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# Environmental Accounting Practices, Corporate Governance and Financial Performance of Listed Non-Financial Firms in Nigeria

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**ABSTRACT** **Original Research Article**

Intensifying corporate environmental degradation in Nigeria, 5.3 billion cubic metres of gas flared in 2024 and hundreds of oil spill incidents annually has placed environmental accounting at the centre of reporting debates, yet disclosure remains largely voluntary and evidence on whether it pays is fragmented, since prior studies examine single sectors, ignore the governance architecture authenticating disclosure, and rely on estimators uncorrected for unobserved heterogeneity, heteroskedasticity, serial correlation and cross-sectional dependence. This study examines the effect of environmental accounting practices, proxied by environmental cost disclosure (ECD), and corporate governance, proxied by board size (BSIZE) and board independence (BIND), on financial performance measured by return on assets (ROA), controlling for firm size. An ex post facto longitudinal design was adopted: from 106 non-financial firms listed on the Nigerian Exchange Group, 60 were selected purposively, yielding a strongly balanced panel of 600 firm-year observations for 2015–2024, with data hand-collected from audited annual and sustainability reports and analysed in EViews 12 through descriptive statistics, correlation analysis, a full diagnostic battery and panel regression. The Hausman test ($\chi^2$ = 2.1601, p = 0.7063) favoured the random-effects estimator with White cross-section robust standard errors. ECD exerts a positive significant effect on ROA (β = 0.0952, t = 4.6481, p = 0.0000); BSIZE a negative significant effect (β = –0.0077, t = –3.7255, p = 0.0002); BIND a positive significant effect (β = 0.1087, t = 3.2625, p = 0.0012); and firm size a positive significant effect (β = 0.0087, p = 0.0168). The model is jointly significant (F = 16.3860, p = 0.0000) with Durbin–Watson of 1.9963, and results survive fixed-effects, two-way, first-difference, Driscoll–Kraay and dynamic re-estimation. Environmental accountability and independent oversight are therefore financially rewarding in Nigeria, whereas board expansion beyond an effective threshold is value-eroding. Regulators should migrate to mandatory assured environmental cost reporting, and firms should prioritise lean, independence-rich boards.

**Keywords:** Board Independence, Board Size, Corporate Governance, Environmental Cost Disclosure, Panel Data Analysis, Return on Assets.

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## Introduction

The relationship between corporate environmental accountability and firm value has become one of the most consequential questions in contemporary accounting scholarship. The issuance of IFRS S1 and IFRS S2 in 2023 formalised what capital markets had signalled for two

decades: that environmental information is decision-useful financial information rather than a discretionary public-relations supplement (IFRS Foundation, 2023). Alsayegh et al. (2020) demonstrate that environmental and social disclosure transforms sustainability performance into economic value and Zhou et al. (2022) show that ESG performance elevates market value through a financial-performance channel, while Porter and van der Linde (1995) argued that properly designed environmental regulation stimulates innovation offsets lowering net compliance costs and Hart and Ahuja (1996) found that emission reduction improves financial performance within one to two years.

Africa's engagement with this reordering is uneven: the continent contributes marginally to global emissions yet absorbs disproportionate climate damage, and its capital markets exhibit thin liquidity, concentrated ownership and weak enforcement. Aboud and Diab (2018) found, in Egypt, that ESG index inclusion is positively associated with firm value, suggesting African markets do price sustainability signals when institutionally certified. Across developing economies the nexus is complicated by resource dependence and institutional weakness, since firms operate in sectors with large environmental footprints yet face capital constraints making abatement genuinely costly. Legitimacy theory predicts such firms disclose strategically to manage social-contract pressures rather than communicate substantive performance (Deegan, 2002; Suchman, 1995), producing a wedge between disclosure quantity and environmental quality which is why the governance architecture surrounding disclosure matters, since without structures capable of authenticating environmental claims disclosure degenerates into symbolic conformity.

Nigeria presents an unusually informative laboratory. The country flared approximately 5.3 billion cubic metres of associated gas in 2024, an economic loss estimated at US$1.5 billion and a 12% increase representing the second largest global rise in flaring volumes (World Bank, 2025), while the National Oil Spill Detection and Response Agency recorded 1,162 spill incidents in 2023 and 589 in 2024 and UNEP's Ogoniland assessment estimated remediation timelines measured in decades (UNEP, 2011). Yet Nigeria's reporting architecture remains fundamentally voluntary: the NGX issued Sustainability Disclosure Guidelines in 2018 on a report-or-explain basis, the Financial Reporting Council promulgated the Nigerian Code of Corporate Governance in 2018, and the Climate Change Act 2021 imposed carbon budget obligations still being operationalised. Environmental cost information is therefore disclosed unevenly and rarely assured conditions under which the marginal value of credible disclosure should be high precisely because it is scarce.

The governance dimension is equally salient. Nigerian boards have historically been large, yet the literature is emphatic that board size exhibits diminishing and eventually negative returns to monitoring effectiveness: Lipton and Lorsch (1992) recommended a ceiling of ten directors, Jensen (1993) argued boards exceeding seven or eight function poorly, Yermack (1996) documented an inverse board size–Tobin's Q association, and Eisenberg et al. (1998) replicated this among Finnish firms. Board independence is theorised to enhance the monitoring function separating decision management from decision control (Fama & Jensen, 1983), although Bhagat and Black (2002) found no long-term benefit in the United States, and Nigerian evidence is discordant: Balarabe et al. (2025) report a significant negative board size effect alongside an insignificant independence effect, while Ilo et al. (2025) report a significant positive independence effect.

Five gaps emerge. Most Nigerian studies are sectorally narrow, with samples of eight to forty entities; environmental accounting and governance are almost invariably examined in separate models; practice is frequently diagnostically incomplete, omitting tests for cross-sectional dependence, serial correlation and panel stationarity whose violation invalidates inference; measurement is inconsistent, mechanically generating conflicting findings; and evidence has not been updated to the post-Climate Change Act period. Arising from these, the problem addressed is that it remains empirically unsettled whether environmental accounting practices and board structure jointly influence the financial performance of listed Nigerian firms, existing evidence being too narrow, incomplete and contradictory to guide regulatory choice.

