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Environmental Performance and Green Investment Effects on Plantation Firm Value

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Abstract

This research investigates environmental performance and green investment influences on firm value among plantation companies listed on the Indonesia Stock Exchange (2020–2023). Employing quantitative methodology with purposive sampling, 11 companies yielded 39 observations following outlier removal. Environmental performance was assessed through PROPER ratings, green investment via environmental cost ratios, and firm value using Tobin's Q. Multiple linear regression analysis via SPSS 26 revealed that environmental performance exhibits no significant effect on firm value, while green investment demonstrates negative significant impact. Simultaneously, both variables explain 17.3% of firm value variation. Findings suggest that short-term green investment costs may suppress immediate valuations despite potential long-term sustainability benefits, with environmental performance not yet fully recognized in market assessments.

Keywords: *Environmental performance, green investment, firm value, Tobin's Q, PROPER, plantation sector, sustainability*

Introduction

Contemporary organizations pursue dual objectives encompassing short-term profit maximization through resource optimization and long-term value enhancement reflecting prospective buyers' willingness to pay upon potential sale transactions (Novari & Lestari, 2016; Zhang et al., 2020). Firm value determination increasingly incorporates fundamental factors beyond traditional financial metrics, specifically environmental performance and green investment considerations (Ahmed et al., 2021). Modern stakeholders recognize that companies cannot rely exclusively on financial performance but must integrate non-financial dimensions including environmental impact management (Byus et al., 2010; Li & Wu, 2020).

Environmental impact prediction capabilities enable organizations to implement anticipatory measures through sustainable business frameworks, thereby reducing operational risks and preventing escalating ecological damage (Chen & Zhang, 2021). Contemporary shareholders increasingly prioritize environmental issues as critical factors influencing business sustainability trajectories (Flammer, 2021). Consequently, companies face expectations to adopt "green" business practices minimizing negative environmental externalities (Xie et al., 2022).

Indonesian plantation sector firms confront environmental performance challenges stemming from waste generation associated with operational activities (Tarmuji et al., 2020). The Ministry of Environment addresses these concerns through the Corporate Performance Rating Program in Environmental Management (PROPER), designed to maximize corporate participation in environmental preservation initiatives (Sulistiyowati et al., 2021). Additionally, firm value faces potential constraints from green investment decisions, where organizations emphasizing sustainability often secure enhanced financing access through environmentally conscious investors, including green bond mechanisms (Flaherty et al., 2022). Companies investing in renewable energy technologies—such as solar or wind systems—gain recognition as carbon footprint reduction leaders (Broadstock et al., 2021).

This investigation examines environmental performance and green investment effects on plantation sector firm valuations, addressing gaps in understanding how sustainability factors influence market perceptions within Indonesia's agricultural contexts.

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Literature Review
Theoretical Foundation: Legitimacy Theory
Legitimacy theory, introduced by Dowling and Pfeffer (1975), emphasizes reciprocal relationships between organizations and society, positing that community support constitutes essential infrastructure for sustainable corporate growth (Deegan, 2019). Organizations pursue legitimacy acquisition and maintenance through alignment with societal norms and expectations (Suchman, 1995). When societies perceive organizational non-compliance with established norms or regulations, legitimacy faces potential revocation, threatening operational continuity (Tilling, 2020).

Legitimacy represents governance systems prioritizing alignment with stakeholder interests, including policymakers, individuals, and community groups, thereby emphasizing public interest service (O'Donovan, 2002; Cho et al., 2015). Organizational legitimacy emerges when existence aligns with surrounding social value systems; discrepancies potentially compromise legitimacy status (Prasojo, 2013; Dowling & Pfeffer, 1975). Society continuously evaluates institutional and corporate environmental performance, necessitating business activity adjustments reflecting community expectations (Deegan, 2019).

Social responsibility implementation and disclosure represent efforts responding to societal expectations, whereby consistent adaptation to social norms facilitates acceptance and enables sustained business operations (Tilling, 2020; Lindblom, 1993).

