

Turning sustainability into value: Green accounting as a catalyst in the ESG and financial performance nexus

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ABSTRACT

Environmental, Social, and Governance (ESG) practices have emerged as a critical strategic consideration for firms, as sustainability initiatives are increasingly linked to enhanced financial performance and long-term value creation. Despite the growing global adoption of ESG practices, empirical evidence regarding direct impact on firm value remains inconclusive. This uncertainty is particularly evident in developing economies and environmentally sensitive industries, where further understanding on the effectiveness of ESG implementation is needed. Moreover, limited attention has been given to the role of accounting mechanisms in translating ESG commitments into tangible financial outcomes. This study examines the moderating role of green accounting in the relationship between ESG performance and firm value among mining and manufacturing companies across selected Southeast Asian countries. Grounded in the Natural Resource-Based View (NRBV), the study argues that firms can achieve sustainable competitive advantage by integrating environmental stewardship with robust accounting systems. Using a sample of 536 publicly listed companies from Indonesia, Malaysia, Thailand, Singapore, and the Philippines (2016–2023), the findings reveal that ESG performance alone does not significantly enhance firm value. The implementation of green accounting may initially impose additional costs on firms, potentially constraining short-term financial performance. However, when effectively integrated, green accounting strengthens the positive relationship between ESG performance and long-term firm value by improving transparency, enhancing accountability, and increasing investor confidence. These findings highlight the importance of green accounting as a strategic mechanism for converting sustainability initiatives into long-term financial value, particularly within emerging economies and environmentally intensive industries.

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1. Introduction

Sustainability is increasingly influencing corporate strategy and investment behavior (Khamisu & Paluri, 2024). As a result, many companies are adopting ESG practices to enhance credibility, strengthen stakeholder trust, and demonstrate commitment to responsible business operations. (Wu et al., 2022). Kim et al. (2025) emphasized that these practices are also important for long-term financial performance because investors and regulators increasingly evaluate firms through an ESG lens. A growing body of literature suggests that firms adopting Environmental, Social, and Governance (ESG) practices are generally perceived as lower risk and more likely to achieve superior financial performance. For instance, Rau and Yu (2023) argue that ESG has evolved into an integral component of corporate strategy and governance. Similarly, Chouaibi et al. (2022) found that effective ESG implementation can enhance corporate performance by strengthening stakeholder relationships and improving organizational sustainability. Despite the increasing adoption of ESG practices across industries, empirical evidence regarding their impact on financial performance remains inconclusive. While some studies report positive outcomes, others find mixed or insignificant effects, indicating that the relationship between ESG practices and firm performance remains a subject of academic debate.

Prior studies have produced mixed findings regarding the relationship between ESG performance and firm value. While some studies report that superior ESG performance enhances firm value (Chen et al., 2026; Wu et al., 2022), others argue that the financial benefits of ESG initiatives are neither immediate nor guaranteed. The positive association is often attributed to improved corporate governance, stronger stakeholder trust, enhanced corporate reputation, and lower financing costs. However, the implementation of ESG initiatives frequently requires substantial investments in environmentally sustainable operations, social responsibility programs, and sustainability reporting. These initiatives can increase operational costs in the short term, and ESG adoption alone does not necessarily translate into improved financial performance. Without appropriate organizational mechanisms to integrate sustainability initiatives into business operations, ESG activities may remain largely symbolic which will limit their ability to generate long-term economic value.

In this context, green accounting has emerged as a critical mechanism for translating ESG commitments into measurable financial outcomes. Green accounting enables firms to identify, measure, and report environmental costs, including expenditures related to pollution control, waste management, resource conservation, and environmental compliance. By incorporating environmental costs into financial decision-making, green accounting enhances corporate transparency, accountability, and resource allocation efficiency. Previous studies suggest that the adoption of green accounting practices can improve environmental performance while contributing to long-term financial sustainability. Nevertheless, empirical evidence on the interaction between green accounting and ESG performance in influencing firm value remains limited, particularly in emerging economies and environmentally intensive industries.

This study is grounded in the Natural Resource-Based View (NRBV), which posits that firms can achieve sustainable competitive advantage by developing capabilities that effectively integrate environmental responsibility into their strategic and operational activities. From the NRBV perspective, environmental resources and capabilities become valuable strategic assets when they are embedded within organizational processes. Accordingly, green accounting serves as an enabling capability that allows firms to operationalize ESG initiatives, improve resource efficiency, and convert sustainability efforts into long-term financial value. This perspective suggests that firms combining strong ESG performance with effective green accounting practices are more likely to achieve superior firm value than firms that are implementing ESG initiatives without adequate accounting systems.

