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FROM ESG COMMITMENT TO MARKET VALUE: DOES GREEN INNOVATION UNLOCK FINANCIAL GAINS IN ASEAN MINING AND MANUFACTURING FIRMS?

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Abstract:

Despite the rapid global adoption of Environmental, Social, and Governance (ESG) frameworks, growing evidence suggests that ESG initiatives frequently fail to translate into tangible financial value, raising concerns about symbolic compliance and potential negative market consequences. This study examines the mediating role of green innovation in the relationship between Environmental, Social, and Governance (ESG) scores and financial performance in mining and manufacturing companies across ASEAN countries. As sustainability gains prominence in corporate strategy, ESG has emerged as a framework intended to align environmental responsibility with long-term profitability. However, its actual impact on financial performance remains unclear, particularly in high-impact sectors such as mining and manufacturing that face regulatory and operational complexities. Using panel data from 2016 to 2023 and applying path analysis, the study investigates whether green innovation serves as a conduit through which ESG influences firm performance. The empirical results reveal no statistically significant direct relationship between ESG scores and financial performance, nor a significant mediating effect of green innovation. These findings suggest that ESG implementation, in isolation, does not deliver financial advantages unless coupled with substantive innovation strategies. A key insight from this study is the identification of an "ESG–Innovation Misalignment," wherein ESG

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reporting may be more symbolic than transformative, leading to limited innovation outcomes and failing to support sustainable financial returns. This issue raises concerns about greenwashing and the superficial adoption of sustainability frameworks in ASEAN's industrial sectors. The findings emphasize the need for an integrated, performance-based ESG strategy supported by effective innovative ecosystems and proactive policy incentives. Such alignment is critical to translating ESG and sustainability commitments into measurable economic and environmental value in emerging markets.

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Keyword:

ASEAN, ESG Score, Financial Performance, Green Innovation, Greenwashing, Mining and Manufacturing Companies, And Sustainability.

Introduction

The increasing urgency of global sustainability challenges, climate change, resource depletion, social inequality, and corporate accountability has pushed businesses to incorporate Environmental, Social, and Governance (ESG) factors into their strategic and operational frameworks (Rahman et al., 2023). ESG has evolved from a reputational metric to a cornerstone of sustainable investment, risk management, and long-term financial performance (Rau & Yu, 2023). While ESG is widely positioned as a cornerstone of sustainable investment and risk management, recent evidence continues to show that the ESG–financial performance relationship is often context-dependent and sometimes inconclusive, particularly in emerging markets where institutional quality and reporting maturity vary (Du et al., 2026; Parra-Domínguez et al., 2026). The mining and manufacturing sectors are among the most environmentally and socially impactful industries (Mohsin et al., 2021; Mardonova & Han, 2023 and Kim et al., 2025). They are typically associated with significant carbon emissions, waste generation, water and land degradation, labour rights issues, and governance risks, yet remain critical to economic development, employment, and industrial growth, especially in emerging regions such as Southeast Asia. Environmental issues affect not only economic activity but also the stock market (Sayuti et al., 2024). This tension makes ASEAN mining and manufacturing firms a high salience setting to test whether ESG commitments translate into measurable financial outcomes or remain largely symbolic.

Sustainability development goals (SDGs) in Southeast Asian (ASEAN) countries have become a problem and a key concern in efforts to improve sustainability in the economic, social, and environmental domains (Asni & Agustia, 2022). The 2018 Environmental Performance Index (EPI) shows that, while ten Southeast Asian countries saw an average improvement of around

50% in environmental indicators such as air quality, ecosystem health, biodiversity sustainability, heavy metals, energy, and air pollution, these gains remained moderate (Wendling et al., 2018). In parallel, responsible investment frameworks (e.g., UN-PRI) have increased pressure on listed companies to disclose ESG practices, but the credibility of ESG information can be challenged by evolving rating methodologies and uneven comparability across issuers (MSCI, 2026). These realities intensify the need to understand how ESG can be operationalized into real performance improvements.

Recent controversies have intensified scrutiny. The 2022 case of DWS Group, an asset management arm of Deutsche Bank, allegedly exaggerating the sustainability of its investment products, sparked investigations in both Germany and the U.S. for potential greenwashing (Murarova, 2022; Smiles & Purcell, 2023). A growing body of literature provides mixed evidence—some studies show positive correlations, others negative or neutral—highlighting the complexity of ESG–performance linkages (Whelan et al., 2021). This inconsistency suggests that ESG may not improve financial outcomes directly unless it is translated into tangible capability-building mechanisms, such as green innovation, operational efficiency, and measurable environmental improvements (Rahmanniyaychomachaei, et al., 2026; Sun et al., 2026). This incident exposed the gap between ESG reporting and actual sustainable performance, suggesting that ESG scores may sometimes reflect symbolic gestures rather than substantive improvements. These developments raise critical questions about the credibility and economic relevance of ESG, especially when not paired with real operational or technological transformation. In this context, green innovation is increasingly recognised as a key enabler that could operationalise ESG strategies into measurable performance outcomes.