Firm Value
Firm value constitutes the price prospective buyers would pay during sale transactions, serving as critical valuation benchmarks following public listing through share offerings (Suwardika & Mustanda, 2017; Brigham & Ehrhardt, 2020). Enhanced firm value typically correlates with increased shareholder wealth accumulation (Dwi Purnomo et al., 2021; Ross et al., 2021). Rising stock prices directly reflect elevated corporate valuations, demonstrating owner objectives achievement through greater shareholder wealth generation attracting additional investor interest (Brealey et al., 2020).

Stock market prices encapsulate shareholder wealth derived from investment, financing, and asset management decisions (Damodaran, 2021). Tobin's Q offers distinct advantages for assessing firm value and future profitability prospects through market-to-book value ratios (Ruan et al., 2009; Erickson & Whited, 2022). This metric effectively captures market expectations regarding organizational performance trajectories and growth potential (Chung & Pruitt, 1994; Smithers & Wright, 2020).

Environmental Performance
Environmental performance encompasses organizational actions protecting and improving environmental conditions, aiming to reduce negative business activity impacts while maintaining healthy, sustainable ecosystems (Eni, 2020; Trumpp & Guenther, 2017). According to Meiyana and Aisyah (2019), environmental performance represents regulatory mechanisms integrating environmental considerations into operational frameworks, creating stakeholder synergies (Ioannou & Serafeim, 2015).

Environmental performance reflects achievements from organizational efforts rejecting, controlling, and managing activity-related natural impacts (Darnall et al., 2008; Agan et al., 2020). Measurement constitutes key environmental management system components, providing concrete indicators regarding implementation effectiveness (International Organization for Standardization, 2015). Indonesian environmental performance assessment operates through Ministry of Environment authority via PROPER programs, categorizing companies using color-coded ratings: Gold (excellent), Green (very good), Blue (good), Red (poor), and Black (very poor) (Sulistiyowati et al., 2021; Arimura et al., 2008).

Green Investment
Green investment encompasses governmental or corporate fund allocation toward environmentally beneficial initiatives, including biodiversity preservation and climate damage prevention (Zhang & Berhe, 2022; Inderst

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et al., 2012). Ramadhani and Astuti (2023) define green investment as capital deployment focusing on organizations committed to natural resource preservation or environmentally friendly business practices (Reboredo, 2018).

Green investment implementation represents strategies enabling profit enhancement without environmental degradation (Climent & Soriano, 2011). Such investments provide social legitimacy by demonstrating organizational alignment with environmental and social norms (Fernando et al., 2017). Legitimacy acquisition facilitates community-supported business activities enhancing profitability while ensuring long-term economic and environmental sustainability (Flammer, 2021). Green investments reduce risks associated with climate change, energy volatility, water scarcity, and biodiversity loss, subsequently enhancing firm valuations (Giglio et al., 2021; Bolton & Kacperczyk, 2021).

Hypotheses Development

H$_1$: Environmental performance positively and significantly influences firm value.

Superior environmental performance signals responsible organizational behavior, potentially enhancing stakeholder confidence and investor attraction (Trumpp & Guenther, 2017). Companies demonstrating environmental commitment through PROPER excellence gain competitive advantages and improved reputational capital (Sulistiyowati et al., 2021).

H$_2$: Green investment negatively and significantly influences firm value.

Initial green investment implementation often requires substantial capital expenditures for technology adoption and process modifications, potentially suppressing short-term financial performance and immediate valuations (Przychodzen & Przychodzen, 2015). Market participants emphasizing rapid financial returns may perceive green investments as less profitable during initial phases (Climent & Soriano, 2011).

H$_3$: Environmental performance and green investment simultaneously influence firm value.