From a theoretical perspective of Sundarasan et al. (2024), green accounting is broadly defined as the identification, measurement, recording, and disclosure of environmental costs, environmental investments, resource consumption, emissions, waste management, and other environmental impacts within organizational decision-making processes. Many of these dimensions are embedded within Refinitiv's Environmental Score, which evaluates corporate environmental management systems, emissions

monitoring, resource utilization, environmental policies, environmental investments, and environmental transparency. Operationally, the Refinitiv Environmental Score does not directly capture accounting procedures; however, it reflects the extent to which firms systematically collect, quantify, manage, and disclose environmental information. These activities align with the practical implementation of environmental accounting systems, as environmental data must be measured, monitored, and integrated into organizational reporting processes before disclosure. Accordingly, this study conceptualizes the Refinitiv Environmental Score as a proxy for the firm's environmental accounting implementation capability rather than a pure measure of environmental performance. This approach is consistent with prior studies that employ environmental disclosure, environmental reporting quality, and environmental management indicators as observable manifestations of green accounting practices when direct environmental accounting data are unavailable. Given the absence of a standardized cross-country database that directly measures green accounting practices, this study follows prior sustainability accounting literature by employing Refinitiv Environmental Scores as a proxy for environmental accounting implementation. The rationale is that environmental accounting requires the systematic identification, measurement, monitoring, and disclosure of environmental information. These dimensions are substantially reflected in Refinitiv's environmental assessment framework.

The ASEAN region provides a compelling context for examining the relationship between ESG performance, green accounting, and firm value. Environmental sustainability has been identified as a key strategic priority under the ASEAN Economic Community (AEC) Blueprint 2025. It reflects the region's commitment to sustainable economic development. Consistent with this objective, the Environmental Performance Index (EPI) indicates that environmental performance across ASEAN countries has generally improved in recent years. Nevertheless, sustainability challenges remain particularly pronounced in the mining and manufacturing sectors, which are highly resource- and energy-intensive and are associated with significant environmental impacts, including pollution, waste generation, carbon emissions, and ecosystem degradation problems (Mohsin et al., 2021; Mardonova & Han, 2023; and Kim et al., 2025). As a result, firms operating in these industries face increasing regulatory requirements, stakeholder expectations, and investor pressure to strengthen their sustainability practices and environmental accountability. Although previous studies suggest that ESG initiatives can influence corporate performance through mechanisms such as sustainability reporting, corporate social responsibility (CSR) disclosure, and environmental accounting practices, the processes through which these initiatives translate into improved financial outcomes remain insufficiently understood. This research therefore focuses on ASEAN mining and manufacturing firms to examine whether green accounting serves as a strategic mechanism that enhances the value-creating potential of ESG performance, particularly within environmentally intensive industries in emerging economies.

Prior research of Darsono et al. (2024) suggest that ESG initiatives may influence performance through mechanisms such as accounting and corporate social responsibility disclosure. However, the financial implications of this interaction remain insufficiently explored. Given the importance of mining and manufacturing industries in ASEAN and their significant environmental footprint, examining the integration of ESG practices and green accounting within these sectors is particularly important. While ESG reflects a firm's sustainability commitment, green accounting operationalizes these commitments by systematically identifying, measuring, and disclosing environmental costs and benefits. This process enhances transparency, reduces information asymmetry, improves stakeholder confidence, and supports more efficient managerial decision-making, thereby enabling ESG initiatives to generate greater economic value. The motivation for ESG implementation is emphasized by increasing regulatory pressure, stakeholder expectations, investor demand for sustainability information, and environmental challenges faced by mining and manufacturing firms in ASEAN.

This study aims to achieve three objectives. First, it examines whether ESG performance influences performance in mining and manufacturing firms across ASEAN countries. Second, it investigates the effect of green accounting on firm value. Third, the study analyzes whether green accounting moderates the relationship between ESG performance and financial performance. By addressing these objectives, this study contributes to the literature by integrating ESG and sustainability accounting perspectives within the

Natural Resource-Based View framework and by providing evidence from ASEAN's resource-intensive industries.

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature and develops the research hypotheses. Section 3 describes the research methodology, including the data, variables, and empirical model. Section 4 presents and discusses the empirical findings. Finally, Section 5 concludes the study by summarizing the key findings, outlining the theoretical and practical implications, acknowledging the study's limitations, and providing recommendations for future research.

