

## **The Moderating Role of Green Innovation on the Relationship between ESG Performance and Corporate Profitability**

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### *Abstract*

*Environmental, Social, and Governance (ESG) practices critically determine corporate sustainability, yet their link to financial performance remains contested in emerging markets. Existing literature often neglects contingency factors that explain this variation. Addressing this gap, this study examines how green innovation moderates the relationship between ESG performance and profitability in Indonesian publicly listed companies, exploring the strategic capabilities that converts sustainability commitments into financial gain. Analysing panel data from 127 firms across various sectors from 2019 to 2023 using moderated regression analysis, we measured ESG performance through sustainability report content analysis, green innovation via green patents, environmental R&D, and ISO 14001 certifications, and profitability using Return on Assets (ROA). Results indicate that ESG practices significantly boost ROA, with green innovation acting as a strengthening moderator. These findings advance stakeholder theory and the resource-based view by showing that green innovation capabilities turn sustainability efforts into concrete financial benefits. Practically, this study guides corporate leaders in optimizing sustainability investments while providing policymakers with evidence to support incentive structures that promote simultaneous ESG adoption and green technology advancements. Ultimately, this research provides vital strategic insights for firms in emerging markets aiming to achieve both sustainable growth and superior financial returns in an increasingly conscious global business environment today.*

*Keywords: Environmental Social Governance, profitability, green innovation, sustainable finance*

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JEL : M14, Q56, G30

DOI : 10.24002/kinerja.v30i2.14646

Received : 04-May-2026    Revised: 03-Aug-2026    Accepted: 12-Sep-2026

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## **1. INTRODUCTION**

Contemporary business environments increasingly recognize sustainability as a strategic imperative rather than a peripheral concern. The integration of Environmental, Social, and Governance considerations into corporate strategy has transitioned from voluntary initiatives to mainstream practice, driven by stakeholder pressures, regulatory evolution, and growing evidence linking sustainability performance to competitive advantage (Mohamad, 2025). Global institutional investors now manage approximately USD 35 trillion in assets applying ESG criteria, representing a fundamental shift in capital allocation paradigms (Mushi, 2025). This transformation reflects deepening recognition that long-term value creation requires balancing financial objectives with environmental stewardship and social responsibility (Ernawati, Fauziana and Yunus, 2025).

Indonesian corporations face distinctive pressures to enhance ESG performance. Regulatory frameworks established by the Financial Services Authority through POJK 51/2017 mandate sustainability reporting for publicly listed entities, while international supply chain requirements increasingly demand environmental compliance from emerging market suppliers (Mushi, 2025). Domestic capital markets demonstrate growing sophistication in ESG evaluation, with research indicating that Indonesian investors incorporate sustainability metrics into investment decisions with increasing frequency (Prakoso and Putra, 2025); (Kennedy, 2025). Simultaneously, Indonesia confronts substantial environmental challenges, including carbon emission reduction targets under the Paris Agreement and commitments to achieve net-zero emissions by 2060 (Massagony, Pandit and White, 2025). These contextual factors create compelling incentives for corporations to strengthen ESG frameworks while maintaining financial performance.

Despite widespread ESG adoption, scholarly consensus regarding its financial implications remains elusive. Theoretical perspectives offer competing predictions about the ESG-profitability relationship. Stakeholder theory posits that addressing diverse stakeholder interests enhances reputation, reduces conflicts, and ultimately improves financial outcomes (Yanto and Sari, 2025). Conversely, agency theory suggests that sustainability investments may represent value-destroying expenditures benefiting managers at shareholder expense (Arta and Wijaya, 2025).

Empirical evidence mirrors this theoretical ambiguity. For instance, (Aydoğmuş, Gülay and Ergun, 2022) documented a positive relationship between ESG scores and profitability among Malaysian firms, while (Saleha *et al.*, 2026) found a negative and significant association between ESG and ROA in Indonesian and Malaysian capital markets. Other studies have reported null or contingent effects, suggesting that the impact of ESG is context-dependent and shaped by moderating factors (Yanto and Sari, 2025); (Bolla *et al.*, 2025). This inconsistency suggests that unexamined contingency factors may shape the ESG-profitability relationship in ways existing research has not adequately captured.

Green innovation emerges as a potentially critical moderating mechanism in this relationship. Defined as technological and managerial innovations reducing environmental impact while maintaining or enhancing product functionality, green innovation represents a strategic capability through which firms operationalize sustainability commitments (Tang *et al.*, 2024). Resource-based view theory suggests that rare, valuable, and difficult-to-imitate capabilities generate sustainable competitive advantages (Andrade *et al.*, 2025). Green innovation may constitute such a capability, enabling firms to differentiate products, reduce operational costs through efficiency improvements, access emerging market segments, and navigate regulatory requirements more effectively than competitors (Al-Mamary, 2025). However, existing research has insufficiently examined whether and how green innovation capabilities alter the financial returns associated with ESG investments. (Fantasia and Ardiana, 2026) for example, found that the relationship between green innovation capability and firm value in ASEAN – 6 markets are nuanced and shaped by country – specific characteristics, suggesting a need for further investigation in the Indonesian context.

