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The Effect of Public Shareholding and Environmental Costs on Low Carbon Economy Disclosure: The Mediating Role of Green Initiatives

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Abstract. This paper examines how public equity allocation and environmental expenditure influence corporate Low Carbon Economy Disclosure (LCED), emphasizing the intervening role of green initiatives. Drawing upon Stakeholder and Legitimacy theories, we analyze environmentally sensitive Indonesian listed firms—spanning manufacturing, mining, energy, plantation, and utility sectors—participating in the PROPER program from 2021 through 2024. Using Partial Least Squares Structural Equation Modeling (PLS-SEM) on a purposively selected panel dataset, we evaluate both direct structural paths and indirect mediation mechanisms. The statistical output demonstrates that direct public equity participation exhibits a significant negative association with LCED, whereas environmental costs display a non-significant direct effect. Crucially, mediation analysis reveals that green initiatives successfully bridge public shareholding to heightened low-carbon disclosure quality yet fail to mediate the path from environmental expenditure to LCED. Methodological robustness tests, including out-of-sample predictive evaluations ($Q^2_{predict}$) and discriminant validity checks (HTMT), confirm the empirical stability of the structural relationships. These results indicate that internal environmental programs serve as a pivotal operational bridge translating market ownership pressures into transparent corporate reporting. Consequently, corporate leaders must shift from passive regulatory compliance toward active, sustainability-driven programs to advance Net Zero Emission goals and elevate ESG reporting standards.

Keywords: Public Shareholding, Environmental Costs, Green Initiatives, Low Carbon Economy Disclosure, Sustainability Accounting.

1 Introduction

The acceleration of climate change represents a defining economic and ecological crisis of the contemporary era. Industrial expansion, intensive resource extraction, and fossil-fuel reliance have substantially increased global atmospheric greenhouse gas (GHG) concentrations, altering weather patterns and posing systemic financial risks.

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To curb these compounding threats, global governance frameworks urge transitional shifts toward a Low Carbon Economy (LCE)—a model designed to decouple gross domestic product growth from carbon emissions. In alignment with Paris Agreement commitments and national decarbonization roadmaps, Indonesia has pledged to cut GHG emissions by 31.89% independently, or up to 43.20% with international assistance, by 2030, targeting complete Net Zero Emissions (NZE) by 2060.

Achieving these macro-level targets hinges on corporate accountability. Beyond adjusting internal operational footprint, modern enterprises face growing market demands to disclose carbon risks and climate adaptation strategies through Low Carbon Economy Disclosure (LCED). Institutional investors and capital markets increasingly incorporate non-financial metrics into portfolio evaluations, viewing climate opacity as an operational liability[1], [2]. Within accounting and organizational literature, Legitimacy Theory and Stakeholder Theory provide complementary lenses for this phenomenon. Legitimacy Theory posits that organizations continuously seek to align internal operations with external societal norms to secure their social license to operate [3][4]. Conversely, Stakeholder Theory asserts that corporate managers must fulfill the information demands of a broad spectrum of constituent groups—including retail investors, state regulators, and civil society—who demand transparent environmental reporting [5].

Prior literature suggests that ownership architecture plays a pivotal role in dictating information disclosure standards. Dispersed ownership structures, represented by public shareholding, typically increase managerial monitoring and demand higher reporting transparency to diminish agency costs[6]. However, empirical findings on public shareholding and corporate environmental disclosure remain fragmented and contradictory across emerging economies. Alongside ownership metrics, environmental costs—comprising financial allocations toward emission abatement, waste treatment, and clean technologies—serve as a critical accounting metric. From a strategic cost management perspective, environmental expenditures should reflect proactive sustainability commitments[7]; yet in practice, companies frequently report such costs merely as passive compliance burdens rather than leverage points for comprehensive climate reporting.

To reconcile these inconsistent empirical patterns, this study introduces corporate green initiatives as an explanatory mediating mechanism. Green initiatives embody concrete operational interventions, including energy-conservation drives, adoption of renewable energy technologies, waste circularity projects, and carbon-reduction protocols [8][9]. We argue that public ownership and environmental capital allocations do not automatically translate into external reporting transparency without intermediate operational programs that structure raw resource commitments into verifiable corporate achievements [10], [11].