2. Literature review and hypotheses development

Sustainability has become a strategic priority, leading firms to integrate Environmental, Social, and Governance (ESG) principles into their operations and decision-making. Over the past two decades, ESG has evolved from a voluntary initiative into a key driver of firm value and corporate strategy. This shift has increased the importance of green accounting, which integrates environmental costs into financial reporting to enhance transparency, accountability, and stakeholder confidence. Previous studies suggest that strong ESG performance improves firm value by enhancing governance, reputation, and stakeholder relationships (Chouaibi et al., 2022; Wong et al., 2021; Xu et al., 2021). However, empirical evidence remains mixed, indicating that the financial benefits of ESG vary across industries and institutional contexts. Consequently, further research is needed to better understand the ESG–firm value relationship.

Green accounting has emerged as an important mechanism through which firms demonstrate their commitment to environmental responsibility by incorporating environmental costs, liabilities, and benefits into their accounting and reporting systems (Asni & Agustia, 2022; Darsono et al., 2024; Sundarasen et al., 2024). By integrating environmental considerations into financial reporting, green accounting enhances corporate transparency, accountability, and the credibility of sustainability disclosures. Moreover, it enables firms to identify and manage environmental risks more effectively while balancing financial performance with environmental stewardship. Previous studies suggest that the adoption of green accounting practices can enhance firm value, particularly when firms possess strong financial performance and sufficient organizational resources to support sustainability initiatives (Asni & Agustia, 2022; Darsono et al., 2024; Sundarasen et al., 2024). Consequently, the integration of Environmental, Social, and Governance (ESG) practices with green accounting has become increasingly important for achieving long-term corporate sustainability.

Empirical evidence further indicates that green accounting contributes to improved sustainability performance, which subsequently enhances overall organizational performance. These findings support the view that environmental capabilities require structured organizational mechanisms to be effectively translated into superior business outcomes. In addition, the literature identifies innovation as a complementary pathway through which sustainability initiatives create value. For example, Huong et al. (2021) highlight how environmental management systems and green innovation have been found to positively influence organizational performance. Similarly, Xu et al. (2021) report that ESG performance enhances innovation outcomes and strengthens the effectiveness of research and development (R&D) investments. Collectively, these studies suggest that ESG capabilities promote innovation-driven competitiveness. However, the successful translation of ESG initiatives into long-term financial value depends on the presence of robust internal systems, such as green accounting. It facilitates sustainability measurement, improves decision-making, enhances the quality of sustainability reporting, and reduces information asymmetry between firms and stakeholders.

Despite the growing attention, research on ESG, green accounting and financial performance is fragmented and inconclusive (Phuoc et al., 2025). Research on ESG and sustainability reporting shows that companies are beginning to adopt these concepts but are not yet putting them into practice. Despite its increasing adoption, green accounting does not always lead to substantive changes in corporate behavior and may instead serve to enhance corporate legitimacy. This highlights the need to examine whether green accounting creates meaningful organizational value or merely improves corporate image. Firms should,

therefore, consider how green accounting can support both environmental responsibility and financial performance, making it an important strategic consideration.

Environmental, Social, and Governance (ESG) practices and green accounting are particularly important in resource-intensive industries such as mining and manufacturing. These industries have substantial environmental impacts and face increasing pressure from regulators and investors to improve sustainability performance. Darsono et al. (2024) have also suggested that ESG initiatives contribute to sustainability through mechanisms such as green accounting and corporate social responsibility (CSR) disclosure. However, few studies have examined how ESG and green accounting jointly influence firm financial performance. Other than that, ESG disclosure enhances investor confidence and may reduce the cost of capital as seen in Rau and Yu (2023), although its effectiveness mainly depends on the credibility and robustness of firms' accounting systems.

2.1 ESG and financial performance

Environmental, Social, and Governance (ESG) performance has become an important determinant of corporate financial performance, particularly in environmentally sensitive industries such as mining and manufacturing. ESG practices enhance stakeholder trust, improve operational efficiency, reduce regulatory risks, and strengthen corporate reputation, all of which contribute to long-term value creation (Chouaibi et al., 2022; Wong et al., 2023; Wong et al., 2021). Empirical evidence shows that firms with superior ESG performance tend to achieve higher firm value and stronger governance quality (Wu et al., 2022; Fatemi et al., 2018). From a financial perspective, ESG initiatives can reduce financing costs and investment risk, thereby improving firms' access to capital and financial performance. Chen et al. (2023) found that strong ESG performance lowers the cost of equity capital, while Gholami & Sands (2022) reported that sustainability disclosures reduce idiosyncratic risk and financing costs. Consistent with the Natural Resource-Based View (NRBV), environmental and social capabilities can generate sustainable competitive advantages through pollution prevention, resource efficiency, and stakeholder engagement, particularly in resource-intensive industries. Given the increasing sustainability pressures faced by ASEAN mining and manufacturing firms, ESG performance is expected to enhance financial performance by strengthening competitiveness, reducing risk, and improving investor confidence. Therefore, this study proposes the following hypothesis:

H₁: ESG performance affects the financial performance of mining and manufacturing companies in ASEAN.