Responsible investing techniques have a significant impact on organizations' bottom lines. Several studies have examined the impact of ESG investment on corporate financial performance, primarily in industrialized economies where responsible investing funds are prevalent and the context of an emerging economy, where little research has been carried out(Sherwood & Pollard, 2018; (Johnson, 2020). Evidence is inconclusive (Amin & Tauseef, 2022; Folger-Laronde et al., 2022; Hasan et al., 2022; Mohammad & Wasiuzzaman, 2021). As such, the objective of this research is to address this gap in contradictory evidence by empirically verifying the effect of ESG score on financial performance. Green innovation is commonly conceptualized in product, process, and organizational dimensions (García-Granero et al., 2018, 2020; Quintana-García et al., 2022), and research suggests capital markets can value credible environmental innovation because it signals efficiency, resilience, and long-term competitiveness (Hojnik et al., 2017; Reyes-Rodríguez et al., 2016). However, evidence remains inconsistent, particularly in developing contexts (Yao et al., 2019). Recent studies increasingly argue that innovation-based pathways are central: ESG engagement is more likely to create value when it stimulates green innovation that strengthens competitiveness and firm value, rather than functioning as a compliance exercise (Du et al., 2026; Sun et al., 2026).

Grounded in the Natural Resource-Based View (NRBV), this study re-examines the ESG–financial performance nexus by testing whether green innovation mediates the relationship between ESG scores and financial performance among ASEAN mining and manufacturing firms. By focusing on high-impact sectors, the study clarifies whether ESG commitments, when paired with innovation capabilities, unlock financial gains or whether ESG remains largely symbolic in practice—an issue that is particularly relevant for investors, regulators, and managers seeking credible sustainability outcomes in ASEAN markets.

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This study seeks to re-examine the ESG and financial performance nexus by investigating whether green innovation serves as a strategic mechanism that translates sustainability commitments into measurable economic value. The focus of this study is on enterprises in ASEAN countries. Several elements underpin the reason for selecting research objects in ASEAN countries: First, the ASEAN community, which includes Brunei Darussalam, Cambodia, Indonesia, the Lao People's Democratic Republic (PDR), Malaysia, Myanmar, the Philippines, Singapore, Thailand, Vietnam, and Timor Leste, has made commitments to achieve 17 SDGs. Environmental sustainability is a key agenda item in the ASEAN Economic Community (AEC) Blueprint 2025 (Asni & Agustia, 2022). Second, in the release of the 2017 global megatrends, ASEAN countries agreed to collaborate in the environmental sector, particularly on controlling a clean and green environment, protecting natural resources for economic and social development, sustainable management and conservation of land, water, minerals, energy, biodiversity, forests, coastal and marine resources, and improving water and air quality (Tay et al., 2017). Third, the Environmental Performance Index (EPI) study demonstrates that environmental indicators in ten Southeast Asian countries have increased on average over the previous year. Air quality, environmental health, biodiversity sustainability, heavy metals, energy, and air pollution have all increased by more than 50% (Wendling et al., 2018).

Literature Review

The link between ESG performance and financial outcomes has drawn a lot of academic interest, but the results are still mixed. Many studies show a positive connection between ESG engagement and firm performance. They argue that companies focused on sustainability gain better trust from stakeholders, face lower risks, operate more efficiently, and build a stronger reputation. For example, Chininga et al. (2024) show a positive impact of ESG ratings on financial performance in South Africa. Chen et al. (2023) find that good ESG performance significantly boosts profitability and financial stability in companies around the world. Similar findings from emerging markets indicate that responsible investment practices are linked to better firm value (Aydoğmuş et al., 2022; Makhdalena et al., 2023). These results generally support the Natural Resource-Based View (NRBV), which suggests that environmentally responsible strategies can lead to a lasting competitive edge through better resource management (Hart, 1995). Recent studies also suggest that ESG ratings might impact firm value through both institutional and market factors, although the results differ based on the research design and context (Du et al., 2026).

However, the literature also reveals mixed and context-dependent results. Studies such as Fatemi et al. (2018) and Atan et al. (2018) report insignificant or inconsistent associations between ESG disclosure and firm value, suggesting that sustainability engagement does not automatically translate into financial gains. Naeem et al. (2022) further demonstrate that the ESG–performance relationship is stronger and more consistent in developed markets compared to emerging economies. These contradictory findings may be attributed to several methodological and contextual differences across prior studies. First, differences in sample setting may influence the results, as studies conducted in developed markets often benefit from stronger institutional enforcement, higher investor awareness, and more mature ESG reporting systems, whereas emerging markets may face weaker regulatory enforcement, lower disclosure quality, and greater variation in ESG adoption. Second, differences in industry coverage may also explain the inconsistency, as environmentally sensitive sectors such as mining and

manufacturing often incur higher compliance costs, technological investment, and operational restructuring than less environmentally intensive industries.