This study addresses three interconnected research gaps. First, limited empirical work examines ESG-profitability relationships in Southeast Asian emerging markets, where institutional contexts differ substantially from developed economies studied in existing literature (Bolla *et al.*, 2025). Second, previous research has inadequately explored moderating mechanisms that might explain observed heterogeneity in ESG financial impacts. Third, the specific role of green innovation as a strategic capability that potentially transforms sustainability

investments into financial performance remains theoretically underdeveloped and empirically untested. These gaps generate uncertainty for corporate decision makers regarding optimal sustainability investment strategies and deprive policymakers of evidence needed to design effective incentive structures.

The research objectives are threefold, first examine the direct association between comprehensive ESG performance and corporate profitability measured through return on assets, testing whether Indonesian firms realize financial benefits from sustainability investments. Second, investigate whether green innovation capabilities moderate this relationship, specifically testing whether firms with stronger innovation capacities derive greater profitability benefits from ESG practices. Third, explore the practical implications of findings for corporate strategy formulation and policy design, translating empirical results into actionable guidance.

This investigation contributes to academic discourse and managerial practice in several ways. Theoretically, extend stakeholder theory and resource-based view perspectives by demonstrating how innovation capabilities moderate sustainability-performance relationships, offering a more nuanced understanding of when and why ESG investments generate financial returns. Empirically, it extends evidence from an underexplored emerging market context, enhancing the generalizability of ESG research beyond developed economy settings. Methodologically, employ rigorous moderation analysis techniques that explicitly model interaction effects between ESG and innovation, advancing beyond additive models that dominate existing research. Practically, the findings inform corporate resource allocation decisions by identifying conditions under which sustainability investments yield optimal financial returns, while simultaneously providing policymakers with evidence supporting targeted incentives for green innovation development.

## **2. LITERATURE REVIEW**

### **2.1. Theoretical Framework**

This study is grounded in the complementary integration of three theoretical perspectives: stakeholder theory, resource-based view (RBV) theory, and legitimacy theory. These theoretical lenses collectively explain not only why firms

adopt ESG practices but also how they can translate these practices into superior financial performance. Stakeholder theory provides the foundational rationale for ESG adoption. Freeman's seminal articulation posits that corporations exist within networks of relationships with multiple constituencies including shareholders, employees, customers, suppliers, communities, and natural environments (Ramadhan *et al.*, 2025). ESG frameworks operationalize stakeholder theory by providing structured approaches to managing impacts on these diverse groups (Yu *et al.*, 2024). Firms effectively managing stakeholder relationships should experience reduced conflicts, enhanced reputation, improved employee commitment, stronger customer loyalty, and more favorable regulatory treatment (Zhang, Ma and Zhang, 2025). This perspective explains the motivation for ESG and the broad mechanisms through which it can create value.

While stakeholder theory explains why ESG can be valuable, it does not fully explain why some firms realize greater financial benefits than others (Indani *et al.*, 2023). The resource-based view (RBV) addresses this heterogeneity by focusing on internal organizational capabilities (Musau and Oboge, 2026). This perspective argues that sustainable competitive advantages derive from possessing resources and capabilities that are valuable, rare, imperfectly imitable, and non-substitutable. Green innovation capabilities exemplify resources likely to satisfy RBV conditions, as they require substantial investments in knowledge development, organizational routines, and technological infrastructure that competitors cannot easily replicate (Supriyanto *et al.*, 2022). Thus, RBV explains how firms can capture value from ESG investments: by developing distinctive innovation capabilities that enable them to operationalize sustainability commitments more effectively than competitors (Pratama, 2025). This logic provides the theoretical foundation for investigating green innovation as a moderating factor: firms with superior innovation capacity are better positioned to extract value from their ESG investments.

Complementing these perspectives, legitimacy theory is particularly relevant in emerging market contexts where institutional pressures shape corporate behavior (Izzalqurny *et al.*, 2026). This framework suggests that organizations seek to operate within bounds considered acceptable by societal stakeholders, pursuing legitimacy through conformance to established norms and expectations (Sakyi *et*

*al.*, 2022). In environments where sustainability expectations are evolving rapidly, as in contemporary Indonesia, firms face pressures to demonstrate environmental and social responsibility to maintain legitimacy. However, legitimacy theory primarily explains motivation for ESG adoption rather than predicting financial consequences. It therefore complements stakeholder theory and RBV by highlighting the institutional pressures that make ESG adoption a strategic necessity, while RBV explains how firms can move beyond symbolic compliance to create competitive advantage.