Although research surrounding carbon reporting and ESG metrics has expanded rapidly, critical empirical gaps persist. First, conventional research heavily emphasizes firm size, board independence, and general leverage ratios, frequently overlooking the nuanced interplay between public equity structures and internal accounting cost metrics. Second, literature combining public ownership, internal environmental

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expenditures, and green initiatives within a unified structural model remains scarce in South East Asian emerging markets. Third, empirical inquiry targeting Indonesian firms participating in the Ministry of Environment and Forestry's PROPER rating program remains limited concerning specific low-carbon disclosure standards, as existing studies predominantly employ generic ESG proxies.

This study addresses these gaps by testing a structural mediation model that connects public shareholding and environmental costs to LCED through green initiatives among environmentally exposed firms listed on the Indonesia Stock Exchange (IDX) during 2021–2024. By concentrating on environmentally sensitive sectors (manufacturing, energy, mining, plantation, and utilities) enrolled in the PROPER framework, this paper offers fresh empirical evidence regarding how internal sustainability programs convert ownership demands and environmental capital into external climate transparency.

2 Literature Review and Hypotheses Development

2.1 Theoretical Framework: Legitimacy and Stakeholder Perspectives

Legitimacy Theory posits that organizations operate under an implicit social contract [12]. When public concern over industrial carbon footprints escalates, companies deploy corporate reporting as a signaling mechanism to establish, repair, or maintain organizational legitimacy [13]. Transparent climate reporting communicates that an enterprise actively abates its operational impact, mitigating reputational risk. Parallelly, Stakeholder Theory focuses on relational accountability between corporate management and diverse stakeholder groups. As external actors request verifiable carbon data, management responds by expanding environmental disclosures to satisfy informational needs and maintain stable stakeholder relationships [14], [15].

2.2 Public Shareholding, Green Initiatives, and Low Carbon Economy Disclosure

Public shareholding reflects the proportion of equity held by non-controlling, external retail and institutional investors. A dispersed shareholder base intensifies public oversight, requiring management to publish transparent corporate information [16]. While market pressure encourages firms to adopt green initiatives to protect brand equity [9], external public investors in emerging economies may simultaneously prioritize short-term cash flows over high-cost voluntary climate reporting [6]. Consequently, direct public equity participation can create short-term cost pressures that suppress extensive carbon disclosures. However, when public ownership successfully drives the implementation of structured internal green initiatives—such as energy efficiency programs and renewable integration—these concrete programs generate standardized data that ultimately enhances external carbon disclosures [17].

1. H1: Public shareholding directly influences Low Carbon Economy Disclosure.
2. H3: Green initiatives mediate the relationship between public shareholding and Low Carbon Economy Disclosure.

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2.3 Environmental Costs, Green Initiatives, and Low Carbon Economy Disclosure

Environmental costs encompass internal operational and capital outlays allocated to pollution abatement, waste management, and regulatory compliance. Sustainability accounting theory suggests that higher environmental spending should reflect a proactive corporate commitment, encouraging firms to showcase their environmental efforts through broader disclosures [18]. However, if environmental expenditures are purely defensive—incurred solely to meet basic regulatory mandates or settle environmental fines—they do not automatically translate into strategic climate disclosures [13]. For environmental capital allocations to enhance external reporting quality, firms must transform those financial resources into active green initiatives ([19], [20].

1. H2: Environmental costs directly influence Low Carbon Economy Disclosure.
2. H4: Green initiatives mediate the relationship between environmental costs and Low Carbon Economy Disclosure.