2.2 Green accounting and financial performance

Green accounting refers to the identification, measurement, and disclosure of environmental costs associated with corporate activities, including pollution control, waste management, carbon reduction, and resource efficiency initiatives. By incorporating environmental costs into managerial decision-making, green accounting enhances transparency, improves resource allocation, and supports sustainable business practices. From the perspective of the Natural Resource-Based View (NRBV), green accounting represents an organizational capability that enables firms to effectively manage environmental resources and translate sustainability initiatives into economic benefits (Darsono et al. 2024; Nguyen et al. 2018; Sundarassen et al., 2024). Firms that systematically integrate environmental costs into their strategic and operational decisions are better positioned to improve resource efficiency, reduce environmental risks, and comply with regulatory requirements. These capabilities can contribute to competitive advantage and long-term financial performance. Prior empirical studies provide evidence supporting the positive role of green accounting in enhancing firm performance. Sundarassen et al. (2024) find that environmental accounting practices improve sustainability outcomes and operational effectiveness, thereby enhancing financial performance. Similarly, Darsono et al. (2024) reported that green accounting strengthens corporate transparency and stakeholder confidence. Similarly, Nguyen et al. (2018) document a positive association between green accounting implementation and firm value. In the ASEAN context, environmentally oriented business practices and

innovation have also been linked to superior financial performance and firm Value (Asni & Agustia, 2022). Green accounting is a strategic mechanism that enhances operational efficiency, mitigates environmental risks, and improves corporate credibility, thereby contributing to stronger financial performance. Therefore, this study proposes the following hypothesis:

H₂: Green accounting positively affects the financial performance of mining and manufacturing companies in ASEAN.

2.3 Green accounting moderates the relationship between ESG practices and financial performance

The financial benefits of ESG are not always realized automatically and may depend on the firm's internal capabilities to translate sustainability initiatives into economic outcomes. From the NRBV theory, green accounting represents an organizational capability that supports the effective implementation of ESG strategies. By integrating environmental costs and performance metrics into decision-making processes, green accounting improves transparency, resource efficiency, and environmental accountability (Sundarasen et al., 2024). Also, Maswadeh and Alhusban (2024) mention how firms are able to monitor environmental investments, reduce waste, and strengthen stakeholder confidence, resulting in enhancing the credibility and effectiveness of ESG initiatives. Consequently, firms with stronger green accounting practices are more likely to convert ESG commitments into financial benefits. In contrast, firms with weak green accounting systems may struggle to realize the economic value of their sustainability efforts. Empirical studies further suggest that ESG-related initiatives contribute to higher firm value, profitability, and lower financing (Wong et al., 2021; Chininga et al., 2024; Nguyen et al., 2022). Therefore, green accounting is expected to strengthen the positive effect of ESG on financial performance.

H₃: Green accounting positively moderates the relationship between ESG performance and financial performance.

2.4 Gap in previous literature

Despite the growing body of literature examining the relationship between ESG practices and financial performance, as well as the direct effect of green accounting on corporate performance, significant gaps remain in understanding how these two sustainability mechanisms interact. Existing studies have predominantly investigated ESG and green accounting as separate determinants of financial performance, with limited attention to green accounting as a mechanism that may enhance the effectiveness of ESG practices in generating financial returns. Within this framework, green accounting is conceptualized as an organizational capability that translates sustainability commitments into measurable managerial actions. Green accounting provides environmental cost information, performance monitoring, resource efficiency measurement, and sustainability-related decision support. Therefore, it strengthens the effectiveness of ESG initiatives in generating firm value. Green accounting is modeled as a moderator rather than a mediator because the study does not assume that ESG performance necessarily leads to the adoption of green accounting systems. Firms with stronger green accounting systems are expected to convert ESG commitments into financial value more effectively than firms with weaker environmental accounting capabilities. Accordingly, green accounting influences the strength of the ESG–firm value relationship rather than serving as an intervening mechanism.

3. Methodology

This quantitative study uses secondary data from 536 publicly listed mining and manufacturing firms in Indonesia, Malaysia, Thailand, Singapore, and the Philippines between 2016 and 2023. The study period was selected due to the increasing availability and consistency of ESG disclosures among ASEAN firms. The sample comprises 449 manufacturing firms and 87 mining firms, including 144 firms from Malaysia,

136 from Indonesia, 120 from Thailand, 88 from Singapore, and 48 from the Philippines. Data were obtained from the Refinitiv Eikon Datastream database to ensure consistency and cross-country comparability. The empirical analysis employs regression analysis (MRA) using STATA 19 to examine the direct effects of ESG performance and green accounting on firm value, as well as the moderating role of green accounting through interaction terms. Firm size is included as a control variable because larger firms typically possess greater resources to implement ESG initiatives, green accounting, and sustainability reporting, which may influence firm value. Controlling for firm size helps isolate the effects of ESG performance and green accounting on firm value, consistent with prior ESG research.