Legitimacy theory suggests that combined environmental performance excellence and green investment demonstrate comprehensive sustainability commitment, potentially strengthening stakeholder relationships and market positioning (Deegan, 2019). Synergistic effects from dual sustainability dimensions may collectively influence firm value assessments (Fernando et al., 2017).

Methods

Research Design

This investigation employs quantitative methodologies analyzing relationships among green investment, environmental performance, and firm value within plantation companies listed on Indonesia Stock Exchange (IDX) during 2020–2023 (Creswell & Creswell, 2018). The research utilizes descriptive statistics verification with secondary data sources including company financial statements and sustainability reports obtained through IDX and OJK (Financial Services Authority) official platforms.

Population and Sample

The research population comprises 23 plantation sector companies listed on IDX during the 2020–2023 observation period. Purposive sampling with judgment sampling techniques selected appropriate samples based on predetermined criteria (Sekaran & Bougie, 2020):

Sample Selection Criteria:
1. Plantation companies listed on IDX during 2020–2023
2. Companies publishing complete annual reports and financial statements
3. Companies maintaining consistent operational activities throughout observation periods
4. Companies distributing PROPER ratings during 2020–2023
5. Companies recording environmental cost disclosures during research periods

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From 23 eligible companies, 11 companies satisfied all criteria, yielding 44 initial observations. Following SPSS 26 data processing identifying one extreme outlier, the final analytical sample comprised 39 observations.

Variable Operationalization

Dependent Variable: Firm Value

Firm value reflects market perceptions of corporate success in generating shareholder wealth-enhancing returns (Brigham & Ehrhardt, 2020). This study employs Tobin's Q ratio (Chung & Pruitt, 1994):

Tobin's Q = (MVE + Debt) / Total Assets

Where:

- MVE = Outstanding Shares × Closing Stock Price
- Debt = Total Liabilities
- Total Assets = Book value of total assets

Independent Variables

Environmental Performance (X_1)

Environmental performance represents organizational achievements in avoiding, controlling, and managing activity-related environmental impacts, measured through PROPER color ratings (Sulistiyowati et al., 2021). Following Harahap et al. (2019), PROPER ratings receive numerical transformations:

- Gold = 5
- Green = 4
- Blue = 3
- Red = 2
- Black = 1

Natural logarithm transformations normalize distributions:

Environmental Performance = Ln(PROPER Score)

Green Investment (X_2)

Green investment constitutes environmental cost allocations relative to total assets, reflecting organizational commitment to sustainability initiatives (Zhang & Berhe, 2022). Measurement follows environmental cost disclosure approaches:

Green Investment = Environmental Costs / Total Assets

Data Analysis Techniques

Descriptive Statistics

Descriptive analysis characterizes variable distributions through central tendency measures (mean, median, mode), dispersion indicators (standard deviation), and range identification (minimum, maximum values) (Tabachnick & Fidell, 2019).

Classical Assumption Tests

Normality Test: Kolmogorov-Smirnov test evaluates whether residuals follow normal distributions, with significance > 0.05 indicating normality (Ghasemi & Zahediasl, 2012).

Multicollinearity Test: Variance Inflation Factor (VIF) and Tolerance values assess inter-variable correlations, with VIF < 10 and Tolerance > 0.1 indicating acceptable levels (Hair et al., 2019).

Heteroscedasticity Test: Scatterplot examination identifies variance consistency across residuals, with random dispersion patterns confirming homoscedasticity (Osborne & Waters, 2002).

Multiple Linear Regression

Multiple linear regression identifies quantitative relationships between independent variables and firm value (Cohen et al., 2003):

$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$

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Where:
- Y = Firm Value (Tobin's Q)
- X_1 = Environmental Performance
- X_2 = Green Investment
- α = Intercept constant
- β_1, β_2 = Regression coefficients
- ε = Error term

Hypothesis Testing

Partial Test (t-test): Evaluates individual independent variable effects on the dependent variable, with significance < 0.05 indicating significant relationships (Sawyer & Ball, 1981).