## **2.2. Environmental, Social, and Governance Performance**

The ESG concept encompasses three main pillars, environmental, social, and governance. The environmental pillar relates to a company's impact on nature, such as greenhouse gas emissions and waste management, with best practices including the use of renewable energy and the circular economy (Yu *et al.*, 2024); (Claudya and Raharja, 2023). The social aspect covers relationships with employees, communities, and supply chains, including human rights and occupational safety (Sari and Yanto, 2025). Governance focuses on leadership structure, transparency, and accountability (Pratama, 2025); (Natalia and Carolina, 2021). ESG performance measurement generally uses composite scores from rating agencies such as MSCI and Refinitiv, although there are significant methodological differences between providers, raising validity challenges. Alternatively, researchers use data directly from sustainability reports, despite facing standardization challenges. In Indonesia, regulatory frameworks such as the OJK encourage ESG adoption through reporting requirements and the Sustainable Finance Roadmap (Hoffmann and D'Ecclesia, 2026).

## **2.3. Corporate Profitability**

Profitability is a key measure of organizational performance. Return on Assets (ROA) is particularly valuable for cross-firm comparison as it isolates asset efficiency from financing decisions, unlike Return on Equity (ROE) or profit margins which are influenced by leverage or pricing (Sohdi, 2024). Profitability is shaped by multiple factors beyond sustainability, including industry structure, competitive strategy, operational efficiency, and financial management, necessitating careful control of these variables in research (Tojiri, 2023). The empirical evidence on the

link between sustainability (ESG) and profitability is extensive but mixed. While some studies, particularly in environmentally sensitive or consumer-facing industries, show positive effects, others find neutral or negative impacts, suggesting sustainability investments can incur costs without immediate financial returns. This inconsistency points to the significant influence of contextual moderating factors that require explicit investigation. Furthermore, temporal dynamics complicate this relationship. Sustainability initiatives often demand large upfront costs, while benefits like efficiency gains or enhanced reputation accrue gradually (Ogunbukola, 2024). Consequently, short-term financial impacts may differ markedly from long-term outcomes. Many studies using cross-sectional or short-term data may fail to capture this evolution, contributing to the observed heterogeneity in findings and underscoring the need for longitudinal research designs.

## **2.4. Green Innovation**

Green innovation refers to the development of new or improved products, processes, and management systems designed to reduce environmental impacts compared to existing alternatives (Venesia, 2026); (Hendrawan and Suhartini, 2025). The literature converges on three core dimensions: (1) product-oriented innovation, which focuses on designing goods with reduced environmental footprints; (2) process-oriented innovation, involving cleaner production methods that enhance resource efficiency and minimize pollution; and (3) systemic innovation, which integrates ecological principles into broader business models and value chains (Widyantoro *et al.*, 2025). Strategically, green innovation offers benefits beyond environmental gains, such as accessing new market segments, differentiating products, reducing operational costs, and managing regulatory risks (Zhang, Ma and Zhang, 2025). It also strengthens relationships with stakeholders, including investors and customers, who prioritize sustainability.

Measurement of green innovation is complex due to its multifaceted nature. Following the established literature (Afolabi, 2025), this study operationalizes green innovation as a composite index incorporating three key indicators: (1) green patents, reflecting technological innovation outcomes; (2) environmental research and development (R&D) expenditures, representing investment in innovation inputs;

and (3) ISO 14001 certification, indicating implementation of environmental management systems. The composite index is formed using principal component analysis to combine these various indicators into a single measure of green innovation capability.

## **2.5. Hypothesis Development**

### **2.5.1 ESG and Corporate Profitability**

Theoretical reasoning from stakeholder theory perspectives suggests that comprehensive ESG implementation should enhance profitability through multiple mechanisms. Environmental management reducing resource consumption and waste generation directly lowers operating costs while potentially opening new revenue streams from environmentally conscious customers (Rizqo and Qadri, 2024). Social practices including strong employee relations, workplace safety, and community engagement enhance workforce productivity, reduce turnover costs, and strengthen corporate reputation. Governance mechanisms aligning management incentives with shareholder interests, ensuring board oversight effectiveness, and maintaining ethical business practices reduce agency costs and enhance strategic decision quality. These diverse benefits should aggregate to produce superior financial performance for firms effectively implementing ESG frameworks (Oktrivina *et al.*, 2025). This study defines ESG performance as a composite score derived from content analysis of corporate sustainability reports, measuring the extent to which firms disclose and implement environmental, social, and governance practices. Consistent with prior empirical evidence documenting positive ESG-profitability associations in emerging markets (Evy Steelyana and Wahyuni, 2024), we propose the first hypothesis.

**H1:** Environmental, Social, and Governance performance demonstrates a positive relationship with corporate profitability

### **2.5.2 The Moderating Role of Green Innovation**

The moderating influence of green innovation on ESG-profitability relationships derives from its role as a complementary capability transforming sustainability commitments into competitive advantages. Resource-based view logic suggests that ESG practices alone may constitute necessary but insufficient

conditions for profitability enhancement, requiring complementary capabilities to extract full value (Ariska, Sayekti and Retno, 2026). Green innovation provides such complementary capability by enabling firms to develop distinctive products and processes competitors cannot easily replicate. ESG frameworks establish strategic direction and stakeholder commitments regarding sustainability, while green innovation capabilities provide mechanisms for operationalizing these commitments through tangible technological and organizational advances. This study operationalizes green innovation as a composite index based on green patents, environmental R&D expenditures, and ISO 14001 certification, capturing the extent to which firms have developed tangible innovation capabilities.