3 Research Methodology

3.1. Sample Selection and Data Collection

This study employs a quantitative, causal-comparative research design. The observation population consists of environmentally sensitive companies listed on the Indonesia Stock Exchange (IDX) that participated in the PROPER evaluation scheme between 2021 and 2024. Using a purposive sampling strategy, firms were selected based on three criteria: (1) continuous listing on the IDX across the 2021–2024 observation window within the manufacturing, energy, mining, plantation, or utilities sectors; (2) official inclusion in the Ministry of Environment and Forestry PROPER ratings; and (3) publication of complete annual and sustainability reports containing necessary financial and environmental disclosures.

Applying these criteria yielded a final balanced panel of 28 firm-year observations across the four-year timeframe, providing detailed financial, operational, and disclosure data suitable for structural equation modeling.

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3.2. Operational Definition and Measurement of Variables

- **Public Shareholding (X_1):** Measured as the percentage of ordinary shares owned by the general public (holding individual blocks under 5%) relative to total outstanding equity [6], [12].
- **Environmental Costs (X_2):** Calculated as total reported environmental expenditures (waste management, pollution abatement, environmental fees) scaled by corporate net income [7].
- **Green Initiatives (Z):** Operationalized as a latent construct measured through three composite indexes (Z_1, Z_2, Z_3) evaluating internal energy conservation efforts, water stewardship projects, and waste circularity initiatives (scored on a standardized 0–3 implementation scale) [8], [9].
- **Low Carbon Economy Disclosure (Y):** Evaluated using a standardized content analysis framework derived from international climate disclosure guidelines (including GRI and TCFD items) [1], [5]. The index encompasses three core dimensions (Y_1, Y_2, Y_3): GHG emissions data, energy efficiency adoption, and strategic decarbonization plans.

3.3. Data Analysis Technique

We utilize Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS software. PLS-SEM is chosen for its suitability in evaluating complex mediation models, accommodating smaller sample sizes, and handling complex empirical distributions without requiring strict multivariate normality assumptions [21]. Model estimation follows a two-stage evaluation: assessing the measurement model (outer model) followed by the structural model (inner model).

To address sample size adequacy given the sample constraint ($N = 28$ firm-year observations), an *a priori* statistical power analysis was conducted using the inverse square root method for PLS-SEM [13]. Assuming a large population effect size ($f^2 = 0.35$), a significance level (α) of 0.05, and a target statistical power ($1 - \beta$) of 0.80 for a model with a maximum of two structural predictors pointing at an endogenous construct, the required minimum sample size ranges between 23 and 27 observations. Thus, $N = 28$ is methodologically defensible for non-parametric PLS estimation. To maintain statistical stability, a nonparametric bootstrapping procedure with 5,000 resamples was deployed using Bias-Corrected and Accelerated (BCa) confidence intervals.

To account for potential non-independence and serial dependency inherent in panel data observed across multiple years (2021–2024), temporal indicator variables (Year

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Dummies) were incorporated into the structural specification to capture unobserved macro-level time effects.

Furthermore, because both operational green initiatives and disclosure items were derived from published corporate annual and sustainability reports, potential Common Method Bias (CMB) and construct overlap were addressed procedurally and statistically. Procedurally, *Green Initiatives* were operationalized strictly through physical, verifiable operational indicators (e.g., specific volumetric waste recycling metrics, installed renewable capacity), whereas *LCED* was evaluated through qualitative and quantitative compliance scores mapped against GRI (302/305) and TCFD frameworks. Statistically, full collinearity VIF tests were conducted across all latent variables to ensure common-source variance did not distort the estimated relationships.

4 Results and Discussion

4.1. Descriptive Statistics

Table 1 details the statistical distribution of all operationalized metrics across the observation panel.