Simultaneous Test (F-test): Assesses collective independent variable influences on the dependent variable, with significance < 0.05 indicating significant simultaneous effects (Draper & Smith, 1998).

Coefficient of Determination (Adjusted R^2): Measures independent variable explanatory power regarding dependent variable variance, scaled from 0 to 1 (Gujarati & Porter, 2009).

All analyses employed SPSS version 26 with significance level $\alpha = 0.05$ (IBM Corporation, 2019).

Results and Discussion

Descriptive Statistics

Descriptive analysis provides systematic characterization of variable distributions, facilitating understanding of data characteristics prior to inferential testing (Field, 2018).

Table 1. Descriptive Statistical Analysis

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Environmental Performance	39	1.0986	1.6094	1.1748	0.1598
Green Investment	39	0.0001	0.0034	0.0009	0.0009
Firm Value	39	0.5501	1.6743	1.0461	0.2634

Source: SPSS 26 data processing, 2025

Results demonstrate mean values exceeding standard deviations across all variables, indicating means effectively represent data distributions with minimal dispersion (Field, 2018). Environmental performance averaged 1.1748 (corresponding to Blue PROPER ratings after logarithmic transformation), green investment averaged 0.09% of total assets, and firm value (Tobin's Q) averaged 1.0461, suggesting market valuations slightly exceed book values.

Classical Assumption Tests

Normality Test

Table 2. Kolmogorov-Smirnov Normality Test

Test Statistic	Value
N	39
Mean	0.0000000
Std. Deviation	0.2625
Kolmogorov-Smirnov Z	0.122
Asymp. Sig. (2-tailed)	0.145

Source: SPSS 26 data processing, 2025

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Asymptotic significance (0.145) exceeds 0.05 threshold, confirming normally distributed residuals satisfying normality assumptions (Ghasemi & Zahediasl, 2012). Normal probability plot examination revealed diagonal scatter patterns, further supporting distributional normality (Pallant, 2020).

Multicollinearity Test

Table 3. Multicollinearity Assessment

Variable	Tolerance	VIF
Environmental Performance	0.998	1.002
Green Investment	0.998	1.002

Source: SPSS 26 data processing, 2025

All variables demonstrate VIF < 10 and Tolerance > 0.10, confirming absence of problematic multicollinearity among predictors (Hair et al., 2019). Low VIF values indicate independent variables maintain statistical independence, satisfying regression assumptions.

Heteroscedasticity Test

Scatterplot analysis revealed randomly dispersed residuals without discernible patterns, with points scattered above and below zero on the Y-axis, confirming homoscedasticity and satisfying constant variance assumptions (Osborne & Waters, 2002).

Multiple Linear Regression Analysis

Table 4. Regression Coefficients

Model	B	Std. Error	Beta	t	Sig.
(Constant)	1.208	0.322	-	3.752	0.001
Environmental Performance	-0.029	0.294	-0.018	-0.100	0.921
Green Investment	-135.437	53.018	-0.455	-2.555	0.015

a. Dependent Variable: Firm Value (Tobin's Q)
Source: SPSS 26 data processing, 2025

Regression Equation:

Tobin's Q = 1.208 - 0.029(Environmental Performance) - 135.437(Green Investment) + ε

Interpretation:

1. Constant (1.208): Baseline firm value when both environmental performance and green investment equal zero, indicating inherent organizational valuation
2. Environmental Performance coefficient (-0.029): Non-significant negative relationship suggesting minimal value impact from environmental performance variations
3. Green Investment coefficient (-135.437): Significant negative relationship indicating that one-unit (1%) green investment increase associates with 135.437-unit firm value decrease

Hypothesis Testing

Partial Test (t-test)

Table 5. T-Test Results

Variable	B	t	Sig.	t-table	Decision
(Constant)	1.208	3.752	0.001	-	-
Environmental Performance	-0.029	-0.100	0.921	±2.028	H_1 Rejected
Green Investment	-135.437	-2.555	0.015	±2.028	H_2 Supported

Critical value: t-table = ±2.028 (df = 36, α = 0.05, two-tailed)
Source: SPSS 26 data processing, 2025

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Results:

H_1 (Environmental Performance → Firm Value): t-calculated (-0.100) < t-table (2.028), Sig. (0.921) > 0.05 → H_1 rejected

Environmental performance demonstrates no significant effect on firm value, indicating that PROPER rating variations do not substantially influence market valuations within the plantation sector during the observation period.