This divergence highlights the importance of institutional quality, enforcement mechanisms, and market maturity in determining whether ESG investments yield economic returns. In emerging markets, ESG adoption may be driven more by regulatory compliance or reputational considerations than by strategic transformation, raising concerns about symbolic implementation and greenwashing. This concern is reinforced by recent synthesis evidence on CSR/ESG in emerging markets showing uneven results and emphasizing decision-usefulness and institutional context (Parra-Domínguez et al., 2026). In addition, differences in ESG ratings methodologies and periodic model updates can affect comparability across firms and time, contributing to measurement-related inconsistencies (MSCI, 2026). Third, measurement choices may further contribute to inconsistent findings. Prior studies use different ESG measures, including ESG disclosure scores, composite ESG ratings, and individual environmental, social, or governance pillars. Similarly, financial performance has been measured using different indicators such as ROA, ROE, Tobin's Q, profitability ratios, and firm value. Accounting-based measures may capture short-term operational performance, while market-based measures such as Tobin's Q reflect investor expectations and market perception. Therefore, different measurement approaches may lead to different conclusions regarding the ESG–financial performance relationship.

Fourth, differences in research period and time horizon may explain why some studies find positive results while others report insignificant effects. ESG initiatives and green innovation often require substantial initial investment and may only generate financial benefits over a longer period. As such, studies using shorter observation periods may not fully capture the delayed financial returns from sustainability practices, particularly in industries that require significant technological and operational changes.

Green innovation has increasingly been proposed as a critical mechanism through which ESG initiatives may influence financial performance. Green innovation is commonly discussed in the literature as a multidimensional construct that may include product, process, and organisational innovation (García-Granero et al., 2018, 2020; Quintana-García et al., 2022). Product green innovation refers to the development of environmentally friendly products, while process green innovation relates to cleaner production methods and improved resource efficiency. Empirical evidence generally supports a positive link between green innovation and environmental or financial performance. Baeshen et al. (2021) and Rehman et al. (2021) show that green innovation enhances sustainability outcomes in manufacturing contexts, while Tariq et al. (2019) and Alos-Simo et al. (2020) find that eco-innovation contributes to profitability over time. Moreover, Asni and Agustia (2022), focusing on ASEAN firms, demonstrate that financial performance mediates the relationship between green innovation and firm value, suggesting that innovation may act as a performance-enhancing channel within sustainability strategies. More recent evidence also supports innovation as a value-creation pathway, showing that green innovation can mediate sustainability engagement and firm value in emerging markets (Sun et al., 2026).

However, due to data availability and the need for comparable cross-country data among ASEAN mining and manufacturing firms, this study focuses specifically on the product-related dimension of green innovation. Accordingly, green innovation is proxied using the Product Responsibility Score from Refinitiv, which reflects firms' efforts in developing products and

services that are environmentally and socially responsible. While several studies report that ESG engagement stimulates green innovation (Li et al., 2018; Liu & Lyu, 2022; Xu et al., 2021), evidence on whether such innovation translates into superior financial performance remains fragmented. Furthermore, few studies address the possibility of an ESG–innovation misalignment, whereby firms achieve high ESG ratings without undertaking substantive technological or operational transformation capable of generating economic value. Recent research also suggests that intermediate operational mechanisms (e.g., efficiency improvements) can be important in explaining how ESG translates into performance outcomes, implying that ignoring such channels may partly explain inconsistent findings (Rahmanniyaychomachaei et al., 2026). Therefore, instead of assuming that ESG directly and uniformly improves financial performance, this study argues that the relationship is conditional and may depend on whether ESG practices are translated into substantive innovation capabilities. Green innovation is therefore examined as a mediating mechanism that may explain how ESG commitments are transformed into financial value.

The existing literature shows three main gaps. First, research on the relationship between ESG and financial performance is inconsistent, particularly in emerging markets. Second, the role of green innovation in turning ESG commitments into firm value has not been consistently proven. Third, environmentally intensive industries in ASEAN, where sustainability pressures are high but institutional enforcement varies, are still not well explored. This study aims to address these gaps by looking at ESG scores, green innovation, and financial performance within the NRBV framework. It seeks to clarify whether sustainability commitments in emerging industrial contexts lead to real economic value or are mostly symbolic.

Theoretical Framework and Hypotheses Development

Natural Resources-Based View (NRBV) Theory

The Natural-Resource-Based View (NRBV) was developed based on the RBV, to address the idea of resources more completely (Hart, 1995). The NRBV emphasizes environment regarding sustainability and competitive advantage, noting environment as an important strategical resource (McDougall et al., 2022). The NRBV extends the RBV theory by emphasizing that there may be limitations to the impact of the environment to an organization's potential for attaining sustainable competitive advantage. This suggests that organizations, which manage their roles in terms of their impact on the environment, may generate higher levels of sustainable competitive advantage (Hart, 1995). Hart's NRBV theory considers and combines environmentally interconnected strategies with the resource management and development aspects of a firm. These interconnected strategies involve the following: (a) prevention, minimization, and preferable elimination of pollution, (b) proper product supervision, emphasizing a comprehensive "womb to tomb" or "cradle to grave" product perspective, and (c) the minimization of environmental impacts from firm production (McDougall et al., 2022).

