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Sustainability as a Signaling Mechanism: The Role of Audit Committee Characteristics in Shaping Environmental and ESG Transparency

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ABSTRACT

The growing demand for sustainable corporate governance has strengthened the role of audit committees in linking environmental transparency with firm value, especially in high-risk industries. Yet, the mechanisms through which audit committee characteristics contribute to value creation through sustainability disclosures remain insufficiently explored in emerging markets. This study investigates whether Environmental Accounting Disclosure (EAD) and Environmental, Social, and Governance (ESG) disclosure act as mediators in the relationship between audit committee attributes and firm value in Indonesia's energy sector. Using panel data from 34 listed energy firms comprising 134 firm-years between 2020 and 2023, the research employs Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze direct and indirect effects. The results indicate that audit committee size significantly enhances firm value but does not affect EAD or ESG disclosure. Independence increases ESG disclosure and firm value, while higher meeting frequency improves both EAD and ESG disclosure but negatively affects firm value directly. The mediation analysis confirms that ESG disclosure mediates the effects of independence and meeting frequency, whereas EAD mediates only meeting frequency. These findings reveal a meeting frequency paradox where more intensive meetings indirectly raise firm value through enhanced disclosure quality despite reducing it directly. The study contributes to governance and sustainability literature by distinguishing structural from process-based governance quality and providing practical implications for regulators, boards, and investors to strengthen ESG-oriented oversight and promote sustainable corporate value in emerging markets.

Keywords: firm value; audit committee; ESG disclosure; environmental accounting; sustainability governance; emerging markets; energy sector

INTRODUCTION

Firm value has been acknowledged as a crucial metric for evaluating a company's performance, future potential, and role in sustainable economic growth. Firm value conceptually represents market perceptions of management's capacity to efficiently utilize resources and produce sustainable returns for shareholders and other stakeholders. Improving internal performance, especially regarding environmental factors, has been demonstrated to enhance profitability and facilitate sustainable development (Hu, J., & Zhao, 2024). In practice, firm value is frequently assessed using metrics such as Price to Book Value (PBV), which indicates the market's valuation of a company's net assets as a proxy for future potential. This value has extensive ramifications, encompassing job creation, heightened investment, tax contributions, and appeal to foreign capital (Damodaran et al., 2020; Sartono, 2010; Sukesti et al., 2020). Empirical data from 26 energy companies listed on the Indonesia Stock Exchange (IDX) from

2020 to 2023 reveal considerable fluctuations in PBV, with numerous firms facing declines, highlighting ongoing challenges in corporate governance, especially regarding the efficacy of audit committees in promoting transparency and accountability (Damodaran, 2012).

The audit committee is essential for maintaining transparency and accountability in both financial and non-financial reporting, which encompasses environmental disclosures. The effectiveness is contingent upon factors including independence, expertise, and meeting frequency, which directly affect monitoring quality and market confidence (Osi et al., 2024; M. Makarim et al., 2024). Multiple international studies provide empirical evidence indicating a positive relationship between audit committee characteristics and firm value. Research in Bangladesh's banking sector indicates that the size and independence of audit committees significantly improve market performance (Fariha et al., 2022). Comparable results have been documented in the manufacturing sector of Indonesia (Arfamaini & Soewarno, 2022) and the oil and gas industry of Nigeria (Jibril et al., 2022). Effective audit committees mitigate the risk of financial misstatements, promote more thorough non-financial disclosures, and enhance corporate reputation, thereby contributing to increased firm value (Chan & Li, 2008; Hassan Bazhair, 2022).

Sustainability dimensions are increasingly essential in assessing corporate performance, in addition to governance mechanisms. Environmental accounting disclosures and Environmental, Social, and Governance (ESG) practices are increasingly acknowledged as critical tools for fostering market trust and evaluating long-term sustainability. Transparent disclosures enhance public credibility, reduce capital costs, and indicate a strong commitment to responsible business practices (Maama & Appiah, 2019; Ilhan et al., 2020). Prior research has consistently demonstrated the beneficial impact of ESG on firm value in diverse global settings, including China's power generation industry (Fu et al., 2018), Chinese A-share listed companies (Ruan & Liu, 2021), and emerging markets like Turkey (Saygili et al., 2022). The audit committee's role in ensuring the quality of ESG disclosures is well recognized (Buallay et al., 2020; Alkurdi et al., 2024). Environmental accounting and ESG disclosures serve as essential mediating mechanisms that connect internal governance to market perceptions and firm value, as articulated within the context of signaling and legitimacy theories (Anggraini et al., 2025; Hameedi et al., 2022).