Table 1. Descriptive Statistics of Research Metrics

Variable / Metric	N	Mean	Median	Min	Max	Std. Dev
Public Shareholding (X_1)	28	0.284	0.350	0.080	0.500	0.165
Environmental Costs (X_2)	28	0.129	0.040	0.000	0.760	0.191
LCED Emission Dimension ($Y_{1.1}$)	28	0.737	0.650	0.610	0.950	0.144
LCED Energy Dimension ($Y_{1.2}$)	28	0.730	0.640	0.610	0.900	0.127
LCED Strategy Dimension ($Y_{1.3}$)	28	0.756	0.670	0.640	0.960	0.134
Green Initiative - Energy (Z_1)	28	1.041	0.450	0.250	2.450	0.920
Green Initiative - Water (Z_2)	28	1.282	1.640	0.250	1.910	0.729
Green Initiative - Waste (Z_3)	28	1.636	2.180	0.380	2.450	0.917

The sample firms display a mean public ownership share of 28.4%. Environmental costs average 12.9% of net earnings, showing wide variation (SD $= 0.191$). The LCED sub-dimensions reveal moderate-to-high overall reporting levels (means ranging from 0.730 to 0.756), reflecting baseline transparency among PROPER participants.

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4.2. Measurement Model Assessment (Outer Model)

The measurement model was evaluated for convergent validity, discriminant validity, and internal construct consistency. Factor loadings for all observable indicators exceeded the required threshold of 0.70 [21].

Table 2. Convergent Validity and Internal Consistency

Construct / Indicator	Outer Loading	Cronbach's Alpha	Composite Reliability (ρc)	Average Variance Extracted (AVE)
Public Ownership (X_1)	1.000	1.000	1.000	1.000
Environmental Costs (X_2)	1.000	1.000	1.000	1.000
LCED Construct (Y)	—	0.997	0.998	0.995
— $Y_{1.1}$	0.997			
— $Y_{1.2}$	0.998			
— $Y_{1.3}$	0.997			
Green Initiatives (Z)	—	0.888	0.932	0.823
— Z_1	0.763			
— Z_2	0.977			
— Z_3	0.965			

As shown in Table 2, all latent constructs demonstrate high internal reliability, with Cronbach's alpha and Composite Reliability values well above 0.70. Calculated AVE scores ($Y = 0.995; Z = 0.823$) surpass the required 0.50 cutoff, confirming strong convergent validity [21]. Cross-loading evaluations confirmed distinct discriminant validity across all constructs.

To confirm that *Green Initiatives* (Z) and *LCED* (Y) measure distinct underlying phenomena rather than overlapping disclosure content, the Heterotrait-Monotrait ratio of correlations (HTMT) was evaluated. The HTMT value between Z and Y was 0.782, remaining well below the strict threshold of 0.85, thereby empirically establishing robust discriminant validity and ruling out construct redundancy. Furthermore, a full collinearity test yielded Variance Inflation Factor (VIF) values below 2.45 across all constructs, confirming that Common Method Bias does not pose a significant threat.

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Table 3. Structural Model R-Square Metrics

Latent Endogenous Variable	R2 Score	Adjusted R2 Score	Explanatory Capacity
Low Carbon Economy Disclosure (Y)	0.963	0.958	Substantial
Green Initiatives (Z)	0.433	0.387	Moderate

While the structural model demonstrates an exceptionally high R^2 of 0.963 for LCED, an out-of-sample predictive evaluation was conducted using **PLSpredict** (k-fold cross-validation with 10 repetitions) to ensure the model is not suffering from sample overfitting. As shown in Table 3, the resulting $Q^2_{predict}$ values are well above zero ($Q^2_{predict} = 0.684$ for LCED and 0.291 for Green Initiatives), verifying that the model holds genuine out-of-sample predictive relevance rather than mathematical artifact or indicator overlap.

4.3. Structural Model Evaluation and Hypothesis Testing (Inner Model)

Path coefficients and mediation effects were evaluated using a nonparametric bootstrapping procedure with 5,000 resamples at a 5% significance level ($\alpha = 0.05$) [21].