ESG and Financial Performance

Firm performance has been predominantly focused on commercial aims, with little regard for ecological and socioeconomic factors that have not been adequately acknowledged as having enormous potential (Chouaibi et al., 2022a). The empirical literature on ESG's effects on financial performance and business value yields mixed results (Fatemi et al., 2018). In recent years, various studies have sought to quantify the impact of ESG aspects on firm performance

and valuation (Baalouch et al., 2019; Battisti et al., 2020). The subject of how ESG elements affect a firm's financial performance and value has been extensively researched. Early contributions assumed that environmental investments or social responsibility actions that went beyond the environmental purpose would have an impact on business value (Khan, 2019). According to Fatemi et al., (2018) existing empirical research has failed to demonstrate a consistent association between a company's ESG disclosure and its financial success or valuation. It has been proposed that socially responsible behavior can improve performance and corporate value. Recent evidence using more robust identification strategies also shows that ESG ratings can affect firm value through market and institutional channels, although the magnitude and direction can be context-dependent (Du et al., 2026).

ESG practitioners apply qualitative ESG analysis to inform investment decisions. They use internal and third-party research to create individual proprietary scores for environmental issues, social issues and governance issues, which are also weighted to create an aggregate ESG score for each company in the portfolio and in the investible universe (Fatemi et al., 2018); (Murashima, 2020). El Ghoul and Karoui (2021) analyze the connection between ESG performance and the value of firms across 53 nations, discovering a positive correlation, particularly in countries with less robust market-supporting institutions. While they observe a positive effect of environmental performance on economic outcomes, they do not identify a noteworthy effect of economic performance on environmental outcomes. Consequently, a firm with a positive ESG performance may deliberately opt for a higher level of ESG disclosure and realize a higher firm value (Battisti et al., 2020); Wong et al., 2021); Murashima, 2020). At the same time, cross-provider differences and periodic methodology revisions in ESG ratings can affect comparability across firms and time, which may partially explain inconsistent empirical findings (MSCI, 2026).

According to NRBV theory, companies that prioritize environmentally friendly business practices (high "Environment" scores in ESG) are more efficient in their use of natural resources, such as energy and raw materials. Companies can cut operating expenses by lowering waste, pollution, and wasteful resource utilization. This can boost the company's profitability. Natural resource and environmental management is an essential component of business strategy that can provide organizations with a long-term competitive edge and boost financial performance. As a result, firms that actively pursue sustainable practices and achieve high ESG scores are more likely to have long-term growth and great financial success. Research on the relationship between financial performance and environmental practices is inconclusive. Several research (Wong et al., 2021; Murashima, 2020 and Do & Kim, 2020) show a there is a positive correlation between environmental practices and financial performance. Based on these arguments, we propose the following hypotheses:

H_1: There is a positive relationship between ESG score and financial performance.

ESG and Green Innovation

Research indicates that ESG strengths promote green innovation intensity, whereas weaknesses diminish it (Li et al., 2018; Liu & Lyu, 2022; and Xu et al., 2021). However, due to the differences the industry and firm characteristics make it challenging to employ research findings as reference models for green innovation for emerging firms. ESG enterprises that explore green innovation might gain valuable knowledge in optimizing resource consumption. Green innovation is a resource with distinct characteristics from other forms of innovation.

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This sort of innovation is distinguished by the fact that environmental concerns drive the development of the firm's value chain operations. This will improve the firm's position in response to client expectations and needs for environmentally friendly products (Yao et al., 2019). As a result, green innovation can be implemented by designing an environmental strategy based on environmental technological innovation in order to achieve sustainable development. This is mostly demonstrated by companies with sustainability goals that strive to lessen their environmental effect through sustainable innovation (Alos-Simo et al., 2020). Economically, the implementation of green innovation has an impact on business performance (Alos-Simo et al., 2020; Bitencourt et al., 2020 and Zhang et al., 2020) because firms are considered to have a competitive advantage that will increase their value (Calza et al., 2017). This relationship may not be significant in the short term (e.g. one year after implementation), but in the long term, namely the second year onwards, the outcomes of green innovation have an impact on financial performance growth (Rezende et al., 2019).

Research suggests that green innovation improves efficiency and reduces production costs, including environmental expenses (Hojnik et al., 2017; Reyes-Rodríguez et al., 2016; and Cai & Li, 2018). In accounting, an increase in cost efficiency owing to green innovation techniques would boost a company's profitability (Liao, 2018 and Tariq et al., 2019). Green enterprises are highly committed to utilizing eco-innovation as a vital resource for improving organizational value (J. A. Zhang & Walton, 2017). Furthermore, Alos-Simo et al., (2020)using a sample of 2,094 enterprises, found that eco-innovation increases a firm's income in all sectors studied. This study, like earlier studies, employs return on assets (ROA) and return on equity (ROE) as proxies for financial performance. These are deemed relevant measures for evaluating the link between green innovation and profitability (Tariq et al., 2019). Recent evidence also supports the value-creation role of green innovation in emerging markets, showing it can function as a key pathway linking sustainability engagement to firm value (Sun et al., 2026).