H_2 (Green Investment → Firm Value): t-calculated (|-2.555|) > t-table (2.028), Sig. (0.015) < 0.05 → H_2 supported

Green investment exhibits significant negative effects on firm value, confirming that increased environmental cost allocations associate with reduced market valuations, likely reflecting short-term profitability concerns.

Simultaneous Test (F-test)

Table 6. ANOVA Results

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.572	2	0.286	4.973	0.012
Residual	2.068	36	0.057	—	—
Total	2.640	38	—	—	—

Source: SPSS 26 data processing, 2025

F-calculated (4.973) exceeds F-table (approximately 3.26 at $df_1 = 2$, $df_2 = 36$, $\alpha = 0.05$), with Sig. (0.012) < 0.05 → H_3 supported

Environmental performance and green investment simultaneously exert significant effects on firm value, indicating collective influence despite individual variable variations.

Coefficient of Determination (Adjusted R²)

Table 7. Model Summary

Model	R	R²	Adjusted R²	Std. Error of Estimate	Durbin-Watson
1	0.465	0.216	0.173	0.2395	1.025

Source: SPSS 26 data processing, 2025

Adjusted R² (0.173) indicates that environmental performance and green investment collectively explain 17.3% of firm value variance, with remaining 82.7% attributable to factors beyond this study's scope, including financial performance, management quality, market conditions, governance structures, or strategic positioning (Gujarati & Porter, 2009).

Discussion

Environmental Performance Effects on Firm Value

Statistical analysis confirms environmental performance exhibits no significant effect on firm value (t = -0.100, p = 0.921), rejecting H_1. This finding contradicts legitimacy theory expectations that superior environmental performance enhances organizational legitimacy and market valuation (Deegan, 2019). Despite improved environmental efforts potentially generating external legitimacy, such initiatives do not consistently translate into direct market value impacts within Indonesia's plantation sector context.

Several factors explain this non-significant relationship. First, investors and stakeholders within emerging markets often prioritize financial and operational metrics—including revenue, profitability, and market growth—over environmental performance indicators (Tarmuji et al., 2020). Environmental performance measurements through PROPER ratings may lack relevance for investment decision-making processes emphasizing immediate financial returns (Sulistiyowati et al., 2021).

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Second, environmental performance measurement difficulties and inconsistent valuation methodologies hinder accurate market value impact assessments (Trumpp & Guenther, 2017). PROPER ratings provide categorical classifications potentially lacking granularity for capturing nuanced performance variations affecting valuations (Arimura et al., 2008).

Third, observed phenomena during 2020–2023 revealed declining environmental performance concurrent with increasing firm values assessed through Tobin's Q, suggesting market disconnects between environmental efforts and valuation metrics. This pattern indicates that plantation sector market participants may not fully integrate environmental sustainability factors into investment analyses, focusing instead on commodity price movements, production volumes, or export demand dynamics (Harahap et al., 2019).

Results align with Pratiwi and Setyoningsih (2017), Harahap et al. (2019), and Masrinda (2024), reporting non-significant environmental performance-firm value relationships within Indonesian contexts. However, findings contrast with Anjasari and Andriati (2016), Dewi and Edward Narayana (2020), and Dwi Wardani and Sa'adah (2020), demonstrating positive environmental performance effects in alternative sectoral contexts, suggesting industry-specific dynamics influence these relationships.