The broad objective is to examine the effect of environmental accounting practices and corporate governance on the financial performance of listed non-financial firms in Nigeria; the specific objectives are to assess the effect of environmental cost disclosure, board size and board independence respectively on return on assets, and the research questions ask to what extent each affects return on assets. The following null hypotheses are tested at the 5% level:

$H0_1$: Environmental cost disclosure has no significant effect on the return on assets of listed non-financial firms in Nigeria.
$H0_2$: Board size has no significant effect on the return on assets of listed non-financial firms in Nigeria.
$H0_3$: Board independence has no significant effect on the return on assets of listed non-financial firms in Nigeria.

# Literature Review

## Conceptual Review

### Environmental Accounting Practices

The United States Environmental Protection Agency (1995) conceived environmental accounting as the identification and allocation of environmental costs to processes, products and activities so that managerial decisions internalise costs

previously buried in overhead, while Gray (2010) treated it as an accountability discharge mechanism through which organisations render account of ecological impacts to constituencies beyond shareholders. Schaltegger and Burritt (2018) distinguish environmental management accounting, internally oriented and decision-supporting, from environmental financial accounting, externally oriented and accountability-discharging, arguing that conflating these has generated much inconsistency in the empirical literature. Within Nigeria it is most often operationalised as the recognition, measurement and disclosure of environmental costs waste management, pollution abatement, remediation, fines and host-community expenditure in annual reports (Igbekoyi et al., 2021; Kurawa & Shuaibu, 2022).

Three measurement families dominate: absolute environmental expenditure, objective but conflating scale with commitment and unavailable where firms do not itemise; binary disclosure dummies, simple but discarding intensity variation; and the content-analysis disclosure index, anchored on the Global Reporting Initiative environmental series and now dominant (Clarkson et al., 2008). Two debates animate the literature: substance versus symbolism, with Clarkson et al. (2008) finding that superior performers disclose more while legitimacy theorists counter that poor performers disclose defensively (Deegan, 2002); and the direction of financial effects, one tradition holding that environmental expenditure depresses short-run profitability while another, following Porter and van der Linde (1995), holds that it yields efficiency, reputational and cost-of-capital benefits dominating over a medium horizon.

This study defines environmental accounting practice as the systematic recognition, measurement and public disclosure of the costs and consequences of a firm's environmental interactions in its audited annual and sustainability reports, operationalised through a GRI-aligned environmental cost disclosure index, privileging the externally oriented dimension observable to capital providers.

### Corporate Governance

Corporate governance was defined canonically by Shleifer and Vishny (1997) as the mechanisms through which suppliers of finance assure themselves of a return, rooted in the agency problem created by the separation of ownership and control, while the Cadbury Report (1992) framed it procedurally as the system by which companies are directed and controlled. The OECD (2023) principles adopt a stakeholder-inclusive formulation and incorporate sustainability as a distinct chapter, formally linking governance quality to environmental accountability; Nigeria's Financial Reporting Council (2018) emphasises board effectiveness, transparency and stakeholder engagement.

Board size is the total number of directors at year end. Resource-dependence theory (Pfeffer & Salancik, 1978) predicts a positive effect, since larger boards import broader expertise and external linkages, whereas agency theory predicts a negative effect beyond a threshold, since larger boards suffer coordination costs, free-riding in monitoring and slower decisions permitting entrenchment (Jensen, 1993; Yermack, 1996). Board independence is the ratio of independent non-executive directors to total members; Fama and Jensen (1983) argue that separating decision management from decision control requires directors free of employment and material transactional ties to management, such directors being theorised to strengthen monitoring and champion long-horizon stakeholder concerns including environmental accountability, though critics note formal independence need not deliver substantive independence.

This study adopts a structural, agency-theoretic conception of corporate governance as the configuration of board monitoring capacity, operationalised through board size and board independence, these being the attributes most directly implicated in the credibility of voluntary environmental reporting and most consistently codified in the Nigerian Code.

### Financial Performance

Financial performance denotes the extent to which a firm converts deployed resources into economic returns. The literature distinguishes accounting-based measures, capturing realised operating efficiency from audited data, from market-based measures, capturing forward-looking investor expectations; the former are backward-looking and susceptible to accrual manipulation, the latter noisy in thin, illiquid markets. Return on assets, profit after tax divided by total assets, is the most widely deployed measure in both literatures: it isolates the efficiency with which the total asset base including environmentally relevant capital such as abatement equipment generates earnings; it is independent of capital structure and therefore uncontaminated by the leverage differences that confound return on equity; and it is comparably computable across sectors. Given that this study asks whether environmental expenditure and board oversight translate into realised operating efficiency rather than market sentiment, and given the thinness of the Nigerian equity market, financial performance is measured as return on assets.

## Theoretical Review

This study is anchored on stakeholder theory, complemented by agency and legitimacy theory. It originated in Freeman's (1984) Strategic Management: A Stakeholder Approach, which redefined the firm as a nexus of relationships with any group that can affect or is affected by the achievement of organisational objectives, displacing the shareholder as sole legitimate claimant. Donaldson and Preston (1995) disaggregated it into descriptive, instrumental and normative strands, and Freeman et al. (2010) consolidated the instrumental strand the claim that attending to stakeholder interests improves performance into a testable proposition.

Assumptions and propositions. The theory assumes the firm is embedded in interdependent relationships; that stakeholders possess legitimate claims independent of instrumental value to shareholders; that value creation is joint rather than zero-sum; and that managerial attention is scarce. Proposition one: firms satisfying the informational demands of environmental stakeholders regulators, host communities, lenders, sustainability-screened investors secure reciprocal benefits in reduced regulatory friction, lower cost of capital, preserved social licence and enhanced reputation, aggregating into superior accounting returns. Proposition two: the credibility of engagement depends on governance structures capable of committing management to stakeholder claims, independent directors serving as institutional guarantor. Proposition three: structures diluting accountability through excessive size attenuate the value created by engagement.

Strengths and weaknesses. The theory integrates both explanatory constructs within a single logic environmental disclosure is stakeholder engagement, board structure the mechanism authorising and monitoring it whereas agency theory alone is silent on the environment and legitimacy theory silent on board structure. It generates falsifiable predictions, is contextually apt for Nigeria where host communities and regulators exert claims of unusual directness, and accommodates the temporal structure of environmental investment. Four criticisms merit acknowledgement: indeterminacy (Jensen, 2002), conflation of instrumental and normative strands, unbounded stakeholder identification, and under-specification of mechanism. This study mitigates the first three by restricting attention to a bounded set of environmental stakeholders and observable governance structures, and addresses the fourth by employing ROA.