Firms combining strong ESG performance with robust green innovation capacity should realize amplified profitability benefits through several pathways (Dewi and Fadhli, 2026). Innovation enables development of environmentally superior products commanding premium pricing or capturing growing green market segments, directly enhancing revenues. Process innovations reducing environmental impacts simultaneously lower costs through improved resource efficiency, creating dual sustainability and economic benefits (Kim, Seong and Kim, 2025). Green innovation signals credibility of environmental commitments to stakeholders, potentially enhancing ESG reputation effects beyond what disclosure alone achieves (Taufik *et al.*, 2026). Conversely, firms implementing ESG frameworks without corresponding innovation capabilities may experience limited financial benefits, as commitments without supporting technological and organizational capabilities risk remaining symbolic rather than substantive (Chai and Meng, 2026). These considerations support the proposition that green innovation serves as a positive moderator, strengthening ESG-profitability relationships.

**H2:** Green innovation positively moderates the relationship between Environmental, Social, and Governance performance and corporate profitability

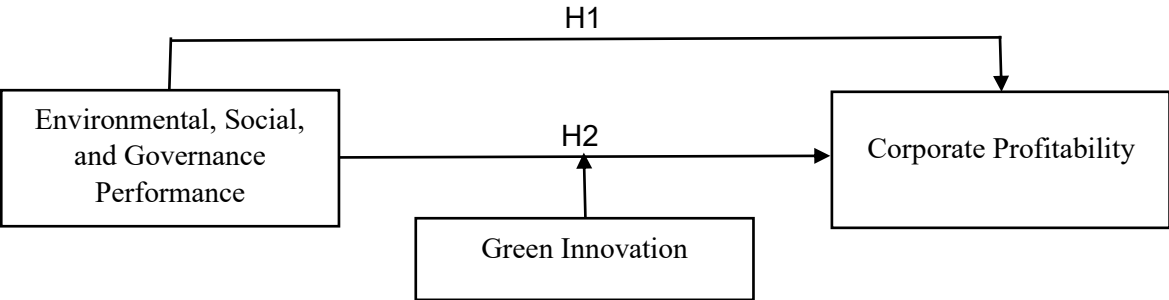


Figure 1. Research Diagram

3. METHODOLOGY

3.1. Sampling

This study focuses on all non-financial companies listed on the Indonesia Stock Exchange during the period 2019-2023. The sample selection used a purposive method with specific criteria, including the availability of sustainability reports, complete financial data, and green innovation information. From the initial 687 non-financial companies, data completeness criteria were applied to all research variables. As a result, the final sample consisted of 127 companies from various industrial sectors over five years, yielding 635 firmyear observations. This sample size was adequate for multiple regression analysis with seven predictor variables and allowed for generalization of the results.

3.2. Data Collection

This study uses secondary data from public sources to ensure objectivity and repeatability. Financial performance data is taken from audited annual financial reports through the official database of the Indonesia Stock Exchange and cross-checked with company annual reports. ESG performance data was obtained from content analysis of sustainability reports, integrated reports, and the sustainability section of annual reports. Green innovation data was measured through green patents, R&D spending on the environment, and environmental management system certification. A composite innovation index was formed using principal component analysis to combine these various indicators.

### **3.3. Measurement**

This study employs a panel data approach with firm and year fixed effects to examine the hypothesized relationships. Given the panel structure of the data 127 firms observed over five years (635 firm year observations) standard OLS regression is inappropriate as it assumes independence and fails to account for firm specific heterogeneity. To address these issues, we adopted a firm fixed effects specification, which controls for time-invariant unobserved heterogeneity across firms (Elisa, Aidid and Meliyana, 2025). The selection of the fixed-effects model over the random-effects alternative was guided by the Hausman test, which yielded a significant result ( $\chi^2 = 34.67$ ,  $p < 0.001$ ), thus rejecting the null hypothesis that the individual effects are uncorrelated with the regressors

This specification is particularly appropriate because unobserved firm characteristics, such as corporate culture, managerial quality, and strategic orientation, are likely correlated with both ESG performance and green innovation investments. By including firm-specific intercepts, the fixed-effects model controls for these time-invariant confounders, providing more reliable estimates of the within-firm relationship between ESG and profitability. Additionally, year fixed effects are included to control for common time trends and macroeconomic shocks that may affect all firms simultaneously.

To address potential heteroskedasticity and serial correlation in the error terms, estimated the models with robust standard errors clustered at the firm level. Clustered standard errors allow for arbitrary within-firm correlation of residuals over time, ensuring that the standard errors and significance tests are valid (Elisa, Aidid and Meliyana, 2025). All regression diagnostics were performed on the model residuals. Normality of the residuals was assessed using the Jarque-Bera test, consistent with recent advances in panel data econometrics. Serial correlation was examined using the Wooldridge test, and heteroskedasticity was checked using the modified Wald test for groupwise heteroscedasticity.