Notwithstanding the expanding corpus of literature, significant research deficiencies persist. Most previous research have concentrated on direct consequences, neglecting the intermediary functions of sustainability disclosures, especially in high-risk businesses. Moreover, the backdrop of rising markets, particularly Indonesia's energy industry, remains inadequately examined despite its considerable environmental hazards and escalating regulatory demands. The era from 2020 to 2023 signifies a pivotal post-COVID-19 transition, distinguished by more stringent ESG requirements worldwide and within Indonesia, encompassing the Financial Services Authority Regulation (POJK 51/2017) and the national green taxonomy framework. This context highlights the necessity to examine the influence of audit committee attributes on business value via sustainability reporting systems in a regulation-heavy and environmentally sensitive sector.

This study presents innovation across three essential dimensions. The strategy concentrates on Indonesia's energy sector, a high-risk business governed by rigorous environmental rules, in accordance with the United Nations Sustainable Development Goals (SDGs), namely clean energy, sustainable industry, and responsible consumption and production. This proposal introduces a new conceptual framework that includes two mediating variables: environmental accounting disclosure and ESG disclosure. It integrates agency theory, which elucidates the audit committee's function as an independent monitoring entity; legitimacy theory, which emphasizes corporate reactions to social and regulatory pressures via sustainability disclosures; and signaling theory, which regards ESG and environmental disclosures as reliable indicators of managerial competence. This study offers practical insights for energy sector managers to improve audit committee effectiveness, guides regulators like the Financial Services Authority (OJK) and IDX in developing governance and sustainability reporting policies, and provides sustainability-focused investors with a reliable tool for assessing long-term corporate viability.

Figure 1 depicts the conceptual relationships and literature framework underpinning the novelty of this study, created through bibliometric analysis with VOSviewer, highlighting the interconnections among audit committee characteristics, environmental accounting disclosures, ESG practices, corporate governance, and firm value.

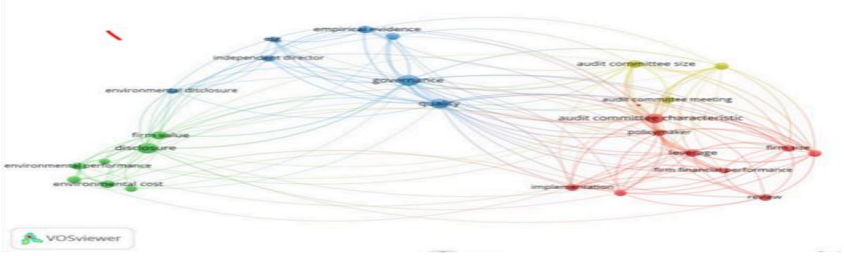

Figure 1. Bibliometric mapping of audit committee characteristics, environmental accounting disclosure, ESG, corporate governance, and firm value

(Source: VOSviewer analysis, 2025).

This study aims to determine the extent to which audit committee size, independence, and meeting frequency significantly affect firm value, both directly and indirectly, through environmental accounting and ESG disclosures as mediating variables among energy companies listed on the IDX from 2020 to 2023. This research seeks to furnish substantial empirical evidence about the intricate interconnections among governance processes, sustainability practices, and business value, thus contributing to theoretical development and practical insights. This study aims to enhance the literature by elucidating the relationship among corporate governance, sustainability disclosure, and company value in emerging markets. The findings have implications for promoting open, responsible, and sustainability-oriented corporate governance procedures, hence improving the global competitiveness of Indonesia's energy sector. The study offers significant insights for other emerging economies confronting analogous issues in harmonizing corporate governance frameworks with sustainability objectives to provide lasting value for economies, ecosystems, and society globally.

RESEARCH METHOD

This study utilizes a quantitative, explanatory research design that employs a causal-comparative (ex post facto) approach, aligned with archival research that depends on non-manipulated historical data (Sugiyono, 2019). The population consisted of IDX-listed energy companies from 2020 to 2023. Of the 87 initially identified issuers, 53 were eliminated due to inconsistent reporting, resulting in 34 qualifying enterprises. Purposive sample included firm-years with comprehensive data on audit committee characteristics, sustainability disclosures, and market/financial statistics (Sugiyono, 2020). Secondary data were obtained from annual reports, sustainability reports, and financial statements accessible on the IDX and corporate websites. Constructs were operationalized as follows: firm value (Y) was represented by Price-to-Book Value (PBV) (Pratomo, 2023); Environmental Accounting Disclosure (EAD, Z1) was quantified as a proportional index of disclosed GRI 2016 items (Tarus, 2020); ESG Disclosure (ESGD, Z2) as a proportional index of GRI 2013 items (Fuadah, 2022); audit committee size (UKA/X1) as the number of members, independence (IKA/X2) as the percentage of independent members, and meeting frequency (FRKA/X3) as the annual count of meetings (Buallay, 2019).