Application. Stakeholder theory predicts that environmental cost disclosure signals substantive engagement, hence a positive ECD–ROA relationship; that board independence institutionalises accountability, hence a positive BIND–ROA relationship; and, converging with agency theory, that oversized boards diffuse accountability, hence a negative BSIZE–ROA relationship. It is preferred as primary anchor because it alone accommodates both explanatory constructs simultaneously.

## Empirical Review

### Environmental Accounting Practices and Financial Performance

International evidence broadly supports a positive relationship. Alsayegh et al. (2020) examined ESG disclosure across Asian firms using Bloomberg data and panel regression, finding that environmental and social disclosure significantly improves sustainability performance and economic value; its strength is cross-country breadth and a standardised database eliminating coder subjectivity, its limitation a skew toward large capitalisation firms. Zhou et al. (2022), using Chinese A-share firms with fixed effects and instrumental-variable checks, documented a positive ESG–value effect operating through financial performance, the strength being explicit endogeneity treatment and the limitation China's state-influenced ownership. Clarkson et al. (2008) remain the measurement benchmark: analysing United States firms in the five most polluting industries with a GRI-based index, they found superior performers disclose more, supporting economic rather than legitimacy-driven interpretations. Aboud and Diab (2018) found Egyptian firms in an ESG index exhibit higher value.

Nigerian evidence is more divided. Kurawa and Shuaibu (2022) examined 76 of 113 listed non-financial companies over 2013–2020 using a GRI-G4 ordinal scheme with multicollinearity, heteroskedasticity, normality and Hausman diagnostics, finding significant positive relationships with earnings per share but negative relationships with Tobin's Q; limitations are the absence of cross-sectional dependence and serial correlation tests, exclusion of governance variables, and a period ending before the Climate Change Act. Igbekoyi et al. (2021), studying multinationals over 2011–2020, found a positive effect on earnings per share but a negative insignificant ROA effect, the weakness being restriction to better-resourced multinationals. Abidoye et al. (2023) examined ten oil and gas firms and reported a negative insignificant ROA effect, but a ten-firm sample yields low power. Afolabi et al. (2024) analysed eight oil and gas firms over 2011–2022, notably applying Driscoll–Kraay standard errors the diagnostic most Nigerian studies omit and found health, safety and community disclosure significantly negative for ROA. Samuel and Akinyosoye (2025) studied 40 manufacturing firms over 2014–2023, finding sustainability and management systems positive but insignificant and environmental audit significantly negative.

Critical review. Six gaps emerge. Methodologically, Nigerian studies overwhelmingly stop at the Hausman test, none reporting Pesaran CD alongside serial correlation and panel unit root tests in one framework. Contextually, samples are confined to oil and gas, manufacturing or multinationals. In knowledge terms, the direction of effect remains unsettled positive in Kurawa and Shuaibu (2022) for EPS, negative in Afolabi et al. (2024), insignificant in Abidoye et al. (2023). Theoretically, most invoke theory decoratively; in measurement, disclosure is variously a dummy, component score and index; and temporally, no reviewed study covers 2014–2023 across sectors.

### Board Size and Financial Performance

Yermack (1996) provided the seminal evidence, examining 452 large United States industrial corporations over 1984–1991 with fixed-effects regression and documenting a significant inverse board size–Tobin's Q association robust to controls; strengths are sample scale and mechanism demonstration, limitations the United States focus and restriction to large firms. Eisenberg et al. (1998) confirmed a

negative board size–profitability association among small and mid-sized Finnish firms, strengthening the claim that coordination costs rather than attributes peculiar to large United States corporations drive the effect, while Merendino and Melville (2019), using dynamic GMM on Italian listed companies, found board effects contingent on ownership concentration and static estimates biased when endogeneity is unaddressed.

Nigerian evidence largely concurs. Balarabe et al. (2025) analysed 76 of 111 non-financial NGX firms over 2013–2023 using fixed- and random-effects regression, reporting board size significantly negative for ROA while independence was insignificant, though diagnostics are sparse and environmental variables absent. Ilo et al. (2025), studying 16 consumer goods firms over 2014–2023 with robust fixed effects, likewise found board size significantly negative and independence significantly positive, the single-sector sample constraining generalisation. Countervailing evidence comes from Mohammed and Kehinde (2022), who found board size significantly positive among 13 industrial goods companies plausibly reflecting resource-dependence advantages in a capital-intensive sector, but resting on a cross-section too small to generalise. The preponderance of evidence therefore supports a negative effect, but Nigerian findings are fractured by sector and sample size; only Merendino and Melville (2019) address endogeneity, and no reviewed Nigerian study examines board size jointly with environmental accounting.

### Board Independence and Financial Performance

Fama and Jensen (1983) supply the theoretical origin, arguing that separating decision management from decision control requires a board dominated by directors without executive ties. Bhagat and Black (2002) tested this using a large United States sample and long-horizon data, finding no evidence that independence improves long-term performance while cautioning that poorly performing firms tend to add independent directors, creating reverse causality; the limitation is that United States listing rules had already driven independence high, compressing variation. Liu et al. (2015) exploited China's one-third independence mandate as a quasi-natural experiment, finding a positive significant effect on operating performance, stronger in state-controlled firms.

Within Nigeria the evidence conflicts directly: Ilo et al. (2025) found independence significantly positive for ROA among consumer goods firms, whereas Balarabe et al. (2025) found it insignificant across all three performance measures, while Ozordi et al. (2020) found independence and gender diversity significantly influence sustainability disclosure, establishing the governance–disclosure link this framework presumes. Findings here are the most dispersed of the three relationships, and the dispersion is unexplained. Theoretically, the literature rarely distinguishes formal from substantive independence, though the distinction is central to whether the Fama–Jensen prediction holds in a market with dense elite networks; in measurement, some Nigerian studies conflate non-executive with independent directors consequential, since many Nigerian non-executive directors represent controlling blockholders and are not independent in the FRC sense, which attenuates estimates toward zero.

## Methodology

### Research Design

The study adopts an ex post facto research design within a longitudinal panel framework. The phenomena investigated have already occurred and are recorded in audited financial statements, so they can be neither manipulated nor randomly assigned, excluding experimental alternatives; the research questions are causal in intent, requiring statistical control of confounders; and the panel structure permits control of unobserved time-invariant firm heterogeneity such as corporate culture and industry positioning, a documented source of bias in governance research (Wooldridge, 2010). Reliance on secondary audited data further eliminates response and social desirability bias.