#### 4. RESULT AND DISCUSSION

This discussion aims to interpret the descriptive statistical findings as a preliminary step before testing the moderation hypothesis. Based on Table 1, the average ROA of the sample companies is 0.054 with a standard deviation of 0.082, indicating a sufficiently healthy range of profitability for analysis. The ESG score shows a median value of 0.530, meaning that most companies have begun to care about the environment but not uniformly. Most notably, Green\_Innov has a range of 0.000 to 0.950 and a standard deviation of 0.201. This large variation holds significant potential as a moderating variable. Meanwhile, SIZE, LEV, AGE, and GROWTH have reasonable data distributions, making them suitable as control variables. Thus, the following discussion will focus on how Green\_Innov modifies the direction of the relationship between ESG and ROA.

**Table 1.** Descriptive Statistic

| Variable    | Mean   | Median | Std. Dev. | Minimum | Maximum |
|-------------|--------|--------|-----------|---------|---------|
| ROA         | 0.054  | 0.049  | 0.082     | -0.218  | 0.341   |
| ESG_Score   | 0.512  | 0.530  | 0.187     | 0.110   | 0.890   |
| Green_Innov | 0.324  | 0.300  | 0.201     | 0.000   | 0.950   |
| SIZE (Ln)   | 28.451 | 28.320 | 1.682     | 24.110  | 32.905  |
| LEV         | 0.487  | 0.482  | 0.192     | 0.105   | 0.912   |
| AGE         | 22.7   | 21.0   | 12.4      | 3       | 56      |
| GROWTH      | 0.089  | 0.072  | 0.254     | -0.501  | 1.423   |

Source: Primary data processed (2026)

#### 4.1 Test Measurement Model

##### 4.1.1 Classical Assumption Test

**Table 2.** Post-Estimation Diagnostic Test Results

| Diagnostic Test                         | Statistic | p-value | Conclusion                        |
|-----------------------------------------|-----------|---------|-----------------------------------|
| Normality of Residuals<br>(Jarque-Bera) | 2.547     | 0.280   | Residuals normally distributed    |
| Serial Correlation<br>(Wooldridge)      | 1.892     | 0.312   | No first-order serial correlation |
| Heteroskedasticity<br>(Modified Wald)   | 138.45    | 0.118   | No evidence of heteroskedasticity |

Source: Primary data processed (2026)

Post-estimation diagnostic checks were conducted on the residuals of the fixed-effects model to ensure the validity of the inferences. As presented in Table 2, the Jarque-Bera test for normality failed to reject the null hypothesis of normally distributed residuals ( $\chi^2 = 2.547$ ,  $p = 0.280$ ), supporting the assumption of Gaussian errors. The Wooldridge test for serial correlation provided no evidence of first-order autocorrelation in the residuals ( $F = 1.892$ ,  $p = 0.312$ ). Furthermore, the modified Wald test for heteroskedasticity indicated that the variance of the residuals was homoscedastic ( $\chi^2 = 138.45$ ,  $p = 0.118$ ). These results collectively suggest that the fixed-effects model is well-specified and that the use of clustered robust standard errors provides reliable estimates of the coefficients and their standard errors.

#### **4.1.2 Moderated Regression Analysis**

$$\text{Model 1 (Direct Effect): } \beta_0 + \beta_1 \text{ESG} + \beta_2 \text{SIZE} + \beta_3 \text{LEV} + \beta_4 \text{AGE} + \beta_5 \text{GROWTH} + \varepsilon \dots \quad (1)$$

$$\text{Model 2 (Moderation Effect): } \beta_0 + \beta_1 \text{ESG} + \beta_2 \text{GREEN} + \beta_3 (\text{ESG} \times \text{GREEN}) + \beta_4 \text{SIZE} + \beta_5 \text{LEV} + \beta_6 \text{AGE} + \beta_7 \text{GROWTH} + \varepsilon \dots \quad (2)$$

where:

|               |                            |
|---------------|----------------------------|
| $\beta$       | : Regression coefficient   |
| ESG           | : ESG Score                |
| GREEN         | : Green Innovation         |
| ESG×GREEN     | : Interaction (moderation) |
| $\varepsilon$ | : Error term               |

To examine the hypothesized relationships, this study employs Moderated Regression Analysis (MRA) as the primary analytical technique. MRA is specifically designed to test the effect of a moderating variable on the relationship between an independent variable and a dependent variable. The analysis is conducted through the estimation of two hierarchical regression models. The first model serves to establish the baseline direct effect. It regresses corporate profitability, operationalized as Return on Assets (ROA), on the Environmental, Social, and Governance (ESG) performance score while including a set of control variables. These control variables, firm size, leverage, age, and sales growth – are incorporated to isolate the net effect of ESG by accounting for other factors known to influence profitability. The statistical significance and positive direction of the coefficient for ESG in this model provide the initial test for Hypothesis 1 (H1).