Data analysis. It subsequently calculated descriptive statistics for all variables and conducted outlier diagnostics using the Grubbs test; any corrective actions (such as error rectification, logarithmic transformation, winsorization, or robust estimators) were applied transparently following current guidelines (Grubbs, 1969; Smiti, 2020). The hypotheses were assessed via PLS-SEM in SmartPLS 3.0. The outer measurement model was assessed through convergent validity (outer loadings ideally > 0.70; 0.50–0.60 acceptable in exploratory contexts), discriminant validity via HTMT (< 0.90), and composite reliability (≥ 0.70) (Hair et al., 2021). The assessment of the structural (inner) model relied on bootstrapped path significance ($p < 0.05$), R^2 thresholds for explanatory power (strong > 0.75; moderate ≈ 0.50; weak = 0.25), and Q^2 for predictive relevance (strong > 0.35; moderate ≈ 0.15; weak ≈ 0.02) (Hair et al., 2021; Leguina, 2015). This pipeline aligns index production with assessments of validity and reliability while explicitly investigating the proposed direct and mediated effects of audit committee characteristics on PBV via EAD and ESGD.

RESULTS AND DICUSSION

Descriptive Statistical Analysis

The study population comprises energy-sector firms listed on the Indonesia Stock Exchange (IDX) during 2020–2023. The target population includes firms that consecutively submitted both annual and sustainability reports across the observation window and provided complete information for all study variables, yielding 34 eligible firms. Employing a census sampling strategy, all eligible firms were included. Secondary data consist of financial statements, annual reports, and sustainability reports publicly available on the IDX website (www.idx.co.id). Data Processing and Descriptive Results. Upon completion of data collection, the dataset was processed using SmartPLS (version 4). The resulting descriptive statistics are presented in Table 1.

Table 1. Descriptive Statistics of the Research Variables

Variable	Minimum	Maximum	Mean	Std. Deviation
NP (ratio; PBV)	0.19	32.62	2.17	4.299
Environmental Accounting Disclosure (EAD, %)	0.09	0.99	0.573	0.198
ESG Disclosure (ESGD, %)	0.26	1.00	0.522	0.198
Audit Committee Size (UKA, persons)	2	6	3.507	0.916
Audit Committee Independence (IKA, %)	0.67	1.00	0.932	0.119

Audit Committee Meeting Frequency (FRKA, times/year)	2	60	9.375	10.439

Authors' computation from IDX data (2025)

Descriptive statistics for the sample (N = 136 firm–year observations) indicate that firm value (NP; PBV) averages 2.17 (SD = 4.30, range = 0.19–32.62), revealing pronounced right-skewness and potential outliers; audit committee meeting frequency (FRKA) likewise shows high dispersion with a mean of 9.38 meetings per year (SD = 10.44, 2–60). Governance structures are comparatively stable: audit committee size (UKA) centers at 3.51 members (SD = 0.92, 2–6) and independence (IKA) is high (M = 0.932, SD = 0.119, 0.67–1.00), suggesting limited cross-sectional variation for IKA relative to other covariates. Sustainability disclosures are at moderate levels with Environmental Accounting Disclosure (EAD) 0.573 (SD = 0.198, 0.09–0.99) and ESG Disclosure (ESGD) 0.522 (SD = 0.198, 0.26–1.00). Collectively, these patterns provide sufficient variance for hypothesis testing while motivating robustness checks (e.g., log transformation, winsorization, or robust estimators) for skewed outcomes such as PBV and FRKA prior to PLS-SEM.

Outlier Analysis

Univariate outliers were assessed using the two-sided Grubbs test, $\alpha = 0.05$, to detect data with significant divergence from their sample averages. The technique was executed for each of the six variables and applied iteratively, with manual verification of raw records for all identified cases. Values resulting from data-entry or coding errors were rectified; substantively plausible outliers were preserved for the primary analysis and examined using predetermined robustness checks (log transformation, winsorization, and robust estimators) (Grubbs, 1969). The identified findings and subsequent decisions are documented in Table 4.2.