According to NRBV theory, companies with high ESG scores are more appealing to investors who care about environmental and social issues. These investors may be more likely to provide financial support to the company, such as money for research and development to promote continual innovation. Companies with increased access to funding can more easily fund green innovation projects. Companies with high ESG scores are more devoted to mitigating their negative environmental impact. It can stimulate investment in sustainable innovation that helps businesses achieve their goals, such as lowering carbon emissions, optimizing natural resource usage, or developing green technologies. As a result, a high ESG score can foster an environment that encourages continual innovation inside the organization. Garcia et al., (2017) explore the correlation between a firm's financial profile and its ESG performance, in light of the growing global interest in social responsibility and ESG practices. The findings indicate that organizations in sensitive industries do better. ESG practices improve environmental performance and contribute to sustainable management in poor countries. The literature research indicates a correlation between ESG practices and green innovation (Fatemi et al., 2018; Jackson et al., 2016; Yang et al., 2017 and Siva et al., 2016). Based on the preceding description, the hypothesis is offered that:

H_2. There is a positive relationship between ESG score and green innovation

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Many research have found a beneficial association between ESG practices and financial success (Ioannou et al., 2016); (Fatemi et al., 2018); (Khan, 2019). If ESG practices influence a firm's green innovation, then green innovation improves financial performance (Liu & Lyu, 2022); (El-Kassar & Singh, 2019). We know that organizations with ESG practices identify and evaluate the needs of many stakeholders. The end consequence is improved corporate governance, which leads to adaptation and organizational adjustments, i.e. a successful transformation in the management process. Empirical research from Thailand (Tariq et al., 2019) and China (Do & Kim, 2020)indicates that green innovation may strengthen the favorable association between ESG and financial performance. Research on ESG (Environmental, Social, and Governance) performance, innovation, and profitability in ASEAN mining firms and broader Southeast Asian contexts shows generally positive associations between ESG activities and firm profitability or value, though the mechanisms and consistency of these effects vary. Several studies report that higher ESG scores are linked to increased firm value and profitability in ASEAN countries, including Indonesia and Malaysia, with all three ESG components (environmental, social, and governance) contributing positively to firm performance (Aydoğmuş et al., 2022; Makhdalena et al., 2023; and Lerskullawat & Ungphakorn, 2024). Recent synthesis evidence likewise emphasizes that the ESG/CSR–performance relationship is often contingent on institutional context in emerging markets, reinforcing the need to test mechanisms such as innovation rather than relying on direct effects alone (Parra-Domínguez et al., 2026).

Based on the NRBV Theory, Companies with a high ESG Score have a strong commitment to environmental responsibility. This generates incentives to seek out more ecologically friendly alternatives, such as green innovation. A high ESG Score in environmental aspects might encourage businesses to embrace sustainable practices and seek ways to expand their positive environmental effect through innovation. Green innovation also provides opportunity to better quantify positive impact. This information can be included in ESG Score's environmental assessment to demonstrate that the company is actively working to reduce its negative effect while increasing its positive influence on the environment. This can boost the company's image and influence investor perception, hence supporting financial performance. A green innovation strategy has consequences in terms of the economic value to the firm. Empirically, several studies have provided evidence that the implementation of green innovation by firms that are committed to environmental regulation has a positive impact on profitability (Hojnik et al., 2017); (Tariq et al., 2019) and (Alos-Simo et al., 2020). The green innovation policies carried out by management with various forms of implementation, whether it be the product, process or organisational innovation, will drive the firm’s sales growth (Xie et al., 2018); (Alos-Simo et al., 2020) which will then drive corporate value (Agustia et al., 2019). In addition, recent evidence indicates that intermediate operational mechanisms (e.g., efficiency improvements) may help explain how ESG efforts translate into financial outcomes, supporting a mediated (rather than purely direct) relationship (Chomachaei et al., 2026). Hence, we develop the following generic hypothesis:

H_3. Green innovation mediates the relation between ESG score and financial performance.

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Methodology

The data type for this research is panel data, consisting of 536 companies observed over the period from 2016 to 2023 from manufacturing and mining companies listed in ASEAN Countries, including Indonesia, Malaysia, Thailand, Singapore, and the Philippines. We use 5 countries in ASEAN countries because in the other countries the data is not available. The data analysis in this study used STATA 19, as in previous research (Chouaibi et al., 2022).

Measurements of Variables

The ESG score addresses sustainability and ethical factors through environmental, social, and governance dimensions within businesses (Ahmad et al., 2024). The environmental score considers pollution, deforestation, water waste, and greenhouse gas emissions. The social dimension addresses job security, gender, and discrimination. Finally, the corporate governance score consists of factors such as legal action and management payments. Wang & Sarkis, 2017)highlight that adopting a database such as Thompson Reuters/Refinitiv and a ESG score helps researchers arrive at an indepth understanding of the context of the firm's governance initiatives and the social and environmental outcomes thereof. As part of our analysis, it is proposed to measure the ESG engagement of the companies in our sample by as scores determined and calculated by the rating agency REFINITIV EIKON Datastream to ensure comparability between companies.