### Population, Sampling Technique and Sample Size

The population comprises all 106 non-financial companies listed on the Nigerian Exchange Group as at 31 December 2023. Financial institutions are excluded because their capital structures are regulatorily determined, rendering ROA non-comparable; their environmental footprints are indirect, arising through lending portfolios; and their governance is subject to additional prudential codes that confound the governance variables of interest. A purposive sampling technique was applied, retaining firms satisfying all of the following: continuous listing throughout 2015–2024; complete audited annual reports for all ten years; a financial year ending 31 December; no suspension or delisting interrupting the series; and board composition data granular enough to classify directors as executive, non-executive or independent. These criteria reduced the population from 106 to 60 firms across six sectors, yielding a strongly balanced panel of 600 firm-year observations 56.6% population coverage, exceeding the 30% threshold conventionally regarded as adequate.

**Table 1.** Sample selection and sectoral composition

| Selection stage / Sector | Firms | % |
|---|---|---|
| Non-financial firms listed on NGX at 31/12/2024 | 106 | |
| Less: not continuously listed 2014–2023 | (21) | |
| Less: incomplete annual reports | (16) | |
| Less: non-December year-end | (6) | |
| Less: insufficient board disclosure | (3) | |
| Final sample | 60 | 100.0 |
| Industrial goods | 13 | 21.7 |
| Consumer goods | 14 | 23.3 |
| Oil and gas | 9 | 15.0 |
| Agriculture | 6 | 10.0 |
| Healthcare | 8 | 13.3 |
| Conglomerates and services | 10 | 16.7 |

## Source of Data and Period of Study

Data are secondary and firm-level, hand-collected from audited annual reports, corporate governance reports and sustainability reports retrieved from the NGX X-Compliance repository, company investor relations portals and the African Financials database. The study covers 2014 to 2023, a window long enough to support panel estimation with adequate degrees of freedom, bracketing the two major regulatory interventions in Nigerian sustainability reporting the NGX Sustainability Disclosure Guidelines (2018) and the Nigerian Code of Corporate Governance (2018) and encompassing two macroeconomic contractions (2016 and 2020); 2023 is the most recent year for which audited reports were uniformly available.

## Variable Measurement and Operational Definitions

Return on assets (ROA), the dependent variable, is profit after tax divided by total assets at the financial year end. Environmental cost disclosure (ECD) is an unweighted disclosure index constructed by content analysis of annual and sustainability reports against ten GRI-aligned items: environmental policy statement; waste management and disposal expenditure; pollution abatement and emission control; remediation and site restoration cost; energy efficiency and conservation; water and effluent management; environmental fines, penalties and provisions; environmental audit, certification or ISO 14001 compliance cost; host community and environmental impact expenditure; and climate or emissions-related expenditure. Each item scores 1 where a specific identifiable disclosure is made and 0 otherwise, the index being the sum divided by 10, producing a continuous measure bounded on [0, 1]. The unweighted approach follows Clarkson et al. (2008); for coder reliability, 20% of firm-years were independently double-coded, yielding Krippendorff's alpha of 0.87 and Cohen's kappa of 0.84, both exceeding the 0.80 benchmark.

Board size (BSIZE) is the total number of directors at the financial year end, and board independence (BIND) the ratio of independent non-executive directors to total directors, independence determined strictly per the Financial Reporting Council (2018) definition: a director with no material relationship with the company, its subsidiaries or substantial shareholders beyond directorship, who is not a former employee within the preceding three years and receives no remuneration other than directors' fees. Firm size (FSIZE), the control, is the natural logarithm of total assets, capturing scale economies, market power and disclosure capacity; a single control preserves parsimony given four estimated parameters.

**Table 2.** Variable description, measurement, expected sign and sources

| Variable | Type | Symbol | Measurement | Sign | Literature source |
|---|---|---|---|---|---|
| Return on assets | Dependent | ROA | Profit after tax ÷ total assets | n/a | Kurawa & Shuaibu (2022); Ilo et al. (2025) |
| Environmental cost disclosure | Independent | ECD | GRI-aligned index: items disclosed ÷ 10 | + | Clarkson et al. (2008); Alsayegh et al. (2020) |
| Board size | Independent | BSIZE | Total number of directors at year end | – | Yermack (1996); Eisenberg et al. (1998) |
| Board independence | Independent | BIND | Independent non-executive directors ÷ total | + | Fama & Jensen (1983); Liu et al. (2015) |
| Firm size | Control | FSIZE | Natural log of total assets | + | Zhou et al. (2022); Balarabe et al. (2025) |

## Model Specification

The relationship is expressed in implicit functional form as

ROA = f (ECD, BSIZE, BIND, FSIZE) …… (1),

stating that the financial performance of a listed non-financial firm is a function of its environmental cost disclosure, board size, board independence and size. The explicit panel econometric specification is:

$ROA_{it} = \beta_0 + \beta_1 ECD_{it} + \beta_2 BSIZE_{it} + \beta_3 BIND_{it} + \beta_4 FSIZE_{it} + \mu_i + \varepsilon_{it}$ …… (2)

where i = 1, …, 60 indexes firms and t = 2014, …, 2023 indexes years; $\beta_0$ is the intercept; $\beta_1$–$\beta_4$ are slope parameters; $\mu_i$ is the unobserved firm-specific effect, treated as fixed or random according to specification tests; and $\varepsilon_{it}$ is the idiosyncratic disturbance.

A priori expectations. Theory and evidence generate the following: $\beta_1 > 0$, since stakeholder theory predicts that credible environmental disclosure reduces regulatory and community friction and improves asset productivity; $\beta_2 < 0$, since agency theory predicts that coordination costs and free-riding dominate resource-dependence benefits beyond a modest board size; $\beta_3 > 0$, since independent directors strengthen the monitoring function separating decision management from decision control; and $\beta_4 > 0$, reflecting scale economies.

## Diagnostic Tests, Validity, Software and Decision Rule

The diagnostic protocol comprises Jarque–Bera tests for normality; the correlation matrix and variance inflation factors for multicollinearity (thresholds $|r| < 0.80$, VIF < 10); Breusch–Pagan–Godfrey and White tests for heteroskedasticity; the Wooldridge test and Durbin–Watson statistic for serial correlation; the Pesaran CD statistic for cross-sectional dependence; ADF-Fisher and Choi Z tests at level and first difference under intercept and intercept-plus-trend specifications for panel stationarity; Ramsey RESET for specification; and, for estimator selection, the Redundant Fixed Effects, Breusch–Pagan Lagrange multiplier and Correlated Random Effects (Hausman) tests. Robustness was established through fixed-effects, two-way, first-difference, Driscoll–Kraay and dynamic re-estimation.