Table 2. Outlier Test Results

Variable	Number of Outliers	Percentage (%)	Minimum	Maximum	Mean	SD
Firm Value (ratio)	5	3.676	0.190	6.820	1.618	1.649
Environmental Accounting Disclosure (ratio)	0	0.000	0.090	0.990	0.573	0.198
ESG Disclosure (ratio)	0	0.000	0.260	1.000	0.521	0.197
Audit Committee Size (members)	0	0.000	2.000	6.000	3.507	0.916
Audit Committee Independence (ratio)	0	0.000	0.670	1.000	0.932	0.119
Audit Committee Meeting Frequency (meetings)	5	3.676	2.000	35.000	8.706	7.822

Source. *Processed secondary data, 2025.*

After outlier screening, only Firm Value (PBV) and Audit Committee Meeting Frequency (FRKA) retain extreme observations (each 3.676%), whereas EAD, ESGD, UKA, and IKA are free of outliers. Dispersion in PBV remains pronounced (M = 1.618, SD = 1.649; range = 0.190–6.820; CV ≈ 102%), indicating substantial cross-firm heterogeneity. FRKA likewise exhibits high variability (M = 8.706, SD = 7.822; 2–35; CV ≈ 90%). By contrast, IKA is high with limited dispersion (M = 0.932, SD = 0.119; CV ≈ 13%), suggesting a potential ceiling effect. Sustainability disclosures are at moderate levels with adequate variance (EAD: M = 0.573, SD = 0.198; CV ≈ 35%; ESGD: M = 0.521, SD = 0.197; CV ≈ 38%). Collectively, these properties provide sufficient variation for hypothesis testing, while motivating robustness adjustments (e.g., log transformation, winsorization, or robust estimators) for skewed outcomes such as PBV and FRKA prior to PLS-SEM.

This study presents, in a standardized table, outlier detection and post-cleaning descriptive statistics for six core variables, highlighting a transparency step that is often overlooked in governance sustainability research. The lack of outliers in EAD/ESGD demonstrates the resilience of GRI-based disclosure indices to market extremes, thereby reinforcing their function as parallel mediators. The identification of a ceiling effect in IKA provides a methodological contribution by highlighting that the marginal effect of audit committee independence may be diminished and necessitates control measures (e.g., mean-centering, alternative scaling). The significant dispersion in FRKA suggests that monitoring intensity may serve as a more informative governance channel compared to size or composition. This observation prompts the examination of dual mediation (EAD/ESGD → PBV) with pre-specified robustness checks.

SEM-PLS Analysis

Measurement and Structural Assessment Overview. Prior to hypothesis testing, we conducted a two-stage PLS-SEM evaluation. First, the measurement (outer) model was assessed to establish indicator reliability, internal consistency, and construct validity: outer loadings were inspected (target ≥ 0.70) alongside Cronbach's alpha and composite reliability (≥ 0.70) for internal consistency and average variance extracted (AVE) (≥ 0.50) for convergent validity; discriminant validity was examined using the HTMT criterion (< 0.90) (Hair et al., 2017; Henseler et al., 2015). Second, the structural (inner) model was appraised via R^2 for explanatory power, Q^2 (> 0) for predictive relevance, and bootstrapped path coefficients ($\alpha = 0.05$) for statistical significance (Hair et al., 2021). The ensuing tables report these diagnostics and provide the basis for the subsequent interpretation of direct and mediated effects.

Convergent validity was evaluated by examining the standardized outer loadings of each indicator on its latent concept; loadings of ≥ 0.70 signify sufficient convergence. The constructs in this study utilize single indicators, resulting in outer loadings fixed at 1.000, hence inherently meeting the convergence condition. The outer-loading summary is presented in Table 3 below, based on the analyzed results.

Table 3. Outer Convergent Validity

Construct	EAD	ESGD	FRKA	IKA	NP	UKA
Firm Value (NP)					1.000	
Environmental Accounting Disclosur (EAD)	1.000					
ESG Disclosure (ESGD)		1.000				
Audit Committee Independence (IKA)				1.000		
Audit Committee Size (UKA)						1.000
Audit Committee Meeting Frequency (FRKA)			1.000			

Source. *Processed secondary data, 2025.*

The "Outer Convergent Validity" matrix indicates that all constructs are defined as single-indicator reflective measures, with diagonal outer loadings set at 1.000 (NP, EAD, ESGD, IKA, UKA, FRKA). According to conventional thresholds (≥ 0.70), this meets the criteria for convergent validity; however, since single-indicator specifications determine the loading by design, assertions of convergence must be supported by theoretical justification and evidence of indicator quality (e.g., verified data sources and exact operational definitions) and validated through supplementary diagnostics such as HTMT (< 0.90), composite reliability, and AVE. The work clearly outlines the single-indicator reflective definition for six fundamental dimensions and presents the convergence matrix, along with discriminant and reliability assessments, an unusual transparency measure in governance-sustainability research utilizing archival data. This approach enhances methodological accountability and replicability within the IDX energy context (2020–2023), particularly concerning indicators that are administrative counts (UKA, FRKA, IKA) and GRI-based disclosure indices (EAD, ESGD). Construct reliability was assessed using three criteria: Cronbach's alpha, composite reliability, and average variance extracted (AVE). As indicated in Table 4.