Table 1 provides the definition and measurements of the variables used in this study.

Variables	Measurement	Past studies
ESG	The ESG score is constructed from more than 400 underlying environmental, social, and governance indicators collected from company annual reports, sustainability reports, and other public disclosures. These indicators are grouped into three main pillars: (i) environmental (e.g., emissions, resource use, and environmental innovation), (ii) social (e.g., workforce management, human rights, and community relations), and (iii) governance (e.g., board structure, shareholder rights, and corporate ethics). Refinitiv standardizes and aggregates these indicators into comparable ESG scores ranging from 0 to 100. The ESG score measures ESG.	(Ahmad et al., 2024); (Chouaibi et al., 2022); (Atan et al., 2018)
Green Accounting	Green accounting is proxied by Refinitiv Environmental Scores. Although Refinitiv Environmental Scores are primarily designed to assess environmental performance and disclosure, they also capture key dimensions of environmental accounting implementation, including environmental measurement, emissions monitoring, resource utilization tracking, environmental investments, waste management, and environmental reporting practices. In line with the environmental accounting literature, the score is interpreted as a firm's environmental accounting implementation capability, reflecting the extent to which environmental information is systematically measured, managed, and disclosed. The score ranges from 0 to 100, with higher values indicating stronger environmental accounting-related practices. Green Accounting is measured by environmental performance.	(Sklavos et al., 2025); (Ye et al., 2025); (Berradia, 2026)
Financial Performance	Tobin's Q is the ratio of a firm's market value of assets to its book value of assets. $\text{Tobin's Q} = \frac{\text{Book Value of Total Assets} + \text{Market Value of Equity} + \text{Book Value of Total Debt}}{\text{Value of Total Debt}}$	(Asni & Agustia, 2022; Atan et al., 2018; Chininga et al., 2024)
Firm Size	Firm size refers to the scale of a company's operations, typically measured by assets, revenue, or number of employees. The natural log of total assets serves as a proxy for firm size.	(Drempetic et al., 2020), (Chen et al., 2026).

3.1 Estimation of models

This study enhances the empirical model by employing a moderated regression analysis (MRA) to accurately examine the conditional influence of green accounting on the relationships between ESG and financial performance (Tobin's Q). Several previous studies have used MRA in their research analysis (Albitar et al., 2020; Elmghamez et al., 2024; Sari & Valdiansyah, 2025; Shakil, 2021). This study adopts an explanatory research approach to examine the relationship between sustainability practices and financial performance. Specifically, it investigates how ESG performance and green accounting interact to influence firm value. By analysing these relationships, the study provides a deeper understanding of the role of green accounting in strengthening the financial materiality of ESG practices and contributes to the literature on sustainable business practices.

$$FP(TBQ) = \beta_0 + \beta_1 ESG + \beta_2 GRA + \beta_3 GRA_ESG + \beta_4 SIZ + \varepsilon \quad (1)$$

Where, FP represents financial performance, measured by Tobin's Q. ESG denotes the Environmental, Social, and Governance performance score obtained from Refinitiv Eikon Datastream. GA refers to green accounting, measured using the environmental accounting disclosure index. SIZE is the control variable, measured as the natural logarithm of total assets. β_0 is the intercept, β_1 – β_3 are the regression coefficients, ε denotes the error term, while i and t represent firm and year, respectively.

4. Results and discussion

4.1 Descriptive statistics

This study employs Moderated Regression Analysis (MRA) to examine the relationship between ESG performance, green accounting, and firm value. Descriptive statistics are first presented to summarize the characteristics and distribution of the variables before testing the proposed hypotheses. The study covers 536 firm-year observations from five ASEAN countries, namely Indonesia, Malaysia, Thailand, Singapore, and the Philippines, over the period 2016–2022. The selected observation period reflects the increasing availability and consistency of ESG disclosures among publicly listed firms in the ASEAN region. Based on industry classification, the sample comprises 449 manufacturing firm-year observations (83.77%) and 87 mining firm-year observations (16.23%). In terms of country distribution, Malaysia contributes the largest proportion of observations with 144 firm-years (26.87%), followed by Indonesia with 136 firm-years (25.37%), Thailand with 120 firm-years (22.39%), Singapore with 88 firm-years (16.42%), and the Philippines with 48 firm-years (8.96%). This distribution demonstrates that the sample provides a broad representation of listed manufacturing and mining companies across the selected ASEAN countries.