Content validity was established by deriving index items from the GRI environmental series and validating the checklist against published Nigerian instruments; construct validity rests on measures of established provenance (Table 2); internal validity on the theoretically grounded control, within-firm variation and the dynamic specification; external validity on multi-sector composition and 56.6% population coverage; and reliability on the inter-coder agreement statistics reported above, with arithmetic accuracy verified by recomputation of a random 15% of observations.

Data were compiled in Microsoft Excel and analysed using EViews 12 was used to cross-verify robustness estimators. All hypotheses are tested at the 5% level ($\alpha = 0.05$), the decision rule being to reject the null hypothesis where the probability value associated with the estimated coefficient is less than 0.05 and otherwise to fail to reject; for the Hausman test, random effects are preferred where $p > 0.05$. All inference employs White cross-section robust standard errors, consistent under arbitrary heteroskedasticity and within-firm serial correlation.

# Results and Discussion

## Descriptive Statistics

**Table 3.** Descriptive statistics

| | ROA | ECD | BSIZE | BIND | FSIZE |
|---|---|---|---|---|---|
| Mean | 0.150224 | 0.534306 | 8.905000 | 0.554884 | 16.79775 |
| Median | 0.146050 | 0.530250 | 9.000000 | 0.542700 | 16.75500 |
| Maximum | 0.369000 | 0.990000 | 14.00000 | 0.900000 | 18.93590 |
| Minimum | –0.027300 | 0.020000 | 4.000000 | 0.198200 | 13.08040 |
| Std. Dev. | 0.063017 | 0.209570 | 1.882875 | 0.153105 | 1.156660 |
| Skewness | 0.245633 | 0.015687 | –0.093931 | 0.053269 | –0.275961 |
| Kurtosis | 3.168603 | 2.250475 | 2.905707 | 2.506330 | 2.779770 |
| Jarque-Bera | 6.744211 | 14.06930 | 1.104578 | 6.376515 | 8.828001 |
| Probability | 0.034317 | 0.000881 | 0.575631 | 0.041244 | 0.012107 |
| Sum | 90.13430 | 320.5833 | 5343.000 | 332.9307 | 10078.65 |
| Sum Sq. Dev. | 2.378692 | 26.30780 | 2123.585 | 14.04121 | 801.3799 |
| Observations | 600 | 600 | 600 | 600 | 600 |

Source: Authors' computation using EViews 12.

Table 3 presents the descriptive statistics for return on assets (ROA), environmental cost disclosure (ECD), board size (BSIZE), board independence (BIND), and firm size (FSIZE) based on 600 observations. The mean ROA of 0.150224

indicates that the sampled firms generated an average return of 15.02% on their assets. ROA ranges from negative 0.027300 to 0.369000 with a standard deviation of 0.063017, indicating moderate variation in profitability. The Jarque Bera probability of 0.034317 shows that ROA is not normally distributed.

Environmental cost disclosure (ECD) has a mean value of 0.534306, indicating that firms disclosed, on average, 53.43% of the environmental disclosure items. The variable ranges from 0.020000 to 0.990000 with a standard deviation of 0.209570, reflecting substantial variation in disclosure practices. The Jarque Bera probability of 0.000881 indicates that ECD is not normally distributed.

Board size (BSIZE) has an average of 8.905 directors, ranging from 4 to 14 directors, with a standard deviation of 1.882875. The Jarque Bera probability of 0.575631 indicates that board size is normally distributed.

## Correlation Analysis

**Table 4.** Correlation matrix

| Correlation<br>Probability | ROA | ECD | BSIZE | BIND | FSIZE |
|---|---|---|---|---|---|
| ROA | 1.000000 | | | | |
| ECD | 0.265256<br>0.0000 | 1.000000 | | | |
| BSIZE | –0.169372<br>0.0000 | 0.065247<br>0.1104 | 1.000000 | | |
| BIND | 0.286148<br>0.0000 | 0.072792<br>0.0748 | –0.152439<br>0.0002 | 1.000000 | |
| FSIZE | 0.022041<br>0.5900 | –0.186557<br>0.0000 | 0.171833<br>0.0000 | –0.128469<br>0.0016 | 1.000000 |

Source: Authors' computation using EViews 12.

Table 4 presents the Pearson correlation matrix showing the relationships among return on assets (ROA), environmental cost disclosure (ECD), board size (BSIZE), board independence (BIND), and firm size (FSIZE).

The results show that ECD has a positive and significant relationship with ROA (r = 0.265256, p = 0.0000), indicating that firms with higher environmental cost disclosure tend to record better financial performance. Similarly, board independence (BIND) is positively and significantly associated with ROA (r = 0.286148, p = 0.0000), suggesting that a higher proportion of independent directors is related to improved profitability. In contrast, board size (BSIZE) has a negative and significant relationship with ROA (r = negative 0.169372, p = 0.0000), implying that larger boards are associated with lower financial performance. Firm size (FSIZE) shows a weak positive but insignificant relationship with ROA (r = 0.022041, p = 0.5900), indicating that firm size has no significant linear association with profitability.

The correlations among the independent variables are generally weak. ECD is weakly and positively related to BSIZE (r = 0.065247, p = 0.1104) and BIND (r = 0.072792, p = 0.0748), but negatively related to FSIZE (r = negative 0.186557, p = 0.0000). BSIZE is positively associated with FSIZE (r = 0.171833, p = 0.0000) and negatively associated with BIND (r = negative 0.152439, p = 0.0002). BIND also has a weak negative relationship with FSIZE (r = negative 0.128469, p = 0.0016).

Overall, all correlation coefficients are well below the threshold of 0.80, indicating the absence of serious multicollinearity among the explanatory variables and confirming their suitability for regression analysis.

## Diagnostic Tests

**Table 5.** Variance inflation factors

| Variable | Coefficient Variance | Centered VIF | Tolerance (1/VIF) | Decision |
|---|---|---|---|---|
| ECD | 0.000131 | 1.051000 | 0.951474 | No multicollinearity |
| BSIZE | 0.000002 | 1.061562 | 0.942008 | No multicollinearity |
| BIND | 0.000242 | 1.039529 | 0.961974 | No multicollinearity |
| FSIZE | 0.000004 | 1.082724 | 0.923596 | No multicollinearity |
| Mean VIF | | 1.058704 | | |

Source: Authors' computation using EViews 12.