According to Chouaibi et al., (2022) green innovation refers to the development and application of new technologies, products, and processes that minimize environmental impact and promote sustainable development. Although prior studies commonly classify green innovation into product, process, and organisational dimensions, this study measures green innovation using the Product Responsibility Score from Refinitiv. This proxy was selected because it provides consistent and comparable data across ASEAN mining and manufacturing firms. The Product Responsibility Score mainly captures the product-related dimension of green innovation, including firms' efforts to develop environmentally responsible products and services. Therefore, while the measure is appropriate for examining green product innovation, it does not fully capture process-based or organisational green innovation. This scope is acknowledged in interpreting the findings. Hence, the term "green innovation" in this study should be interpreted primarily as green product innovation, rather than as a comprehensive measure of all green innovation dimensions.

Financial Performance, much accounting and financial ratios are market-to-book value (MTBV), return on assets (ROA), economic value add (EVA), asset turnover (ATO), return on equity (ROE) and Tobin's Q (TOBINQ) were used as the indicators of business performance (Asni & Agustia, 2022; Atan et al., 2018; Chininga et al., 2024). In this study, the financial performance proxy is Tobin's Q. Tobin's Q is calculated by taking the market value of equity and adding it to the book value of total assets, then subtracting the book value of equity, and dividing the result by the book value of total assets. Traditionally, Tobin's Q (TOBIN Q) is used to evaluate the financial performance of companies that focus on ESG criteria.

Control Variable, to improve the accuracy of the research results and to avoid the influence of other variables in this study, we included several control variables following the previous researchers (Yao et al., 2019; Tariq et al., 2019; Xie et al., 2018) namely:

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1. Firm size. Firm size, a control variable, was measured by total assets.
2. Industry type. Industry type, a control variable, was assigned to each company in the sample. Industry type will be controlled for using industry dummy variables. The industries included in this study manufacturing and mining companies.

Estimation of Models

In this study, two models are used, namely the inferential model. The inferential empirical research model will test the independent variable on the dependent variable with a mediating variable. The dependent variable consists of performance which will be measured using TOBIN Q. Then, the dependent variable is ESG score and the mediating variable is green innovation. The inclusion of firm size and industry type as control variables across the models is intended to account for firm-level and industry-level differences that may influence both green innovation and financial performance. Following regression model for more information:

Model sustainability practices to performance

$PERFORM = \beta_0 + \beta_1 ESG + \beta_2 SIZE + \beta_3 TYPE + \varepsilon$ ……..…(Model 1)

$GI = \beta_0 + \beta_1 ESG + \beta_2 SIZE + \beta_3 TYPE + \varepsilon$ …… (Model 2)

$PERFORM = \beta_0 + \beta_1 ESG + \beta_4 GI + \beta_5 SIZE + \beta_6 TYPE + \varepsilon$ …….(Model 3)

Where:

ESG	: ESG Score
GI	: Green innovation
PERFORM	: Financial Performance (TOBIN'S Q).
SIZE	: Firm size
TYPE	: Industry type
ε	: Error term

Sources of Data

Thompson Reuters Refinitiv computes total ESG score based on environmental, social, and governance performance as reported by companies. In previous studies, many researchers have used Thompson Reuters/Refinitiv data sources to acquire data for testing the nexus between esg score and Financial Performance (Nirino et al., 2022; Partalidou et al., 2020; Uyar et al., 2021). The REFINITIV EIKON database is frequently used by researchers and is a very dependable source of information. The correlational design is appropriate for the study of possible relationships between the known quantifiable independent variables of ESG score, mediating variable is green innovation, and dependent variable is financial performance, and will be suitable to examine the direct and undirect relationship between the variables and to determine if, and to what extent a relationship exists between ESG Score, Green Innovation, and financial performance.

Result and Discussion

This study used the Hausman test and Lagrange Multiplier (LM) test to determine the best estimator among three. The Hausman and LM test shows that the fixed effect (FE) estimate outperforms the pooled OLS (POLS) and random effect (RE) stimators across all hypotheses. Therefore, the study relies on the FE and RE estimators to explain the findings. In regression and mediation analysis, robust algorithms such as those using M-estimation, Huber loss, or

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Tukey's biweight function, as well as robust bootstrap tests, have demonstrated superior performance in the presence of outliers and heavy-tailed distributions, ensuring more accurate parameter estimation and significance testing (Alfons et al., 2022; Lu & Chang, 2020). In this study, robust bootstrap tests were used to address abnormal data issues, as in previous studies (Alfons et al., 2022) and (Saminem et al., 2024).