Table 4. Outer Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Firm Value (NP)	1.000	1.000	1.000
Environmental Accounting Disclosure (EAD)	1.000	1.000	1.000
ESG Disclosure (ESGD)	1.000	1.000	1.000
Audit Committee Size (UKA)	1.000	1.000	1.000
Audit Committee Independence (IKA)	1.000	1.000	1.000
Audit Committee Meeting Frequency (FRKA)	1.000	1.000	1.000

Source. Processed secondary data, 2025.

Table 4 indicates that all constructs achieve Cronbach's alpha = 1.000, composite reliability = 1.000, and AVE = 1.000, surpassing standard thresholds (α, CR ≥ 0.70; AVE ≥ 0.50). This outcome, typical for single-indicator reflective specifications, signifies flawless internal consistency and convergence by design. Consequently, the measurement model's adequacy is confirmed, allowing the study to advance to structural testing. However, interpretation must be grounded in robust theoretical justification and documented indicator provenance, rather than psychometric redundancy. The innovation resides in the clear presentation of single-indicator specifications alongside a comprehensive reliability table, a transparency measure rarely documented in governance sustainability research utilizing archival data. This approach improves methodological accountability and replicability, elucidating that reliability in this context is based on audited corporate disclosures (e.g., administrative counts and GRI-based

indices) rather than multi-item survey scales. Furthermore, discriminant validity testing reveals that the correlations between Firm Value (NP) and other constructs remain moderate NP–EAD = 0.247, NP–ESGD = 0.417, and NP–FRKA = 0.214 well below the 0.90 threshold, thereby confirming distinct construct boundaries and mitigating multicollinearity concerns prior to structural analysis.

Table 5. Discriminant Validity: Heterotrait–Monotrait Ratio (HTMT)

Construct	EAD	ESGD	FRKA	IKA	NP	UKA
Environmental Accounting Disclosure (EAD)						
ESG Disclosure (ESGD)	0.415					
Audit Committee Meeting Frequency (FRKA)	0.313	0.282				
Audit Committee Independence (IKA)	0.148	0.127	0.285			
Firm Value (NP)	0.247	0.417	0.214	0.280		
Audit Committee Size (UKA)	0.096	0.138	0.126	0.395	0.189	

Source. SmartPLS 3.0 output, 2025.

The HTMT matrix demonstrates adequate discriminant validity among all constructs, with coefficients significantly below the 0.90 threshold (Henseler et al., 2015). The highest correlations are modest: NP–ESGD = 0.417, EAD–ESGD = 0.415, and NP–UKA = 0.395, while others are minimal (e.g., EAD–UKA = 0.096), indicating restricted construct overlap and mitigating the potential for biased structural estimates. The innovation resides in the comprehensive disclosure of the complete HTMT matrix within a singular indicator, archival governance-sustainability context, augmenting dependability proof and improving methodological transparency and replicability for IDX energy companies (2020–2023). The inner model is assessed by analyzing the coefficient of determination (R-square) for each endogenous construct; elevated R-square values signify more predictive efficacy of the proposed research model. The statistical significance of the proposed associations is evaluated by route coefficients utilizing P-values. The PLS-SEM analysis performed in SmartPLS 3 is presented in Table 6.

Table 6. R-Square and Q-Square Values

Variable	R-Square	Interpretation	Q-Square	Interpretation
Environmental Accounting Disclosure (EAD)	0.104	Weak	0.043	Weak
ESG Disclosure (ESGD)	0.145	Weak	0.104	Weak
Firm Value (NP)	0.507	Moderate	0.286	Moderate

Source: SmartPLS 3 output, 2025

According to Table 6, the variance in EAD attributable to audit committee size, independence, and meeting frequency is little (10.4%), and the variance in ESGD explained by these same factors is similarly low (14.5%). In contrast, the variance in Firm Value (NP) explained collectively by the features of the audit committee, EAD, and ESGD is moderate at 50.7%, exhibiting significant predictive significance (Q-Square = 0.286). This study employs data from Indonesia's energy sector spanning 2020 to 2023 to evaluate a unified PLS-SEM dual-mediation model, wherein EAD and ESGD collaboratively convey the effects of the audit committee on firm value, integrating agency legitimacy signaling, a topic infrequently explored, thereby providing actionable insights for boards, regulators, and investors. Following the establishment of inner-model adequacy, hypotheses were assessed using bootstrapped structural path coefficients in SmartPLS. The SmartPLS findings are presented in Tables 7 and 8.