Table 2. Descriptive statistics of variables

Variable	Obs	Mean	Std. Dev.	Min	Max
TBQ	536	1.371959	1.843244	0.01	13.07
ESG	536	55.84862	18.07724	8.25	91.97
GRA	536	53.42226	22.71531	0.93	97.29
GRA_ESG	536	3333.085	2090.493	17.82	8933.046
SIZ	536	113541.9	177424	468	929293

Note: TBQ (financial performance), GRA (Green accounting), ESG (environment, social, and governance), SIZ (firm size), GRA_ESG (moderating interaction between green accounting and ESG)

Table 2 presents the statistical results describing the variables in the study. The data include 536 firm-year observations, which are sufficient to estimate the relationships among the variables and analyze their interactions. The Tobin's Q values are all over the place, with a mean of 1.372 and a standard deviation of 1.843, suggesting they are widely dispersed. The findings reveal considerable heterogeneity in firm market values. This indicates that market valuation varies significantly across companies. The values range from 0.01 to 13.07, indicating substantial variation in firm value across the sample. This variability enhances the robustness of the analysis while highlighting the need to assess potential data issues before conducting further empirical tests. The ESG scores have a mean of 55.85 and a standard deviation of 18.08, indicating a moderately spread distribution. These results suggest that firms differ considerably in their implementation of sustainability-related initiatives and practices. The Green Accounting scores have a mean of 53.42 and a standard deviation of 22.72, indicating that the firms differ significantly in their accounting practices. The interaction term, representing the product of ESG performance and green accounting, exhibits the expected mean and standard deviation. Given the relatively large magnitude of the interaction term, the constituent variables were mean-centered before estimation to minimize potential multicollinearity and improve the reliability of the regression results. Firm size shows considerable variation across the sample, with a mean of 113,541.9 and a standard deviation of 177,424, indicating

substantial heterogeneity among firms. Accordingly, firm size is included as a control variable because it is associated with both ESG engagement and firm value.

The statistics indicate that the data are sufficiently variable to analyze the relationships between the variables. This is especially true for the Green Accounting and ESG scores, which are important because we want to see whether green accounting strengthens or weakens the relationship between ESG and financial performance. Before we run the regression analysis, we need to examine the correlations among the variables to assess their relationships and ensure there is no multicollinearity. The results of the correlation analysis are shown in Table 3.

Table 3. Correlation results for ESG, Green Accounting, and Firm Value

	TBQ	ESG	GRA	GRA ESG	Size
TBQ	1.000				
ESG	0.0777	1.0000			
GRA	0.0291	0.8528	1.0000		
GRA_ESG	0.0551	0.9331	0.9488	1.0000	
SIZ	0.1971	0.1355	0.1320	0.1278	1.0000

*Refer to Table 2 for the notation of variables

The correlation analysis indicates that Tobin's Q is weakly correlated with both ESG performance and green accounting (GRA), suggesting that sustainability performance alone has a limited direct association with firm value. Firm size is negatively associated with Tobin's Q, indicating that larger firms tend to exhibit lower market growth opportunities. A positive correlation is observed between ESG performance and GRA, implying that firms with stronger ESG performance are more likely to adopt green accounting practices. As expected, the interaction term is highly correlated with its constituent variables because it is constructed by multiplying ESG and GRA. To mitigate potential multicollinearity, the variables were mean-centered before generating the interaction term. Overall, the correlation coefficients do not indicate severe multicollinearity. This supports the suitability of the variables for regression analysis, although further diagnostic tests are performed to confirm model adequacy. The modest direct association between ESG and firm value reinforces the theoretical justification for employing Moderated Regression Analysis (MRA) to test whether green accounting strengthens or conditions the ESG–Tobin's Q relationship.

4.2 Panel data estimation and model selection

To identify the most appropriate panel data estimation technique, this study estimated three alternative models: the Pooled Ordinary Least Squares (POLS), Fixed Effects Model (FEM), and Random Effects Model (REM). The selection of the final estimation model followed the standard panel-data procedure.

First, the Chow test was performed to compare the POLS and FEM specifications. A significant Chow test indicates that the Fixed Effects Model is preferred over the pooled model. Second, the Breusch–Pagan Lagrange Multiplier (BP-LM) test was conducted to determine whether the Random Effects Model provides a better fit than POLS. Finally, the Hausman test was employed to choose between the Fixed Effects Model and the Random Effects Model. A significant Hausman statistic indicates that the Fixed Effects Model is more appropriate because the individual effects are correlated with the explanatory variables.