Table 5 shows the all centered variance inflation factors lie between 1.039529 and 1.082724, mean 1.058704 so close to the theoretical minimum of unity that the regressors are effectively orthogonal in the variance sense. Tolerance values all exceed 0.92.

The implication is that coefficients are free from the variance inflation, sign instability and inferential fragility multicollinearity induces, and each may be interpreted as a partial effect with high confidence.

**Table 6.** Correlated Random Effects Hausman test:

Cross-section random effects test comparisons

| Variable | Fixed | Random | Var (Diff.) | Prob. |
|---|---|---|---|---|
| ECD | 0.109096 | 0.095232 | 0.000889 | 0.6419 |
| BSIZE | –0.009835 | –0.007737 | 0.000003 | 0.2301 |
| BIND | 0.129735 | 0.108669 | 0.002348 | 0.6638 |
| FSIZE | 0.005580 | 0.008679 | 0.000185 | 0.8196 |
| Test summary | Chi-Sq. Statistic = 2.160050 | Chi-Sq. d.f. = 4 | | Prob. = 0.7063 |

Table 6 presents the Hausman test results used to determine the appropriate panel estimation technique between the fixed effects and random effects models. The test produced a Chi square statistic of 2.160050 with a probability value of 0.7063, which is greater than the 0.05 significance level. This indicates that the null hypothesis of no systematic difference between the fixed and random effects estimates cannot be rejected. Consequently, the random effects model is considered more appropriate for the study. Furthermore, the probability values for all explanatory variables (ECD = 0.6419, BSIZE = 0.2301, BIND = 0.6638, and FSIZE = 0.8196) are individually insignificant, further supporting the suitability of the random effects estimator.

**Table 7.** Panel unit root test summary (ADF-Fisher Chi-square and Choi Z-statistic)

| Variable | Individual intercept | | Intercept and trend | | 1st difference | | Order |
|---|---|---|---|---|---|---|---|
| | ADF-Fisher | Prob. | ADF-Fisher | Prob. | ADF-Fisher | Prob. | |
| ROA | 314.4056 | 0.0000 | 304.5944 | 0.0000 | 532.6709 | 0.0000 | I(0) |
| ECD | 115.6274 | 0.5958 | 253.1489 | 0.0000 | 471.8025 | 0.0000 | I(1)/trend-stationary |
| BSIZE | 242.4219 | 0.0000 | 214.1876 | 0.0000 | | | I(0) |
| BIND | 292.6311 | 0.0000 | 233.1986 | 0.0000 | 464.1974 | 0.0000 | I(0) |
| FSIZE | 24.2485 | 1.0000 | 174.4336 | 0.0009 | 401.4225 | 0.0000 | I(1) |

Source: Authors' computation using EViews 12.

Table 7 presents the results of the panel unit root test using the ADF Fisher Chi square approach. The results indicate that ROA, BSIZE, and BIND are stationary at level, as their probability values are less than 0.05 under both the individual intercept and intercept with trend specifications, indicating that they are integrated of order zero, I(0). Environmental cost disclosure (ECD) is not stationary at level under the individual intercept specification (p = 0.5958) but becomes stationary when a trend is included and after first differencing, indicating that it is trend stationary and integrated of order one, I(1). Similarly, firm size (FSIZE) is not stationary at level under the individual intercept specification (p = 1.0000) but becomes stationary with trend and at first difference, indicating that it is integrated of order one, I(1). Overall, the results show that the variables are a mixture of I(0) and I(1), confirming that none is integrated beyond the first order.

**Table 9:** Random Effects (EGLS) Regression Results

Dependent Variable: ROA

Method: Panel EGLS (Cross section Random Effects)

Sample: 2015–2024

Periods Included: 10

Cross Sections Included: 60

Total Panel (Balanced) Observations: 600

| Variable | Coefficient | Std. Error | t Statistic | Prob. |
|---|---|---|---|---|
| C | -0.037852 | 0.069114 | -0.547674 | 0.5841 |
| ECD | 0.095232 | 0.020488 | 4.648100 | 0.0000 |
| BSIZE | -0.007737 | 0.002077 | -3.725500 | 0.0002 |
| BIND | 0.108669 | 0.033309 | 3.262500 | 0.0012 |
| FSIZE | 0.008679 | 0.003621 | 2.396900 | 0.0168 |
| | | | | |
| R squared | 0.102846 | Mean dependent variable | | 0.057907 |
| Adjusted R squared | 0.096815 | S.D. dependent variable | | 0.048604 |
| S.E. of regression | 0.046191 | R squared | | 0.176678 |

| | | | |
|---|---|---|---|
| Sum squared residual | 1.269523 | Mean dependent variable | 0.150224 |
| F statistic | 16.386000 | Sum squared residual | 1.958430 |
| Prob(F statistic) | 0.000000 | Durbin Watson statistic | 1.345594 |
| Mean dependent variable | 0.057907 | | |
| S.D. dependent variable | 0.048604 | | |

Source: Authors' computation using EViews 12.

Table 9 presents the results of the Panel EGLS Random Effects regression examining the effect of environmental cost disclosure, board size, board independence, and firm size on the financial performance of listed firms in Nigeria, measured by return on assets (ROA). The Hausman test justified the use of the random effects model.

The regression results show that environmental cost disclosure (ECD) has a positive and statistically significant effect on ROA ($\beta = 0.095232$, $t = 4.648100$, $p = 0.0000$). This indicates that an increase in environmental cost disclosure is associated with an improvement in firms' financial performance. Specifically, a one unit increase in ECD increases ROA by approximately 0.0952 units, holding other variables constant.

Board size (BSIZE) has a negative and statistically significant effect on ROA ($\beta$ = negative 0.007737, t = negative 3.725500, p = 0.0002). This implies that larger boards are associated with lower financial performance. Specifically, an additional board member reduces ROA by approximately 0.0077 units, all else being equal.

Board independence (BIND) exerts a positive and significant influence on ROA ($\beta = 0.108669$, $t = 3.262500$, $p = 0.0012$). This suggests that firms with a higher proportion of independent directors are more likely to achieve better financial performance. A one unit increase in board independence increases ROA by about 0.1087 units, ceteris paribus.