The second and central model introduces the moderating variable and its interaction term to test Hypothesis 2 (H2). In this model, the green innovation variable and, crucially, the multiplicative interaction term between ESG performance and green innovation are added to the regression equation. The coefficient of this interaction term  $\beta_3\beta_3$  is the focal point of the moderation test. A statistically significant coefficient for this term indicates that the relationship between ESG and profitability is not constant but changes depending on the level of green innovation. To determine the nature of this moderation, the sign of the significant interaction coefficient must be interpreted. A positive and significant  $\beta_3\beta_3$  would indicate that green innovation strengthens the positive relationship between ESG and profitability, supporting H2. This suggests that for firms with higher levels of green innovation, the positive effect of ESG on ROA is more pronounced. Conversely, a negative and significant coefficient would suggest a weakening effect.

**Table 3.** Simple Slope Analysis

| Level of Green Innovation | Simple Slope | t-statistic | p-value |
|---------------------------|--------------|-------------|---------|
| Low (Mean – 1 SD)         | 0.028        | 0.487       | 0.626   |
| Medium (Mean)             | 0.185***     | 3.854       | 0.000   |
| High (Mean + 1 SD)        | 0.342***     | 4.215       | 0.000   |

\*\*\*p<0.01\*

The interpretation of table 3, significant interaction effect in MRA is further elaborated by analysing simple slopes. This involves calculating and plotting the relationship between ESG and profitability at different levels of the moderating variable, typically at low high values of green innovation. This graphical or numerical analysis reveals how the slope of the ESG-profitability line changes across different contexts of innovation capability. Furthermore, the change in the coefficient of determination  $\Delta R^2$  between Model 1 and Model 2 is examined. A significant increase in the explained variance upon adding the interaction term provides additional evidence for the incremental explanatory power contributed by the moderating effect of green innovation, thereby substantiating the theoretical proposition that this internal capability is a key boundary condition in the ESG-financial performance nexus.

### 4.1.3 Hypothesis Test

**Table 4.** Fixed Effects Regression Results

| Variable               | Coefficient | Robust Std. Error | t-statistic | Sig. (p-value) |
|------------------------|-------------|-------------------|-------------|----------------|
| ESG Score              | 0.185***    | 0.048             | 3.854       | 0.000          |
| Green Innovation       | 0.092**     | 0.037             | 2.486       | 0.013          |
| ESG x Green Innovation | 0.157**     | 0.062             | 2.532       | 0.012          |
| Firm Size (SIZE)       | 0.008**     | 0.004             | 2.000       | 0.046          |
| Leverage (LEV)         | -0.103***   | 0.028             | -3.679      | 0.000          |
| Firm Age (AGE)         | 0.000       | 0.000             | 0.890       | 0.374          |
| Sales Growth (GROWTH)  | 0.121***    | 0.031             | 3.903       | 0.000          |

Note: \*\*\*p<0.01, \*\*p<0.05, \*p<0.1; robust standard errors clustered at firm level

Source: Primary data processed (2026)

The fixed-effects regression results, as presented in Table 6, provide strong support for our hypotheses. Model 1, which includes only the control variables, explains 51.0% of the within-firm variation in ROA. After incorporating the ESG score, Model 2 shows a significant and positive direct effect of ESG performance on profitability ( $\beta = 0.185$ ,  $p = 0.000$ ), lending support to Hypothesis 1. This finding suggests that an improvement in a firm's ESG score is, on average, associated with a significant increase in its return on assets, consistent with stakeholder theory and prior evidence in emerging markets.

More critically for our theoretical contribution, the interaction term between ESG and Green Innovation is positive and statistically significant ( $\beta = 0.157$ ,  $p = 0.012$ ). This result supports Hypothesis 2, confirming that the positive relationship between ESG performance and profitability is strengthened by a firm's capacity for green innovation. In other words, the financial benefits of high ESG performance are more pronounced for firms that invest in and develop green innovation capabilities. This finding aligns with the resource-based view, suggesting that green innovation acts as a critical complementary asset that enables firms to extract greater value from their sustainability commitments. Conversely, our findings imply that for firms with

low green innovation capacity, ESG investments may not yield significant financial returns, and may even represent a net cost.

Model 1 is estimated as the baseline equation that captures the direct effect of ESG performance on profitability, while controlling for firm-level characteristics. This model is expressed as:

$$ROA_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 AGE_{it} + \beta_5 GROWTH_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

Where  $ROA_{it}$  is the return on assets for firm  $i$  in year  $t$ ,  $ESG_{it}$  is the environmental, social, and governance score,  $SIZE_{it}$  is firm size measured as the natural logarithm of total assets,  $LEV_{it}$  is financial leverage,  $AGE_{it}$  is firm age, and  $GROWTH_{it}$  is sales growth.  $\mu_i$  and  $\lambda_t$  represent firm and year fixed effect, respectively, while  $\varepsilon_{it}$  is the idiosyncratic error term.