After determining the appropriate panel estimation model, several diagnostic tests were conducted to evaluate the validity of the regression assumptions. These included tests for multicollinearity using the Variance Inflation Factor (VIF), heteroskedasticity using the Modified Wald test, and autocorrelation using the Wooldridge test. The diagnostic results indicated heteroskedasticity and autocorrelation. Therefore, following the recommendations of Sayuti et al. (2024) and Bui et al. (2023), the regression coefficients were re-estimated using the Generalized Least Squares (GLS) estimator with robust standard errors to obtain consistent and efficient parameter estimates (R5b). GLS explicitly accounts for heteroskedastic error variances and within-panel serial correlation by transforming the disturbance variance–covariance matrix. Consequently, the estimator produces more efficient coefficient and statistically valid standard errors. This

should improve the reliability of hypothesis testing. Consistent with previous panel-data studies of Sayuti et al. (2024) and Bui et al. (2023), the discussion of the hypotheses is therefore based on the GLS estimation results reported in Table 4.

Table 4 reports the estimation results for the POLS, FEM, REM, and the final GLS model. The Chow test with p-value less than 0.005, rejected the pooled model in favor of FEM, while the BP-LM test with p-value less than 0.005 indicated that REM was preferable to POLS. Furthermore, the Hausman test with Chi-square value of 14.21 and p-value of 0.0067, confirmed that the Fixed Effects Model was the preferred specification over the Random Effects Model. Nevertheless, because the diagnostic tests revealed heteroskedasticity and autocorrelation, the final interpretation of the regression coefficients is based on the GLS estimates, which provide more reliable statistical inference under these conditions.

Table 4. Statistic panel data analysis results of Moderated Regression Analysis (MRA)

Variables	Model (1) POLS	Model (2) FEM	Model (3) REM	Model (4) GLS
ESG	0.00323 (0.790)	0.00800 (0.492)	0.00834 (0.453)	0.00323 (0.789)
GRA	0.0636*** (0.000)	0.0146 (0.107)	0.0218** (0.013)	0.0636*** (0.000)
GRA_ESG	0.000701*** (0.000)	-0.0000824 (0.580)	0.0000376 (0.793)	0.000701*** (0.000)
Size	0.00000207*** (0.000)	0.00000218*** (0.004)	0.00000216*** (0.001)	0.00000207*** (0.000)
Constant	2.489*** (0.000)	2.227*** (0.000)	2.192*** (0.000)	2.489*** (0.000)
Observations	536	536	536	536
R-squared	0.1084	0.0764	0.0418	
Number of Groups	67	67	67	67
Chows Test- POLS vs FEM	20.39 (Prob F = 0.0000)			
LM Test- POLS vs REM	51.02 (Prob Chibar-2 = 0.0000)			
Hausman Test- FEM vs REM	14.21 (Prob Chi-2 = 0.0067)			
FEM- F Statistik	9.61 (Prob F = 0.0000)			

The fixed effect model (FEM) is efficient over REM and OLS

***, **, * indicate the value is significant at 1%, 5%, and 10% level

*Refer to Table 1 for the notation of variables

4.3 ESG and financial performance

The results indicate that ESG has a statistically insignificant effect on firm value, thereby rejecting H1. Although firms with higher ESG performance tend to have higher firm value, the effect is not strong enough to directly influence market valuation. This suggests that investors in ASEAN markets may continue to prioritize short-term financial performance over long-term sustainability initiatives, whose benefits generally require time to materialize. The varying quality and credibility of ESG disclosures across ASEAN countries may also explain the insignificant relationship. Differences in reporting standards and regulatory environments reduce the comparability of ESG information, while concerns over greenwashing may further weaken investor confidence. When ESG disclosures are perceived as symbolic rather than reflecting genuine sustainability practices, investors are less likely to incorporate ESG performance into firm valuation.

These findings are consistent with the Natural Resource-Based View (NRBV), which argues that sustainability practices create competitive advantage only when they are transformed into strategic capabilities, such as green innovation and operational efficiency. Therefore, ESG performance alone is insufficient to improve a firm's value unless it generates tangible economic benefits (Rohendi et al. 2024; Desai, 2024; and Tamasiga et al. 2024).