Table 7. Hypothesis Testing Results (Direct Effects)

Relationship	Original Sample	Mean Sample	STDEV	t-Statistic	P-value	Decision
UKA → NP	0.419	0.423	0.097	4.321	0.000	Significant
IKA → NP	0.246	0.248	0.050	4.893	0.000	Significant
FRKA → NP	−0.360	−0.354	0.066	5.436	0.000	Significant
UKA → EAD	0.049	0.053	0.112	0.434	0.665	Not significant
IKA → EAD	−0.055	−0.054	0.083	0.667	0.505	Not significant
FRKA → EAD	0.292	0.295	0.071	4,116	0.000	Significant
UKA → ESGD	0.143	0.143	0.092	1.560	0.119	Not significant
IKA → ESGD	0.249	0.250	0.073	3.389	0.001	Significant
FRKA → ESGD	0.335	0.332	0.082	4.086	0.000	Significant
EAD → NP	0.215	0.217	0.084	2.555	0.011	Significant
ESGD → NP	0.340	0.333	0.078	4.363	0.000	Significant

Notes: UKA = Audit Committee Size; IKA = Audit Committee Independence; FRKA = Audit Committee Meeting Frequency; NP = Firm Value; EAD = Environmental Accounting Disclosure; ESGD = ESG Disclosure.

Source: SmartPLS 3.0 output, 2025.

At α = 0.05, firm value (NP) rises with audit committee size (β = 0.419, p < 0.000) and independence (β = 0.246, p < 0.000), but falls with meeting frequency (β = −0.360, p < 0.000). FRKA significantly increases EAD (β = 0.292) and ESGD (β = 0.335), IKA increases ESGD (β = 0.249), while UKA does not affect EAD/ESGD. Both EAD (β = 0.215, p = 0.011) and ESGD (β = 0.340, p < 0.000) positively affect NP, indicating governance shapes valuation directly and primarily via FRKA and IKA through sustainability disclosures, with ESGD showing the stronger value linkage.

Table 8. Hypothesis Testing Results (Indirect Effects)

Relationship	Original Sample	Mean Sample	STDEV	t-Statistic	P-value	Decision
UKA → EAD → NP	0.010	0.013	0.027	0.389	0.697	Not significant
IKA → EAD → NP	−0.012	−0.012	0.020	0,592	0.554	Not significant
FRKA → EAD → NP	0.063	0.063	0.029	2,159	0.031	Significant
UKA → ESGD → NP	0.049	0.046	0.031	1.575	0.116	Not significant
IKA → ESGD → NP	0.085	0.083	0.032	2,641	0.009	Significant
FRKA → ESGD → NP	0.114	0.110	0.037	3,046	0,002	Significant

Notes: UKA = Audit Committee Size; IKA = Audit Committee Independence; FRKA = Audit Committee Meeting Frequency; NP = Firm Value; EAD = Environmental Accounting Disclosure; ESGD = ESG Disclosure.
Source: SmartPLS 3.0 output, 2025.

Mediation study indicates that the frequency of audit committee meetings (FRKA) favorably influences company value through both EAD (β_ind = 0.063, significant) and ESGD (β_ind = 0.114, significant), whereas committee independence (IKA) similarly exerts its effect through ESGD (β_ind = 0.085, significant). The EAD- and ESGD-mediated pathways from committee size (UKA) are insignificant, as is the EAD-mediated pathway from IKA. ESGD serves as the primary channel connecting audit-committee characteristics to company value, succeeded by the EAD pathway influenced by FRKA.

ESG and Environmental Accounting Disclosures Mediate the Audit Committee–Firm Value Relationship (IDX Energy, 2020–2023)

The discovery that the size of the audit committee positively and significantly influences firm value among IDX energy issuers from 2020 to 2023 is consistent with agency theory: an increased number of members improves monitoring capabilities, mitigates managerial opportunism, and diminishes agency conflicts, resulting in higher market valuations. The system functions by distributing tasks across high-risk areas such as accounting estimates, revenue recognition, and compliance, while also leveraging diverse expertise to enhance deliberation and the quality of committee recommendations (Rahman et al., 2019; Basiru & Nur Ashikin, 2015). Consequently, the effect is likely non-linear: surpassing a certain threshold, increasing the number of seats may result in "process loss" (more intricate coordination, diminished accountability). Governance designers should aim for effectiveness rather than merely increasing scale to maintain positive marginal returns. Alignment with Afza & Nazir (2014), Nurokhmah et al. (2021), and Maulia & Yanto (2020), and deviation from Fariha et al. (2022), highlights that a high-risk environment like energy provides enhanced opportunities for the coordination advantages of comparatively larger committees.