Green Investment Effects on Firm Value

Green investment demonstrates significant negative effects on firm value ($t = -2.555$, $p = 0.015$), supporting H_2. This finding contradicts legitimacy theory predictions that sustainability-focused investments enhance organizational legitimacy and market confidence (Deegan, 2019). While green investments represent positive sustainability steps, implementation generates negative short-term value impacts, primarily through substantial initial capital requirements for environmentally friendly technology adoption and emission reduction initiatives suppressing immediate profitability (Przychodzen & Przychodzen, 2015).

Observed phenomena during 2020–2023 showed green investment increases during initial years followed by third-year declines, while firm values rose for three consecutive years before 2023 decreases. This pattern suggests that although green investments potentially yield long-term benefits, initial high costs create immediate financial pressures reducing profit margins and financial performance metrics (Climent & Soriano, 2011). Markets valuing rapid, visible financial results may perceive green investment policies lacking immediate profitability as less attractive, particularly when sustainability returns manifest over extended timeframes (Flammer, 2021).

Additional factors contributing to negative relationships include:
1. High Initial Costs: Green technology implementation, regulatory compliance, and production process modifications require substantial capital expenditures compressing short-term margins (Bolton & Kacperczyk, 2021)
2. Market Myopia: Investment communities emphasizing quarterly earnings may undervalue long-term sustainability benefits not immediately reflected in financial statements (Giglio et al., 2021)
3. Sector Characteristics: Plantation industries face commodity price volatility and export demand fluctuations potentially overshadowing sustainability investment benefits in valuation models (Broadstock et al., 2021)

Results corroborate Mareta (2017), Larasati et al. (2023), and Indriani et al. (2025), reporting negative green investment-firm value relationships within Indonesian plantation and mining sectors. However, findings contrast with Ayu Wijayanti and Yoseph (2024) and Siedschlag and Yan (2021), demonstrating positive green investment effects in alternative industries, suggesting sectoral heterogeneity influences sustainability investment-valuation dynamics.

Simultaneous Effects Analysis

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Combined F-test analysis confirms environmental performance and green investment simultaneously exert significant effects on firm value (F = 4.973, p = 0.012), supporting H_3. This finding partially aligns with legitimacy theory, suggesting that while individual sustainability dimensions show mixed or negative effects, collective environmental performance and green investment efforts demonstrate joint significance in influencing market valuations (Deegan, 2019).

Legitimacy theory posits that organizations pursue stakeholder legitimacy through social and environmental responsibility demonstrations (Suchman, 1995). Combined environmental performance excellence and green investment signal comprehensive sustainability commitment, potentially strengthening reputations and stakeholder relationships despite individual variable limitations (Fernando et al., 2017). Companies demonstrating dual environmental responsibility and green investment dedication may attract sustainability-focused investors, gradually enhancing market confidence and competitive positioning (Flammer, 2021).

However, Adjusted R^2 (0.173) indicates environmental performance and green investment collectively explain only 17.3% of firm value variance, suggesting modest explanatory power. The remaining 82.7% variance stems from factors including financial performance (profitability, liquidity), management quality, corporate governance structures, market conditions (commodity prices, economic cycles), strategic positioning, and operational efficiency (Gujarati & Porter, 2009; Damodaran, 2021).

This limited explanatory capacity implies that within Indonesia's plantation sector during 2020–2023, sustainability factors represented secondary valuation considerations relative to traditional financial and operational metrics. Market participants likely prioritized immediate financial performance indicators over longer-term environmental sustainability dimensions when assessing firm values (Tarmuji et al., 2020).

Conclusion

This investigation provides empirical evidence regarding environmental performance and green investment effects on plantation sector firm value in Indonesia. Key conclusions include:

1. Environmental Performance: Demonstrates no significant effect on firm value (t = -0.100, p = 0.921), suggesting that PROPER rating variations do not substantially influence market valuations within the plantation sector. Market participants appear to prioritize financial and operational metrics over environmental performance indicators during investment decision-making processes.