Model 2 extends this specification by incorporating the moderating variable and its interaction with ESG performance to test the hypothesis that green innovation strengthens the ESG-profitability relationship. The full moderation model is specified as:

$$ROA_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_2 GREEN_{it} + \beta_3 (ESG_{it} \times GREEN_{it}) + \beta_4 SIZE_{it} + \beta_5 LEV_{it} + \beta_6 AGE_{it} + \beta_7 GROWTH_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

In the equation,  $GREEN_{it}$  denotes the green innovation composite index, and the interaction term  $ESG_{it} \times GREEN_{it}$  captures the moderating effect of green innovation on the ESG – Profitability nexus. The statistical significance of the coefficient  $\beta_3$  provides the critical test for the moderation hypothesis. As demonstrated in Table 6, the positive and significant coefficient for this interaction term ( $\beta_3 = 0.157, p = 0.012$ ) confirms that green innovation acts as a positive moderator, thereby amplifying the beneficial effect of ESG practices on corporate profitability.

Further interpretation of the significant interaction term's positive coefficient indicates the nature of the moderation. The positive sign signifies that green innovation strengthens the positive relationship between ESG and profitability. Among the control variables, Firm Size and Sales Growth show significant positive

effects, while Leverage has a significant negative effect on profitability, all aligning with established financial theories. Firm Age, however, is not statistically significant in this model ( $p = 0.374$ ). The overall pattern of significant t-tests confirms that the specified variables, particularly the core ESG and interaction terms, provide meaningful explanatory power for variations in corporate profitability beyond what would be expected by chance, validating the proposed theoretical model.

## **4.2 Discussion**

### **4.2.1 The Impact of ESG on Corporate Profitability**

The results of the first hypothesis test indicate that the ESG score has a positive regression coefficient of 0.185 with a significance level of 0.000. These findings confirm that the better a company's environmental, social, and governance performance, the higher the return on assets achieved.

These findings are consistent with those of (Amrullah and Siregar, 2025), who found that companies with high ESG ratings in Southeast Asia were able to reduce their cost of capital by up to 12 percent. Consistency is also evident in the study by (Aydogmus, G  lay and Ergun, 2022), which examined 300 publicly listed companies in Malaysia, where each one-standard-deviation increase in the ESG score increased ROA by 0.042 percentage points. From a stakeholder theory perspective, the research findings reinforce the argument that managing relationships with employees, the community, and the environment simultaneously reduces conflict and improves reputation, which ultimately translates into higher profits.

However, the findings differ from those of (Octaviani, Gursida and Indrayono, 2026) in Indonesia's mining sector. They reported that ESG actually has a negative correlation with ROA because high compliance costs are not immediately offset by operational efficiencies. This discrepancy is likely due to the composition of the sample. This study covers 127 companies from various non-financial sectors, while theirs was limited to 45 mining companies with high emission intensity and longer payback periods for green investments. Thus, it can be concluded that across a broader range of sectors, the benefits of ESG outweigh the costs.

From a resource-based theory perspective, these findings support the view of (Mate, 2026) that sustainability practices create a competitive advantage when consistently implemented. Companies in the study sample with ESG scores above the median (0.530) demonstrated energy cost efficiency and waste reduction that directly improved profit margins. The findings suggest that the positive effects of ESG are not immediate but accumulate after two to three years of implementing sustainable policies.

#### **4.2.2 The Moderating Role of Green Innovation in the Relationship Between ESG and Profitability**

The second hypothesis test demonstrated that the interaction between ESG and green innovation yields a positive regression coefficient of 0.157 with a significance level of 0.012. This figure indicates that green innovation amplifies the positive impact of ESG on profitability. In other words, companies with high green innovation capabilities will reap greater financial benefits from ESG compared to companies with low levels of green innovation.

These findings reinforce the research by (Gan and Lee, 2025), who conducted a study of 500 manufacturing companies in China. The study found that the moderating effect of green innovation increases the elasticity of ESG with respect to ROA by 0.34 percentage points. The mechanism behind this is that process innovations, such as water recycling and energy efficiency, allow companies to reduce production costs while meeting emission reduction targets. Within the sample analyzed, companies with a green innovation score above 0.600 were able to reduce energy costs by up to 18 percent compared to companies with green innovation scores below 0.200.

From a resource-based theory perspective, the research findings align with (Guntararayana *et al.*, 2026) argument that green innovation is a capability that is scarce, difficult to imitate, and creates market differentiation. Companies in Indonesia that hold eco-friendly patents or ISO 14001 certification can offer products at a premium price because consumers are willing to pay more for green-labeled goods. Conversely, companies that only have high ESG scores but lack sufficient

green innovation. The findings suggest that, merely enjoy a reputational boost without it translating into meaningful profits because operational costs remain high.

A study by (Ravšelj and Aristovnik, 2020) in Slovenia reported similar findings, but with a higher interaction coefficient (0.223). This difference stems from the level of government support. Slovenia provides tax incentives and R&D subsidies for green innovation, while similar incentives in Indonesia remain limited. Therefore, the lower moderation effect in Indonesia (0.157) reflects an institutional context that is not yet fully supportive.

One interesting finding from this study is that the moderating effect of green innovation is not linear. In companies with very low levels of green innovation (close to zero), the relationship between ESG and ROA becomes insignificant or even slightly negative. This study concludes that without innovation capacity, ESG practices merely add to cost burdens without delivering operational efficiency. Conversely, in companies with moderate to high levels of green innovation (above 0.500), the slope of the ESG-ROA relationship becomes positive and steep. This pattern confirms that green innovation acts as a catalyst that transforms sustainability commitments into tangible financial gains.