The exceptionally high degree of committee independence in the sample (about 93.2%) correlates favorably with company value. This outcome is consistent in Nigeria, China, and the UK, where independence correlates with enhanced oversight and superior audit quality, consequently bolstering investor confidence and market evaluations (Adedeji et al., 2020; Chan & Li, 2008; Al-Shaer et al., 2022). Counter-arguments presented in Afza & Nazir (2014), Al-Matari et al. (2014), and Fariha et al. (2022) suggest that independence alone may be inadequate; domain competence, such as proficiency in energy-transition risks, GRI/ESRS, and climate issues, influences whether independent status translates into oversight enhancements that the market appreciates. Conversely, the frequency of audit committee meetings negatively impacts corporate value. An excessive frequency of meetings (approximately nine annually, significantly exceeding the OJK standard of four) may be perceived by the market as an "alarm effect," indicating managerial or operational challenges that necessitate frequent meetings, thereby increasing costs and hindering execution (Vafeas, 1999; Kusnadi et al., 2016). From an agency-cost perspective, excessive governance activities may likewise elevate agency costs (M. C. Jensen, 1993). This conclusion contrasts with research indicating no substantial effect (Afza & Nazir, 2014; Al-Matari et al., 2014; Fariha et al., 2022) and

suggests a transition from "quantity" to "quality" in the risk-materiality agendas of meetings, follow-up KPIs, and disciplined implementation.

The negligible impact of committee size on Environmental Accounting Disclosure (EAD) suggests that an increase in personnel does not inherently enhance environmental reporting. Between 2020 and 2023, due to pandemic pressures and energy price fluctuations, managerial emphasis likely shifted towards financial and operational stability. In contrast, environmental disclosure necessitates specialized skills (such as GRI, environmental costing, and impact assessment) that have not been consistently integrated into audit committees traditionally focused on financial reporting. This outcome aligns with Wang and Sun (2022) and Michelon and Parbonetti (2012), emphasizing sustainability competence rather than mere size, and contradicts Jibril et al. (2022); although expertise diversity may enhance reporting quality (Kusnadi et al., 2016), its impact is constrained in the absence of environmental literacy.

Similarly, the independence of the committee does not influence EAD. Despite the predominance of independent members, supervision frequently emphasizes economic and financial concerns, as well as general compliance, rather than addressing environmental challenges that necessitate expertise in sustainability and transparency standards (Michelon & Parbonetti, 2012; Wang & Sun, 2022). This is consistent with Kaur and Lodhia (2018), Muttakin et al. (2015), and Rupley et al. (2012), which demonstrate that external pressures, stakeholder engagement, and media exposure often surpass formal committee attributes in influencing EAD; it contradicts Hameedi et al. (2022) and Fakhari and Pitenoei (2017). Unlike the two prior findings, meeting frequency has a favorable impact on EAD. Purposeful meetings centered on environmental agendas, including GRI compliance reviews, assurance activities, and emissions/waste dashboards, enhance discipline in the reporting process and responsiveness to regulatory and stakeholder pressures (Persons, 2009; Jibril et al., 2022). This is particularly significant in the high-environmental-risk energy sector, where active committee involvement enhances accountability in disclosure.

The size of the audit committee similarly demonstrates no impact on ESG disclosure. This aligns with the findings of Biçer & Feneir (2019), Al-Share & Zaman (2016), and Wang & Sun (2022), emphasizing that a structural framework devoid of a definitive ESG mandate, requisite ESG competences, board endorsement, and effective cross-functional processes is inadequate to promote sustainable transparency. Previous research indicates that the efficacy of oversight is predominantly determined by capability and experience rather than personnel numbers (Q et al., 2008; Michelon & Parbonetti, 2012; Liao et al., 2015), elucidating why the current findings do not corroborate those of Raimo, Vitolla, Marrone, & Rubino (2021). In contrast, committee independence correlates positively with ESG disclosure. This aligns with the findings of Pozzoli & Pagani (2022), Zamzamir et al. (2021), Arif et al. (2020), Ashfaq & Rui (2019), Bamahros et al. (2022), and Buallay & Al-Ajmi (2019), and is consistent with agency, signaling, and legitimacy theories: independent oversight enhances transparency, accountability, and the verifiability of ESG information. The effect intensifies when independence is bolstered by ESG training, access to external experts, and obligatory follow-up on suggestions.