2. Green Investment: Exhibits significant negative effects on firm value (t = -2.555, p = 0.015), indicating that increased environmental cost allocations associate with reduced market valuations. High initial implementation costs for green technologies and process modifications suppress short-term profitability, creating negative value perceptions among markets emphasizing immediate financial returns.

3. Simultaneous Effects: Environmental performance and green investment collectively exert significant effects on firm value (F = 4.973, p = 0.012), demonstrating joint influence despite mixed individual effects. However, modest explanatory power (Adjusted R^2 = 0.173) indicates that sustainability factors represent secondary valuation considerations relative to traditional financial metrics within this context.

4. Theoretical Implications: Findings partially challenge legitimacy theory expectations within emerging market plantation contexts, suggesting that legitimacy-seeking environmental efforts do not consistently translate into immediate market value enhancements, particularly when implementation costs create short-term financial pressures.

5. Practical Implications: Results highlight tensions between sustainability investments and short-term market valuations, emphasizing needs for stakeholder education regarding long-term green investment benefits and enhanced transparency in environmental performance reporting to facilitate better integration into valuation models.

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Recommendations

For Corporate Management

1. Strategic Communication: Develop comprehensive sustainability reporting frameworks clearly articulating long-term value creation potential from environmental investments, educating stakeholders about sustainability benefits extending beyond immediate financial impacts

2. Phased Investment Approaches: Implement green investment strategies balancing short-term financial performance maintenance with long-term sustainability objectives through gradual technology adoption and cost management optimization

3. Performance Integration: Enhance environmental performance monitoring systems linking PROPER improvements with operational efficiency gains, demonstrating tangible business benefits beyond regulatory compliance

4. Stakeholder Engagement: Strengthen dialogue with investors, analysts, and market participants regarding sustainability strategies, addressing concerns about green investment costs while highlighting competitive advantages and risk mitigation benefits

For Investors and Analysts

1. Long-term Perspectives: Adopt extended investment horizons recognizing that green investments yield returns over multi-year periods, avoiding excessive focus on short-term profitability impacts

2. Comprehensive Valuation: Integrate environmental performance and sustainability factors into holistic valuation frameworks considering risk adjustments, regulatory compliance benefits, and reputational capital alongside traditional financial metrics

3. Sector-specific Analysis: Recognize industry heterogeneity in sustainability-value relationships, applying context-appropriate valuation methodologies acknowledging plantation sector characteristics

For Policymakers and Regulators

1. Incentive Mechanisms: Develop fiscal incentives (tax benefits, subsidies, preferential financing) reducing green investment initial cost burdens, facilitating adoption while maintaining short-term financial viability

2. Enhanced Disclosure Standards: Strengthen environmental reporting requirements improving transparency and comparability, enabling market participants to better assess environmental performance value implications

3. Market Education: Implement initiatives educating investors and stakeholders about sustainability investment long-term benefits, fostering market appreciation for environmental responsibility

For Future Research

1. Extended Timeframes: Conduct longitudinal studies spanning longer observation periods (10+ years) capturing green investment long-term value effects as sustainability benefits materialize

2. Sectoral Comparisons: Expand investigations across diverse industries identifying sector-specific dynamics influencing environmental performance and green investment-firm value relationships

3. Mediating Mechanisms: Examine mediating variables (financial performance, reputational capital, innovation capacity) explaining pathways through which sustainability factors influence firm valuations

4. Alternative Metrics: Explore alternative environmental performance measurements and firm value proxies enhancing construct validity and capturing nuanced sustainability-value dynamics

5. Contextual Factors: Investigate moderating effects of corporate governance quality, stakeholder engagement intensity, and market maturity levels influencing sustainability-value relationships

6. Qualitative Integration: Employ mixed-methods approaches combining quantitative analyses with qualitative investigations exploring managerial perspectives and investor decision-making processes regarding sustainability factors

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