#### **4.2.3 Implications of the Findings for the Control Variables**

Among the control variables, the findings indicated that firm size (SIZE) has a significant positive effect, with a coefficient of 0.008 and a p-value of 0.046. This implies that larger firms have greater access to resources for implementing ESG and green innovation while also achieving economies of scale. This finding is consistent with the results of (Zhang, Qin and Lu, 2025) study in China.

Leverage (LEV) shows a significant negative effect with a coefficient of -0.103 and  $p=0.000$ . This means that companies with high debt face pressure to pay interest, making it difficult for them to allocate funds to sustainability initiatives that require significant upfront investment. These findings align with (Tuyet, Nghiem and Ninh, 2024), who reported that a debt ratio above 0.60 reduces a company's ability to invest in environmental certification.

Sales growth (GROWTH) has a significant positive effect with a coefficient of 0.121 and  $p=0.000$ . Fast-growing companies are more agile in adopting clean technologies and responding to market demand for environmentally friendly products. Meanwhile, firm age (AGE) is not statistically significant ( $p=0.374$ ), indicating that older firms are not necessarily superior in ESG practices compared to younger firms.

## 5. CONCLUSION

This study examined whether green innovation moderates the relationship between ESG performance and corporate profitability. Utilizing a panel data set of 127 non-financial companies listed on the Indonesia Stock Exchange from 2019 to 2023 (635 firm-year observations) and employing a firm and year fixed-effects model with clustered standard errors, we derive three main conclusions.

First, ESG performance has been shown to have a positive impact on profitability, as measured by return on assets. The regression coefficient for the ESG variable is 0.185, with a significance level of 0.000. This figure implies that a one-point increase in the ESG score will raise ROA by 0.185 points, after controlling firm size, leverage, firm age, sales growth and firm and year fixed effects. This finding refutes the notion that sustainability practices are merely a cost burden. On the contrary, companies with high ESG ratings in Indonesia enjoy operational efficiencies and improved reputations that positively impact profits. These results confirm stakeholder theory: managing relationships with employees, communities, and the environment simultaneously reduces conflicts and enhances public trust, which ultimately reflects in financial performance.

Second, green innovation has been shown to strengthen the relationship between ESG and profitability. The interaction coefficient between ESG and green innovation is 0.157, with a p-value of 0.012. The positive sign of this coefficient indicates that the higher a company's green innovation capabilities, the greater the financial benefits derived from ESG implementation. Conversely, companies with very low green innovation scores show no significant relationship between ESG and ROA, and the relationship tends to be negative. This finding supports resource-

based theory, which posits that green innovation is a scarce and difficult-to-imitate capability, thereby serving as a source of competitive advantage. Process innovations such as water recycling and energy efficiency allow companies to reduce production costs while meeting emission reduction targets. Thus, ESG alone is not enough; companies must build green innovation capacity to transform sustainability commitments into tangible profits.

Regarding the control variables, the results provided theoretically consistent insights. The positive effect of firm size on profitability corroborates the argument that resource-rich organizations are better equipped to undertake green investments. In contrast, the negative influence of leverage underscores the financial constraints imposed by high indebtedness, which may divert funds away from sustainability-oriented expenditures. The positive contribution of sales growth further supports the notion that dynamic, expanding firms are more agile in adopting environmentally friendly technologies. Notably, firm age failed to demonstrate a significant effect, suggesting that longevity alone does not determine a firm's capacity to translate ESG commitments into enhanced financial performance.

The limitations of this study include the ESG measurements that rely on annual sustainability reports are potentially biased because not all companies disclose information fully and consistently. Future research should consider using more comprehensive ESG databases and explore alternative measures of green innovation such as patent citations. Furthermore, examining organizational culture or green leadership as antecedents of green innovation may provide additional insights. From a practical perspective, company managers are advised not only to focus on ESG reporting but also to allocate a dedicated budget for research and development of environmentally friendly technologies. For policymakers, tax incentives and subsidies for green patents need to be expanded to enhance the moderating effect of green innovation. Overall, these three conclusions reinforce the evidence that green innovation acts as a catalyst that transforms sustainable investments into financial gains in emerging markets such as Indonesia.

## **ACKNOWLEDGMENTS**

The authors would like to express their deepest gratitude to the Lampung State Polytechnic for funding this community service project through the Polinela DIPA budget. This support was instrumental in facilitating the successful completion of this project. We would also like to express our appreciation to the Center for Research and Community Service (P3M) at the Lampung State Polytechnic for serving as an intermediary that facilitated the improvement of the quality of this community service project. We also extend our gratitude to all parties who contributed to this research, including peers, colleagues, and other stakeholders who provided assistance, resources, and constructive feedback. Finally, we would like to thank the anonymous reviewers and editors for their insightful suggestions to improve the quality of this manuscript.

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