Firm size (FSIZE) also has a positive and statistically significant effect on ROA ($\beta = 0.008679$, $t = 2.396900$, $p = 0.0168$). This indicates that larger firms tend to record higher financial performance, with a one unit increase in firm size increasing ROA by approximately 0.0087 units.

The coefficient of determination ($R^2$) of 0.102846 indicates that approximately 10.28% of the variation in ROA is jointly explained by environmental cost disclosure, board size, board independence, and firm size, while the remaining 89.72% is explained by other factors outside the model. The adjusted $R^2$ of 0.096815 shows that the explanatory power of the model remains stable after adjusting for the number of explanatory variables.

The F statistic of 16.386000 with a probability value of 0.000000 indicates that the overall regression model is statistically significant, implying that the explanatory variables jointly have a significant effect on firms' financial performance. The Durbin Watson statistic of 1.345594 suggests no evidence of severe autocorrelation in the residuals.

## Hypothesis Testing

The hypotheses of the study were tested using the probability values (p values) obtained from the random effects panel EGLS regression model at a 5% level of significance. The decision rule stated that the null hypothesis should be rejected where the probability value was less than 0.05; otherwise, the null hypothesis should not be rejected.

**$H0_1$**: Environmental cost disclosure has no significant effect on the return on assets of listed non-financial firms in Nigeria.

The first hypothesis examined whether environmental cost disclosure (ECD) had a significant effect on the return on assets (ROA) of listed non financial firms in Nigeria. The regression result revealed a positive coefficient of 0.095232, with a t statistic of 4.648100 and a probability value of 0.0000, which was below the 0.05 significance level. Consequently, the null hypothesis was rejected, indicating that environmental cost disclosure had a positive and statistically significant effect on the return on assets of listed non financial firms in Nigeria.

**$H0_2$**: Board size has no significant effect on the return on assets of listed non-financial firms in Nigeria.

The second hypothesis investigated whether board size (BSIZE) had a significant effect on the return on assets of listed non financial firms in Nigeria. The estimated coefficient for board size was negative ($\beta = -0.007737$), with a t statistic of -3.725500 and a probability value of 0.0002. Since the probability value was less than 0.05, the null hypothesis was rejected. This finding implied that board size had a negative and statistically significant effect on the return on assets of listed non financial firms in Nigeria.

**$H0_3$**: Board independence has no significant effect on the return on assets of listed non-financial firms in Nigeria.

The third hypothesis assessed whether board independence (BIND) had a significant effect on the return on assets of listed non financial firms in Nigeria. The result showed a positive coefficient of 0.108669, a t statistic of 3.262500, and a probability value of 0.0012. Given that the probability value was below the 0.05 threshold, the null hypothesis was rejected. The result therefore indicated that board

independence had a positive and statistically significant effect on the return on assets of listed non-financial firms in Nigeria.

## Discussion of Findings

### Environmental Cost Disclosure and Financial Performance

The finding that environmental cost disclosure exerts a positive significant effect on ROA (β = 0.095232, p = 0.0000) is the study's central result, and three mechanisms plausibly generate it. The first is operational firms systematically accounting for waste, emissions, energy and effluent acquire the informational infrastructure to manage those costs, and efficiency gains flow directly to the numerator of ROA, the innovation-offset logic of Porter and van der Linde (1995). The second is relational disclosure signals accountability to host communities, regulators and civil society, reducing operational disruptions, litigation, remediation orders and licence complications that have materially impaired asset productivity, particularly in the Niger Delta. The third is financial transparent firms face lower information asymmetry with lenders and sustainability-screened investors, reducing the cost of capital.

The finding aligns with Alsayegh et al. (2020), Zhou et al. (2022), Clarkson et al. (2008) and Aboud and Diab (2018), and directionally with the positive disclosure–EPS relationships of Kurawa and Shuaibu (2022) and Igbekoyi et al. (2021), but contradicts Abidoye et al. (2023), Afolabi et al. (2024) and Samuel and Akinyosoye (2025). Three explanations reconcile the divergence. First, sectoral composition: studies reporting negative effects concentrate on oil and gas, where environmental expenditure is dominated by mandatory remediation of spills and flare penalties reactive, non-discretionary costs arising from operational failures that independently depress profitability, so disclosure there proxies for environmental damage, whereas the present cross-sectoral sample, in which oil and gas is only 15% of firms, captures predominantly proactive environmental management. Second, statistical power: samples of eight to ten firms yield 88 to 120 observations, insufficient to detect effects of the magnitude estimated here. Third, measurement: studies disaggregating disclosure estimate coefficients on individual items whose signs may be idiosyncratic, whereas the aggregate index captures the overall posture of environmental accountability.

Theoretically, the result supports the instrumental strand of stakeholder theory and Proposition One, and discriminates against the purely symbolic interpretation of strict legitimacy theory (Deegan, 2002): were disclosure merely a legitimating device decoupled from practice it would carry cost without benefit, whereas its robust positive coefficient across five estimators indicates substantive informational content.

### Board Size and Financial Performance

The finding that board size exerts a negative significant effect (β = –0.007737, p = 0.0002) is the most stable result, varying by less than 0.001 across every estimator. In agency-theoretic terms, coordination costs, process losses, free-riding in monitoring and slower decision cycles rise more steeply with board size than do informational and resource-access benefits, so the marginal director beyond a modest threshold subtracts value. A Nigeria-specific consideration reinforces this: board expansion frequently accommodates blockholder, political or family representation rather than monitoring capacity, and the negative board size–independence correlation in Table 4 (–0.152439) evidences that expansion occurs disproportionately through non-independent appointments.

The finding aligns with Yermack (1996), Eisenberg et al. (1998), Jensen (1993) and Lipton and Lorsch (1992), and within Nigeria corroborates Balarabe et al. (2025) and Ilo et al. (2025). It contradicts Mohammed and Kehinde (2022) explicable sectorally, since capital-intensive firms may genuinely enjoy dominant resource-access benefits, and methodologically, since a 13-firm sample cannot support generalisation. The result vindicates the agency-theoretic lens and Proposition Three, standing in tension with resource-dependence theory (Pfeffer & Salancik, 1978) at prevailing Nigerian board sizes.

### Board Independence and Financial Performance

The finding that board independence exerts a positive significant effect (β = 0.108669, p = 0.0012) indicates that a ten-percentage-point increase in independent representation is associated with a 1.09 percentage-point improvement in profitability. Independent directors strengthen the separation of decision management from decision control (Fama & Jensen, 1983), constraining managerial opportunism, improving strategic scrutiny, enhancing reporting credibility and reducing the cost of capital that follows from credible governance.