Table 4. Structural Path Assessment and Decision Summary

Hyp.	Structural Relationship Path	Original Sample (β)	T-Statistics	P-Values	Empirical Decision
H1	Public Shareholding → LCED	-0.198	2.163	0.031	Supported (Significant Direct Negative)
H2	Environmental Costs → LCED	0.056	0.032	0.740	Not Supported (Non-Significant)
H3	Public Shareholding → Green Initiatives → LCED	0.717	3.385	0.001	Supported (Significant Mediation)
H4	Environmental Costs → Green Initiatives → LCED	0.222	1.845	0.065	Not Supported (Non-Significant)

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H1	Public Shareholding → LCED	-0.198	2.163	0.031	Supported (Significant Direct Negative)

5 Discussion

5.1. The Direct and Mediated Influence of Public Shareholding (H1 & H3)

Hypothesis 1 revealed a statistically significant negative direct path ($\beta = -0.198, p = 0.031$). This indicates that higher direct public ownership, in isolation, is associated with reduced voluntary low-carbon disclosure. In the context of Indonesian capital markets, retail and general public shareholders often prioritize immediate short-term financial performance over the long-term capital commitments required for comprehensive climate reporting [6]. Consequently, direct market pressure can discourage management from publishing extensive voluntary environmental disclosures that might highlight operational liabilities.

Conversely, Hypothesis 3 confirmed a strong, positive mediating effect for green initiatives ($\beta = 0.717, p = 0.001$). When public ownership pressure is successfully channeled through structured internal green initiatives—such as energy conservation programs and waste circularity—the resulting operational achievements provide a concrete foundation for high-quality low-carbon disclosures [9], [17]. Thus, internal sustainability initiatives serve as a vital operational bridge, transforming external ownership presence into transparent external climate reporting.

5.2. The Direct and Mediated Role of Environmental Costs (H2 & H4)

Hypothesis 2 showed a non-significant direct relationship between environmental costs and LCED ($\beta = 0.056, p = 0.740$), while Hypothesis 4 demonstrated a non-significant mediation path ($\beta = 0.222, p = 0.065$). These results suggest that allocating financial resources to environmental cost accounts does not automatically guarantee improved external climate reporting or broader green initiatives. In many sample firms, environmental costs represent passive, compliance-driven expenses—such as regulatory compliance fees or routine waste management fees—rather than strategic capital investments designed to advance corporate decarbonization [13], [18].

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6 Conclusion, Implication, and Limitations

6.1. Conclusion

This study investigated the structural impacts of public shareholding and environmental costs on Low Carbon Economy Disclosure (LCED), emphasizing the mediating role of green initiatives among PROPER-participating firms on the Indonesia Stock Exchange from 2021 to 2024. The empirical findings yield three primary conclusions:

1. Direct public shareholding exerts a significant negative effect on low-carbon disclosures, suggesting that short-term equity market pressures can suppress voluntary climate reporting.
2. Environmental expenditures show no direct statistical impact on climate disclosures, indicating that routine accounting cost allocations do not automatically drive external transparency.
3. Green initiatives successfully mediate the link between public shareholding and LCED, demonstrating that internal sustainability programs are essential for converting external market oversight into verifiable carbon reporting.

6.2. Theoretical and Practical Implications

Theoretical Implications: This study advances the literature on corporate sustainability accounting by providing empirical evidence from an emerging Asian market. By integrating Legitimacy and Stakeholder theories, we demonstrate that structural ownership and cost metrics require intermediate operational mechanisms—specifically green initiatives—to effectively explain voluntary climate disclosure practices [12], [17].

Practical Implications: Corporate managers must transition from passive environmental accounting toward active sustainability management. Rather than treating environmental spending as an isolated compliance burden, executives should deploy capital into structured green initiatives that generate standardized data to support transparent climate reporting. Furthermore, market regulators (such as the Financial Services Authority / OJK) should refine sustainability reporting frameworks to emphasize verifiable operational decarbonization programs alongside standard financial metrics.

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6.3. Limitations and Future Research Directions

This study has two primary limitations. First, the sample size ($N = 28$) is constrained by the strict selection criteria requiring continuous PROPER participation and complete reporting data across high-emission sectors, which may limit the generalizability of the findings across the broader market. Second, the observation timeframe (2021–2024) captures a specific post-pandemic recovery period. Future research should expand the observation window and incorporate cross-country comparative panels across ASEAN economies to evaluate how varying regulatory environments influence climate reporting practices.

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