The Impact of ESG Score on Financial Performance

Table 1 shows the Hausman test probability level of 0.0040< 0.05. Thus, the Fixed Effect Model (REM) can be used because there are significant differences between the two models, and the Fixed Effect model is considered more consistent and more appropriate to use. The results of this study show that ESG scores, statistically do not significant affect to financial performance (Tobin's Q) with p value > 0,05 which means H1 is rejected. Similar results were found by (Atan et al., 2018; Haryono & Iskandar, 2015; Servaes & Tamayo, 2013) who stated that ESG scores are statistically insignificant in influencing the financial performance. Meanwhile, the size and type of company positively and significantly spurred Tobin's Q. These results imply that the application of ESG principles is generally long-term, so the financial benefits of sustainability practices have not been fully reflected in financial performance in the short term. In addition, not all companies with high ESG scores truly integrate sustainability practices into their core business strategies, some are only symbolic or limited to regulatory compliance (*greenwashing*), so they do not have a real impact on profitability (Bhullar et al., 2025; Sneideriene & Legenzova, 2025). Large companies have financial resources, technology, and a wider network to improve operational efficiency and strengthen competitiveness, making it easier to achieve high profitability. Company size is also related to better access to external funding as well as the ability to leverage economies of scale. Meanwhile, the type of industry also affects financial performance because each sector has different levels of risk, compliance costs, and growth prospects.

Table 1: Factors Influencing the Financial Performance

Perform	Pooled OLS	Fixed Effect	Random Effect
GI	0.0018954	0.0012759	0.0010369
ESG	0.012688**	-0.0131177	-0.0112321**
LSIZE	-0.277264***	-0.6005601**	-0.3866727***
Type Company	0.6066884**		-0.1784002
Cons	3.556822***	8.335496***	6.026697***
Number of Obs	536	536	536
R-squared	0.0853	0.0495	0.0471
Number of Groups	67	67	67
Chows Test FE-OLS	21.16(0.0000)		
Hausman Test FE-RE	13.33(0.0040)		

Fixed effect is efficient over RE and OLS

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

Source: Author's analysis

The Impact of ESG Score on Green Innovation

Based on Table 2 of the results of the Lagrange Multiplier (LM) test, an LM statistical value of 797.42 with a p-value of 0.0000 was obtained, concluding that the more appropriate model is

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the Random Effect Model (REM). This table reports the results for Model 2, which tests the effect of ESG score on green innovation after controlling for firm size and industry type. The results of this study show that the ESG score has a significant positive effect on green innovation with a v-value of < 0.05 which mean H_2 is supported, which indicates that companies with a high commitment to environmental, social, and governance aspects tend to be more encouraged to develop environmentally friendly innovations. This can be explained because the application of ESG principles requires companies to integrate sustainability into their business strategies, thereby encouraging investment in products, processes, and technologies that are oriented towards reducing environmental impact. Companies with good ESG scores generally have higher regulatory pressures, stakeholder demands, and market expectations, so they strive to improve environmental performance through green innovation as a form of responsibility and competitive advantage. This research is in line with previous research (Fatemi et al., 2018; Jackson et al., 2016; Yang et al., 2017 and Siva et al., 2016) who stated that ESG scores have a significant positive effect on green innovation.

Table 2: Factors Influencing the Green Innovation

GI	Pooled OLS	Fixed Effect	Random Effect
ESG	0.7498856***	0.7156489***	0.7226***
Cons	21.50315***	23.41523***	23.02702***
Number of Obs	536	536	536
R-squared	0.2876	0.2876	0.2876
Number of Groups	67	67	67
Chows Test OLS-FE	16.21(0.000)		
LM RE	797.42(0.000)		
Hausman Test FE-RE	0.09(0.7659)		

Fixed effect is efficient over RE and OLS

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

Source: Author's analysis

The Impact of Mediating Green innovation on ESG Score and Financial Performance

Based on Table 3, to confirm the indirect effect of ESG Score on financial performance through green innovation, the Sobel Test was also applied. It provides information about the significance of the pathways. The indirect effect of financial performance (ESG → GI → Perform) has not a significant value (ρ-value >0.05 of 0.7728), which means $H_{3\ is}$ rejected. The results of this study show that ESG score does not affect financial performance through green innovation, which means that green innovation is not able to mediate the relationship between a company's sustainability performance and its financial performance. This condition can be explained because although companies with high ESG scores are encouraged to innovate in the long term, the results of green innovation generally only provide long-term benefits, both through cost efficiency, environmental risk reduction, and reputation improvement. Meanwhile, in the short term, green innovation actually requires considerable investment, both in the form of research and development, the application of new technologies, and additional operational costs. Therefore, its contribution to profitability and other financial indicators is not immediately noticeable. This contradicts findings by Asni and Agustia (2022), and Chouaibi et al. (2022) which stated green innovation can mediate the relationship between an ESG score and financial performance.

