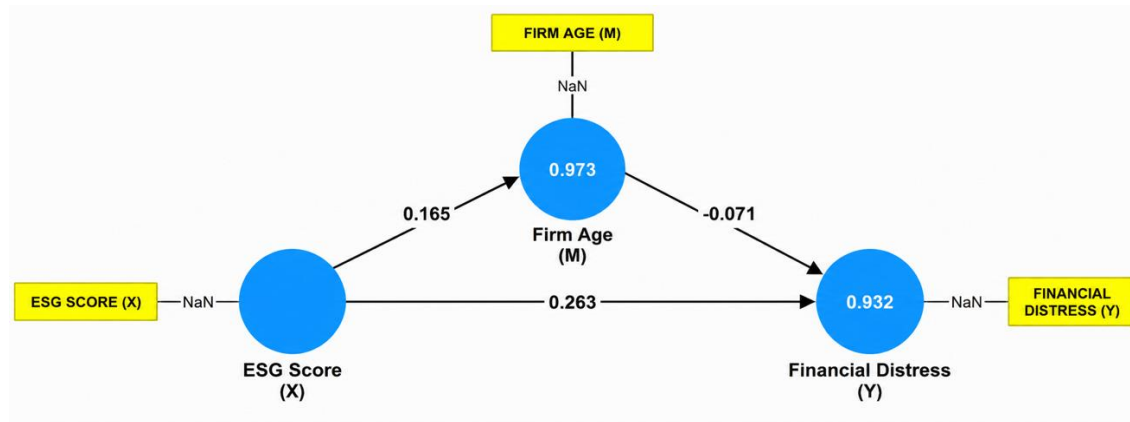


Table 5. Test Results for Direct and Indirect Effects (Bootstrapping)

Relationship/Influence	Original Sampel (O)	Sample Mean (M)	Standar Deviation (ST DEV)	T-Statistics (O/ST DEV)	P Value	Decision
ESG Score (X) → Firm Age (M)	0,165	0,157	0,087	1,883	0,060	Not Significant (p < 0,05)
Firm Age (M) → Financial Distress (Y)	-0.071	-0.061	0.069	1.035	0.301	Not Significant (p > 0,05)
ESG Score (X) → Financial Distress (Y)	0.263	0.262	0.060	4.407	0.000	Significant (p > 0,05)
ESG → Firm Age → Financial Distress (mediasi)	-0.012	-0.012	0.014	0.845	0.398	Not Significant (P > 0,05)

(Source: processed data, 2026)

Based on table 5, the data can be interpreted as follows:

1. the first hypotesis tests whether the ESG Score negatively impacts company age. The test results indicate that the ESG Score has a positive but insignificant effect on company age. This is based on the test results, which show a path coefficient of 0,165 with a T-statistic of 4,407 and P-value of 0,060 (P>0,05).
2. He second hypothesis tests whether company age has a positive effect on financial distress. The results indicate that firm age has a negative but insignificant effect on financial distress. This is based on the path coefficient of -0,071, a T-statistic of 1,035, and a P-Value of 0.301 (P>0,05).
3. The third hypothesis tests whether the ESG Score negatively impacts financial distress. The

test results indicate that the ESG Score has a positive and significant effect on financial distress. This is based on a path coefficient of 0.263, a T-statistic of 4.407, and a P-value of 0.000 ($P < 0.05$).

4. The fourth hypothesis tests whether the ESG Score mediates the relationship between financial distress and firm age. The test results indicate that firm age does not mediate the relationship between the ESG score and financial distress. This is based on a path coefficient of -0.012, a T-statistic of 0.845, and a P-value of 0.398 ($P > 0.05$).

4. Discussion

a. ESG Score by Firm Age

The test results indicate that the ESG Score has a positive but insignificant effect on firm age. Firm age is essentially a chronological variable or natural historical characteristic of a company, calculated from its official founding to the observation period. The implementation of Environmental, Social, and Governance (ESG) commitments by current management cannot directly alter or determine how long a company has been operating in the market. Although older (mature) companies tend to have more developed financial capabilities and structural resources to implement sustainability practices, the ESG score itself is not a causal factor that triggers or determines a company's age (Drempetic et al., 2020). The relationship between a company's age and its ESG performance is generally unidirectional, in which historical variables influence the level of ESG disclosure as an antecedent predictor, rather than the other way around (Broadstock et al., 2021) (Bakker & Josefy, 2018). The chronological nature of a company's age confirms that this variable is determined deterministically based on the time period and the data of corporation's legal incorporation. Meanwhile, ESG performance is the outcome of contemporary managerial strategic decisions that are dynamic and oriented toward future sustainability (Khatib et al., 2023) (Bakker & Josefy, 2018). Therefore, both theoretically and methodologically, currently implemented ESG policies lack a feedback mechanism to influence the accumulation of a company's years in operation from the past (temporal asymmetry). Even newly established energy companies (young firms) can achieve very high ESG scores if they consistently adopt clean technologies, energy efficiency, and transparent governance from the very beginning, without having to wait for a long operational history in the capital markets (Zou et al., 2022). On the other hand, various works in corporate finance literature confirm that mature companies do possess advantages in terms of capital accumulation, partnership networks, and regulatory experience that facilitate ESG adoption (Gangi et al., 2025). However, these empirical findings only demonstrate the role of firm age as a control variable or precursor, not as an effect of the ESG score. ESG scores reflect the current quality of governance and environmental responsibility, whereas firm age reflects the historical track record of a business entity's existence. Thus, the absence of a significant effect of the ESG score on firm age confirms the logical distinction between strategic ESG performance variables and a firm's inherent historical characteristics.