4.4 Green accounting and financial performance

The results in Table 4 show that green accounting has a positive and significant effect on firm value. The coefficient is 0.0636 with a p-value of 0.000, indicating that greater implementation of green accounting is associated with higher firm value, measured by Tobin's Q. The result is consistent with the Natural Resource-Based View (NRBV), which argues that environmental capabilities become strategic resources when they improve operational efficiency, innovation, and corporate reputation. By integrating environmental considerations into accounting systems, firms can enhance resource utilization and create sustainable competitive advantages that increase firm value. Previous studies such as study by Orbaningsih (2023) report that environmental accounting improves corporate accountability and supports sustainable financial performance, while Maechler and Boisvert (2025) find that effective environmental accounting systems strengthen environmental risk management and organizational resilience. Likewise, Wu et al. (2022) show that the positive impact of sustainability practices on firm value is stronger when supported by effective governance and strategic implementation.

4.5 Green accounting moderates the relationship between ESG and financial performance

The results in Table 4 show that green accounting affects the relationship between Environmental, Social, and Governance factors and the firm's value. The coefficient of the interaction term GRA_ESG is 0.000701 and a p-value of 0.000. The positive coefficient indicates that ESG initiatives are more effective when firms use green accounting systems. The results indicate that green accounting strengthens the impact of Environmental, Social, and Governance (ESG) strategies by providing more reliable, quantifiable sustainability information and embedding ESG considerations in managerial decision-making. Wu et al. (2022) report that sustainability performance is more important for value when it is supported by strong governance and structured sustainability mechanisms. This means that formal systems can make sustainability initiatives more valuable. Another researcher, Berradia (2026) discovers environmental disclosure is not particularly important for performance, but it becomes more important when accompanied by actual sustainability practices. This shows that internal mechanisms can make Environmental, Social, and Governance engagement more financially important. Research on environmental accounting transformation shows that including metrics in corporate accounting systems can improve strategic alignment and sustainability performance (Song et al., 2025). Bibliometric analyses of sustainability and accounting research also show that firms that combine Environmental, Social, and Governance engagement with environmental management systems can create greater long-term value (Aljawarneh et al., 2025).

The positive interaction coefficient of 0.000701 and the p-value of 0.000 confirm that green accounting enhances the effectiveness of Environmental, Social, and Governance for value. This is consistent with the Natural Resource-Based View theory, which says that firms with environmental accounting capabilities can turn Environmental, Social, and Governance initiatives into operational efficiency, innovation, risk mitigation, and higher market valuation. This finding highlights the importance of including accounting systems in broader sustainability frameworks to achieve long-term financial performance gains. Green accounting is important for firms because it helps them use Environmental, Social, and Governance initiatives effectively and create more value for the firm.

Firm size, as a control variable, has a positive and significant effect on firm value, indicating that larger firms tend to have higher market valuations. Larger companies generally possess greater financial resources, operational efficiency, and stronger competitive advantages, which increase investor confidence. In addition, large firms typically have better access to external financing and greater capacity to implement sustainability initiatives and manage business risks effectively.

5. Conclusion

The findings reveal that ESG performance has an insignificant relationship with firm value, indicating that sustainability disclosure alone is insufficient to enhance market valuation. In contrast, green accounting

has a positive and significant effect on firm value. It strengthens the relationship between ESG performance and firm value, suggesting that effective environmental accounting enables firms to translate sustainability commitments into tangible economic value. The positive and significant effect of firm size further suggests that larger firms are more likely to achieve higher market valuation due to their greater resources and competitive advantages. These findings support the Natural Resource-Based View (NRBV).

From a policy perspective, the findings underscore the need for regulators and standard-setting bodies in ASEAN to strengthen environmental reporting frameworks and encourage the wider adoption of green accounting practices to improve the quality and credibility of sustainability information. For managers, the results emphasize that comprehensive environmental accounting systems should support ESG initiatives to maximize their contribution to firm value. This study contributes to the growing sustainability literature by providing region-specific evidence on the complementary roles of ESG performance and green accounting in enhancing firm value within the ASEAN context. Future research may incorporate institutional quality, corporate governance, or green innovation to further explain variations in sustainability performance across emerging economies.

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Conflict of interest statement

The author(s) declare that this research was conducted in the absence of any self-benefits, commercial or financial interests that could influence the work reported in this paper.

Ethics statement

The authors declare that this research did not involve human or animal subjects. All experimental procedures were performed following the institutional Safety, Health, and Environmental (HSE) protocols of Universiti Teknologi MARA. This research involved minimal risk and approved a waiver for informed consent.

Declaration of generative AI

During the preparation of this work, the author(s) used generative AI in order to improve grammar and refine the manuscript. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

Data availability/supplementary materials

Available upon request: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Muliani carried out the research, wrote, and revised the article. Jamaliah Said worked on supervision, conceptualised the central research idea and provided the theoretical framework. Nurhidayah Yahya on the validation and resources for the paper. Naila Erum covered on writing for reviewing and editing, as well as the technical aspects of the software and formal analysis.



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