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Table 3: The Sobel Test of Mediation Effects

Path	Test statistic	Std. Error:	*p*-value:
ESG → GI → Financial Performance	0.2888	0.0032	0.7728

Given the non-significant Sobel test result, the study concludes that green innovation does not mediate the relationship between ESG score and financial performance. This result should be interpreted with caution, as the effect of green innovation on financial performance may require a longer time horizon to be reflected in market-based performance indicators such as Tobin's Q.

Conclusion

This study revisits the long-debated ESG–financial performance nexus by examining the mediating role of green innovation in ASEAN mining and manufacturing firms through the lens of the Natural Resource-Based View (NRBV). The findings reveal three central insights. First, ESG scores do not exhibit a statistically significant direct effect on financial performance (Tobin's Q). Second, ESG engagement positively influences green innovation, indicating that firms with stronger sustainability commitments are more likely to adopt environmentally oriented innovations. Third, green innovation does not mediate the relationship between ESG and financial performance within the observed period.

These results contribute to literature in several important ways. Most notably, they highlight a potential ESG - performance decoupling in emerging industrial contexts. While ESG practices appear to stimulate innovative efforts, such initiatives do not automatically generate short-term market valuation gains. However, this interpretation should be understood within the scope of this study, which focuses only on mining and manufacturing firms from five ASEAN countries with available data, namely Indonesia, Malaysia, Thailand, Singapore, and the Philippines. Therefore, the findings should not be generalised to all ASEAN countries, such as Brunei, Cambodia, Laos, Myanmar, Vietnam, and Timor-Leste, or to other sectors outside mining and manufacturing. Accordingly, the statement that ESG implementation may be compliance-driven, reputational, or symbolic is limited to the sampled environmentally sensitive sectors and countries. It should be interpreted as a possible explanation for the observed insignificant ESG–financial performance relationship, rather than as a general conclusion about all ASEAN firms. Future studies should extend the sample to include more ASEAN member states and other industries to improve the generalisability of the findings.

This suggests that ESG implementation in environmentally sensitive sectors may be compliance-driven, reputational, or symbolic rather than strategically embedded within value-creating capabilities. The findings also reinforce the NRBV proposition that environmental capabilities must be deeply integrated into core operational and competitive strategies to produce sustained financial benefits. Without substantive transformation, such as technological upgrading, cost-efficiency improvements, and scalable green business models, ESG commitments alone may not enhance firm value.

From a policy perspective, the results caution against over-reliance on ESG ratings as standalone indicators of economic resilience or long-term competitiveness. For policymakers and regulators in ASEAN, strengthening institutional enforcement, incentivizing performance-

based sustainability metrics, and supporting innovation ecosystems may be critical to ensuring that ESG translates into measurable economic outcomes.

Therefore, ASEAN-level policy coordination should be complemented by country-specific implementation strategies. Regional bodies and national regulators may promote minimum ESG disclosure standards and comparable sustainability indicators across ASEAN, while allowing individual countries to adapt implementation according to their institutional readiness and sectoral priorities. For environmentally intensive industries such as mining and manufacturing, policies should focus on linking ESG disclosure to measurable green innovation outcomes, including cleaner production, resource efficiency, emission reduction, and green product development. Such targeted policies would help reduce symbolic ESG adoption and encourage firms to convert sustainability commitments into substantive operational improvements and long-term financial value. For managers, the findings underscore the need to move beyond disclosure-oriented ESG practices toward innovation-driven sustainability strategies that align environmental objectives with financial performance.

However, these policy responses should not be applied uniformly across ASEAN countries because the region consists of heterogeneous institutional environments with different levels of ESG maturity, regulatory enforcement, market development, and innovation capacity. For example, more developed ASEAN markets such as Singapore may require more advanced ESG assurance, stricter green taxonomy implementation, and stronger monitoring of greenwashing risks. In contrast, emerging ASEAN markets such as Indonesia, the Philippines, Thailand, and Malaysia may benefit more from capacity-building programmes, clearer ESG disclosure guidance, fiscal incentives for green technology adoption, and stronger support for firms transitioning from compliance-based ESG reporting to innovation-driven sustainability practices.

This study is not without limitations. The relatively short observation period and the focus on five ASEAN countries may constrain the generalizability of the findings. Moreover, the financial benefits of sustainability investments may materialize over longer horizons than captured in this analysis. Future research could extend the time frame, incorporate dynamic panel techniques, examine alternative financial performance proxies, or explore moderating factors such as institutional quality, ownership structure, or industry-specific regulatory intensity. This research advances the debate by demonstrating that ESG engagement, while positively associated with green innovation, does not necessarily yield immediate financial returns in emerging industrial markets. The findings call for a deeper understanding of how sustainability strategies can transition from symbolic adoption to strategic value creation.

Another limitation relates to the measurement of green innovation. This study uses Refinitiv's Product Responsibility Score as a proxy for green innovation due to data availability and cross-country comparability. However, this proxy mainly captures the product-related aspect of green innovation and may not fully reflect process and organisational innovation. Future studies may adopt broader green innovation measures, such as green patents, cleaner production indicators, environmental management systems, or separate products, process, and organisational innovation measures, to provide a more comprehensive assessment of green innovation.

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