b. Firm Age by Financial distress

The test results indicate that firm age has a positive but insignificant effect on financial distress. This means that maturity or length of time an energy company has been in operation does not guarantee a stronger level of resilience against financial distress. The energy sector is highly dynamic and sensitive to fluctuations in global energy prices as well as government regulations. Therefore, both older and newer companies face similar levels of financial risk if they do not manage their capital structure and cash flow adaptively. Additionally, older companies (incumbent firms) often face structural inertia—specifically, slow adaptation to renewable technology innovations and high maintenance costs for legacy assets. Conversely, relatively new energy companies may be more agile but have limited capital reserves. Consequently, a company's age does not guarantee immunity from the risk of bankruptcy. These results confirm that the primary predictors of financial distress are management's ability to manage debt, operating cash flow, and profitability—not the length of time the company has been operating in the capital market. These research results are consistent with the findings of several previous studies, namely (Fredrick, 2018) and (Murni et al., 2019), which concluded that an increase in a company's age is statistically associated with an increase in financial distress. However, because the effect is not significant, a company's age cannot yet be considered a factor that empirically determines financial distress. Furthermore, companies that have been listed on the stock exchange for a long time do indeed have more extensive experience, broader access to information, relationships with investors, market reputation, and experience dealing with economic conditions. However, this does not mean that older companies are better equipped to deal with more complex cost structures, organizational rigidity, legacy issues, slower growth, and competitive pressure from new companies. Therefore, the effect of company age on financial distress may be positive but is not statistically significant.

c. ESG Score by Financial Distress

The test results indicate that the ESG Score has a positive and significant effect on financial distress. The positive coefficient implies that the stronger an energy company's ESG performance, the higher its z-score (serving as a proxy for financial health), which indicates a decrease in financial distress risk and an increase in financial stability. The implementation of Environmental, Social, and Governance (ESG) principles requires significant upfront investment and compliance costs, particularly in the energy sector, which is highly capital-intensive and has a high carbon emission intensity. Operational transformation toward sustainable business practices demands a significant allocation of capital expenditures for the modernization of environmentally friendly technologies, waste management, and compliance with increasingly stringent environmental regulations. Although it requires substantial initial financial outlays, comprehensive and transparent disclosure of ESG performance sends a positive signal (signaling theory) to investors, creditors and stakeholders that the company possesses superior future risk management capabilities (Broadstock et al., 2021). These credible signals effectively reduce information asymmetry in the capital markets, which in turn enhances corporate reputation and builds sustainable trust among institutional investors. The direct and strategic impact of thus improved reputation and greater transparency of information is a reduction in the cost of capital.

(Zou et al., 2022) empirically demonstrated that superior ESG ratings can significantly reduce the cost of debt and the cost of equity, as capital providers perceive entities with high ESG ratings as having a lower risk of default. In addition, solid ESG performance facilitates a company's access to green financing instruments, such as green bonds and sustainability-linked loans, which offer cheaper, more efficient, and more flexible interest rate structures for the energy industry (Feng & Zhang, 2022). At the same time, the implementation of strong governance transparency serves to minimize the risks of fraud, agency conflicts, and poor operational efficiency. According to (Khatib et al., 2023), the governance dimension within the ESG framework acts as an internal oversight mechanism that tightens managerial controls, strengthens the transparency of financial reporting, and optimizes the allocation of capital expenditures. The synergy between internal operational cost efficiency and easy access to low-cost external financing creates stability in operating cash flow and strengthens the corporate capital structure. The integration of these factors as a whole has proven capable of improving a company's financial health and stability while reducing the potential risk of financial distress.

d. Firm Age as a Mediating Mechanism

The test results show that firm age does not mediate the relationship between ESG Scores and financial distress. Efforts to mitigate the risk of financial distress through improvements in ESG performance cannot be explained or reinforced by a company's age or maturity. Management at energy companies must focus directly on improving internal financial governance, operational efficiency, and mitigating commodity price risks, rather than hoping that a combination of ESG factors and the company's age will automatically reduce the risk of bankruptcy. Energy companies that have been in operation for decades (mature companies) are not automatically immune to financial distress if they are unable to adapt to the renewable energy transition or when commodity prices drop drastically. Conversely, relatively young companies with a healthy debt structure can avoid financial distress. ESG is a sustainability practice that can change in a relatively short period, whereas a company's age is a cumulative variable that cannot be altered by improvements in ESG. Furthermore, financial distress is a complex phenomenon that cannot be explained solely by an ESG score and a company's age. Factors such as leverage, liquidity, profitability, cash flow, capital structure, company size, energy commodity prices, exchange rates, interest rates, capital expenditures, and energy transition risks have the potential to contribute more significantly to financial distress. Thus, the results of this study do not imply that the ESG Score is unimportant for energy companies. Rather, these results should be interpreted to mean that, in the model used, ESG has not been proven to be a direct or indirect determinant of financial distress through firm age. ESG can still play a strategic role in managing environmental, social, reputational, and governance risks, which can ultimately affect a company's resilience; however, this mechanism could not be captured by the research model, which included only firm age as a mediator. Thus, conceptually, the ESG score does not significantly increase or decrease firm age, and firm age also does not have a significant effect on financial distress. This study is consistent with (Chakraborty et al., 2025)(Lina & Anatha, 2026), The test results indicate that changes in the ESG Score do not significantly affect firm age, and changes in firm age also do not significantly affect financial distress. These results can be conceptually explained by the fact that firm age is a temporal characteristic reflecting the

length of time a firm has been in operation, whereas the ESG Score reflects the quality of a firm's environmental, social, and governance practices. The ESG Score causally leads to an increase in firm age because firm age is primarily determined by the time elapsed since the firm's establishment. Therefore, treating firm age as a mediator in the relationship between the ESG Score and financial distress has causal limitations.

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