The frequency of committee meetings enhances ESG disclosure by serving as a process engine that enforces preparation, review, and verification; effectiveness is more accurately assessed by outcomes (completeness, assurance quality, remediation) rather than mere counts, and cross-industry variations indicate context sensitivity. EAD positively correlates with firm value, serving as an indicator of effective environmental risk management and a legitimacy mechanism that mitigates investor uncertainty; similarly, ESG disclosure enhances firm value by signaling long-term risk readiness and establishing social legitimacy. Mediation analyses indicate that EAD does not convey the effects of committee size or independence on value, but meeting frequency enhances value indirectly through EAD; likewise, ESG does not mediate the relationship between size and value but does mediate the connection between independence and meeting frequency. In IDX Energy (2020–2023), the independence of process quality and the effectiveness of meetings are more significant than structural scale.

SG and Environmental Accounting Disclosures Mediate the Relationship Between the Audit Committee and Firm Value (IDX Energy, 2020–2023) The research substantiates that mediation through ESG and EAD is present, albeit incomplete and specialized to certain dimensions. In summary: (i) Committee size enhances firm value directly, but not indirectly through ESG or EAD structural frameworks lacking sustainability expertise, which do not inherently prompt market-relevant disclosures; (ii) Independence influences value both directly and indirectly through ESG (notable mediation), but not through EAD, aligning with agency, signaling, and legitimacy theories that assert independent oversight fosters credible ESG transparency valued by the market; and (iii) Meeting frequency presents a paradox: its direct impact on value is negative (due to alarm/cost effects), while its indirect effects through ESG and EAD are positive, suggesting that intentional, sustainability-focused meetings refine disclosure processes, diminish information asymmetry, and ultimately enhance market perceptions. In light of the pandemic shocks and energy-price volatility from 2020 to 2023, this pathway map elucidates why process and quality mechanisms (independence and ESG/EAD-focused meeting efficacy) more reliably convert governance into value than structure (size) alone. The title therefore precisely encapsulates a selected dual mediation: ESG

and EAD function as conduits between the audit committee and corporate value, but limited to specific aspects such as independence and meeting frequency.

This research presents three primary contributions. This study concurrently delineates direct pathways and dual mediations (through EAD and ESG) from audit committee characteristics size, independence, and meeting frequency to firm value, specifically within Indonesian energy issuers from 2020 to 2023, a timeframe characterized by disruptions (pandemic, energy-price fluctuations) and heightened demands for sustainability disclosure. Secondly, it reveals an under-reported asymmetry: meeting frequency exhibits a negative direct correlation with value (alarm/cost effect) while demonstrating a positive indirect correlation through EAD/ESG, thereby reconciling previously conflicting data. Third, it distinctly differentiates structure from process/quality: size enhances value but does not promote EAD/ESG without sustainability competencies, while independence and meeting effectiveness serve as the "engine" that conveys governance advantages to the market through more credible and informative disclosures. These findings provide implementable policy recommendations: Develop ESG competences within audit committees, formulate materiality-driven meeting agendas with quantifiable follow-ups, and include EAD/ESG into data governance frameworks and company strategy.

CONCLUSION

This study provides empirical evidence that audit committee characteristics significantly influence firm value through the mediating roles of Environmental Accounting Disclosure (EAD) and Environmental, Social, and Governance (ESG) disclosure within Indonesia's energy sector. The findings highlight that audit committee size directly enhances firm value but does not contribute to EAD or ESG transparency, independence strengthens both ESG disclosure and firm value, while meeting frequency improves EAD and ESG disclosure but simultaneously reduces firm value when measured directly. The mediation analysis reveals selective relationships, showing that EAD mediates only the effect of meeting frequency, whereas ESG mediates both independence and meeting frequency. This pattern exposes a meeting frequency paradox where active governance meetings generate positive indirect impacts on firm value through improved sustainability disclosure despite their negative direct influence. The novelty of this study lies in its dual-mediation framework that integrates agency, signaling, and legitimacy theories to differentiate structural from process-oriented governance quality in an emerging market context. These findings imply that sustainable value creation relies more on the quality of independent oversight and ESG literacy than on committee size alone. Practically, regulators should align governance standards with sustainability competence, while boards and investors should foster ESG-driven agendas to reinforce market trust. Future research should extend this model to other industries and cross-country settings to explore the long-term dynamics of audit committee effectiveness and sustainability-oriented governance practices.

RECOMMENDATION

Future research should expand the sampling frame beyond energy firms to encompass other IDX sectors and, where applicable, to international exchanges to enhance generalizability and cross-sector relevance; prolong the observation period beyond four years to identify structural trends and mitigate period-specific shocks; and augment model specification with audit committee characteristics (education, experience, training, age, gender) to evaluate their direct impacts on environmental accounting disclosure (EAD), ESG disclosure, and firm value, as well as their indirect pathways mediated by EAD and ESG.

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