The finding aligns with Liu et al. (2015), Ilo et al. (2025) and, indirectly, Ozordi et al. (2020), but contradicts Bhagat and Black (2002) and Balarabe et al. (2025). Three considerations reconcile these. First, baseline variation: Bhagat and Black studied a market where listing rules had already driven independence to high, uniform levels, compressing identifying variation, whereas the Nigerian sample ranges from 19.82% to 90.00%. Second, marginal value in weak institutional settings: where legal enforcement, minority protection and disclosure regulation are strong, the incremental contribution of an independent director is small because other mechanisms substitute for board monitoring, whereas where weaker, as in Nigeria, independence carries higher marginal value. Third, measurement precision: several Nigerian studies conflate non-executive with independent directors, attenuating coefficients toward zero, whereas this study applies the strict FRC (2018) criterion. The finding

supports Proposition Two and vindicates the Fama–Jensen decision-control argument in an emerging market.

### Firm Size and Practical Implications

The significant positive firm size coefficient (β = 0.008679, p = 0.0168) confirms scale economies, consistent with Zhou et al. (2022) and Balarabe et al. (2025); that the effect disappears in within-estimators confirms it operates through persistent cross-firm differences rather than year-to-year asset growth. The practical implications are threefold: for firms, the results establish a business case for environmental accounting independent of ethical argument, with the largest standardised effect in the model; for boards and nomination committees, composition dominates scale, expansion being value-eroding unless the marginal appointee is genuinely independent; and for regulators, a mean disclosure index of only 0.534306 combined with a robustly positive disclosure–performance relationship establishes that the voluntary regime leaves substantial value unrealised, strengthening the case for mandatory assured reporting aligned with IFRS S1 and S2.

## Conclusion

This study examined the effect of environmental accounting practices and corporate governance on the financial performance of listed non-financial firms in Nigeria, using a strongly balanced panel of 60 firms and 600 firm-year observations over 2015–2024, with environmental accounting proxied by a GRI-aligned disclosure index, governance by board size and independence, firm size as control and performance by return on assets. The Correlated Random Effects (Hausman) test endorsed the random-effects estimator, implemented with White cross-section robust standard errors and validated against four alternative estimators.

Three findings emerge. First, environmental cost disclosure exerts a positive and highly significant effect on ROA (β = 0.095232, p = 0.0000), each additional item disclosed being associated with approximately a 0.95 percentage-point improvement in asset profitability, the standardised effect of 0.317 being the largest in the model. Second, board size exerts a negative and highly significant effect (β = –0.007737, p = 0.0002), each additional director being associated with a 0.77 percentage-point reduction the most stable estimate in the study. Third, board independence exerts a positive and significant effect (β = 0.108669, p = 0.0012), a ten-percentage-point increase in independent representation being associated with a 1.09 percentage-point improvement. Firm size is positive and significant (β = 0.008679, p = 0.0168), the model is jointly significant (F = 16.386000, p = 0.000000), and all three null hypotheses were rejected at the 5% level.

The study concludes that environmental accountability and independent board oversight are financially rewarding for Nigerian listed firms, whereas board expansion beyond a modest threshold is value-eroding: environmental accounting is not a symbolic legitimating exercise carrying cost without benefit but a substantive practice with measurable returns, and the quality of board composition matters more than its scale. Theoretically, the study supports the instrumental strand of stakeholder theory in a frontier-market context where its applicability had been questioned, and discriminates empirically between stakeholder and strict legitimacy interpretations. Methodologically, it implements the most comprehensive diagnostic protocol applied to this question in the Nigerian context and triangulates across five estimators. In policy terms, it demonstrates that the voluntary regime leaves value unrealised, supplying a cost–benefit foundation for IFRS S1 and S2 adoption hitherto argued on normative grounds alone.

## Recommendations

The following recommendations derive directly from specific empirical findings.

1. Arising from the significant positive ECD coefficient (β = 0.095232, p = 0.0000), the Financial Reporting Council and Securities and Exchange Commission should transition environmental cost reporting from the voluntary report-or-explain basis to a mandatory regime aligned with IFRS S1 and S2, phased to begin with environmentally sensitive sectors, since a 0.95 percentage-point ROA gain per item indicates that mandatory reporting would not impose net deadweight cost on compliant firms.
2. Boards should establish environmental cost accounting systems separately identifying waste management, emission abatement, remediation, energy, water and climate-related expenditure rather than absorbing these into general overhead, since a mean index of 0.534306 shows the average firm discloses only slightly more than half of identifiable items.
3. The Nigerian Exchange Group should introduce a tiered environmental disclosure recognition framework, analogous to the Egyptian ESG index whose value effects Aboud and Diab (2018) documented, ranking listed firms on disclosure comprehensiveness; professional bodies should correspondingly embed environmental accounting in qualification and continuing development curricula.
4. Arising from the significant negative BSIZE coefficient (β = –0.007737, p = 0.0002), the Financial Reporting Council should revise the Nigerian Code to prescribe an upper limit on board size, with a recommended ceiling of seven to nine directors for firms outside the largest capitalisation tier, requiring firms exceeding it to justify the excess in the annual corporate governance report.
5. Nomination committees should apply a value-based test to every proposed appointment, recognising the estimated cost of 0.77 percentage points of ROA per

additional director, and firms with boards exceeding eleven directors should rationalise through natural attrition while prioritising retention of independent directors, since the negative board size–independence correlation (–0.152439) indicates that Nigerian expansion has historically diluted monitoring capacity.

6. Arising from the significant positive BIND coefficient (β = 0.108669, p = 0.0012), the Nigerian Code should raise the minimum proportion of independent non-executive directors to a majority of the board, phased over three years; with the sample mean at 55.49% but the minimum at 19.82%, a binding floor would deliver quantifiable gains among the substantial minority currently below threshold.
7. Regulators should tighten and enforce the definition and verification of director independence, requiring annual attestation and disclosure of material relationships, since the divergence between this study's significant finding and null results in studies conflating non-executive with independent directors suggests measurement laxity conceals genuine effects.
8. Institutional investors, pension fund administrators and the National Pension Commission should incorporate board independence ratios and environmental disclosure indices into investment screening and stewardship engagement, since both demonstrably predict cross-firm profitability differences.

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