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Artificial Intelligence in The Application of ESG to Improve Company Reputation: The Moderating Role of Financial Performance

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General Background: The implementation of Environmental, Social, and Governance (ESG) practices has become a global focus as a strategic mechanism for enhancing corporate reputation and ensuring long-term sustainability. **Specific Background:** In the Indonesian context, existing studies mostly emphasise the relationship between ESG disclosure and financial performance, while empirical research that integrates artificial intelligence (AI) into ESG practices and analyses its impact on corporate reputation is still limited. **Knowledge Gap:** There is a lack of evidence regarding the impact of AI-supported ESG on corporate reputation, especially when financial performance is positioned as a moderating variable, and previous studies rarely use AI-specific ESG indicators or focus on reputation as the main outcome. **Objective:** This study aims to analyse the influence of AI-supported ESG on corporate reputation and evaluate the moderating role of financial performance. **Method:** This study uses a quantitative approach with secondary data from 425 Indonesian manufacturing companies in the basic and chemical, mixed goods, and consumer goods sectors, analysed using multiple linear regression and Moderated Regression Analysis (MRA). **Results:** Findings indicate that AI-supported ESG does not significantly influence corporate reputation independently; however, financial performance (ROA) significantly strengthens this relationship. **Novelty:** This study expands the ESG literature by integrating AI-based ESG measures and placing corporate reputation as the primary outcome variable with financial performance as a moderator. **Implications:** The results suggest that companies can enhance the reputational benefits of AI-based ESG initiatives when supported by strong financial performance, providing strategic insights for managers and policymakers in emerging markets.

Keywords: Artificial Intelligence, ESG, Corporate Reputation, Financial Performance, Moderation.

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INTRODUCTION

The rapid development of digital transformation in Indonesia has significantly changed the business landscape, especially in the manufacturing sector, which has long been the backbone of national industrial development. Digitalisation has forced companies to adopt advanced technologies not only to improve operational efficiency but also to strengthen their competitiveness in an increasingly integrated global market (Minkkinen et al., 2024). In this evolving context, companies can no longer rely solely on productivity and profit; they are now required to demonstrate accountability in Environmental, Social, and Governance (ESG) practices, which have become key determinants in public and investor perception (Zhang & Yang, 2024). As stakeholders pay increasing attention to sustainability, Artificial Intelligence (AI) is increasingly being utilised to support corporate ESG initiatives.

Although AI was initially applied in areas such as production optimisation and supply chain management (Burnaev *et al*., 2023; Zhang, 2024), recent developments show that AI contributes strategically to ESG through real-time monitoring, sustainability reporting automation, and risk analysis (Li *et al*., 2024). However, existing studies highlight several limitations. ESG data integration remains complex due to fragmented reporting standards (Zhironkin & Ezdina, 2023). Meanwhile, companies often exaggerate or inaccurately present their sustainability performance (Selim, 2020). These findings suggest that the impact of AI-supported ESG practices on corporate recognition is not always linear. Corporate reputation has become a strategic intangible asset that influences stakeholder and investor decisions, as well as corporate sustainability in the long term. However, despite its importance, little is known about how AI-supported ESG practices contribute to strengthening or weakening corporate recognition.

These issues are also evident in real-world phenomena. Bloomberg's Sustainability Intelligence report shows that although global companies are increasingly adopting AI in ESG methods, concerns about data transparency and credibility remain significant (Bloomberg, 2023). In Indonesia and other ASEAN countries, several manufacturing companies have faced criticism due to inaccuracies in their ESG reports, resulting in a decline in public trust despite significant investments in digital technology. Conversely, companies that successfully use AI to identify emissions, improve resource efficiency, or standardise disclosure tend to enjoy stronger stakeholder trust and enhanced reputation (Lim, 2024). These contrasting results indicate that the impact of AI on corporate reputation is highly dependent on a company's ability to implement it credibly. For example, several Indonesian manufacturing companies listed on the IDX experienced a decline in reputation after inconsistencies in ESG reporting were revealed in the 2022 sustainability audit. Companies such as Astra International and Unilever Indonesia have gained reputational benefits from adopting AI-supported sustainability monitoring (Handayani & Nurzhavira, 2024).

Research also shows that financial performance plays a crucial role in supporting technology adoption. Companies with strong financial results are better able to invest in advanced AI systems and robust sustainability initiatives (Bora *et al*., 2021; Chang & Ke, 2024). In the assessment, companies with economic constraints often find it difficult to maintain consistent ESG activities, thereby limiting the potential for reputational benefits (Visalli *et al*., 2023). However, there are still knowledge gaps, particularly in the Indonesian manufacturing sector, regarding how economic performance moderates the relationship between AI adoption in ESG and corporate reputation. This situation points to an important research gap. First, there is little empirical evidence that directly explores how AI-supported ESG implementation affects corporate reputation, especially in emerging markets. Second, previous research has not adequately explored the role of financial performance as a moderating factor in this relationship. In addition, there are methodological gaps, as many studies rely entirely on existing ESG ratings and do not utilise more specific AI adoption indicators, nor do they consider corporate reputation as a valuable outcome variable. Previous studies on AI and ESG have generally focused on technology adoption and sustainability performance, while studies linking ESG to corporate reputation tend to emphasise reporting quality and stakeholder perceptions.

Research that directly explores the impact of AI reputation is still limited and fragmented, with inconsistent results on whether AI enhances or complicates ESG credibility. Furthermore, evidence on whether financial performance reinforces the effects of AI-supported ESG practices is still scarce (Chen & Zhang, 2025).

To address this gap, this study draws on stakeholder theory and signalling theory. Stakeholder theory states that companies must respond to stakeholder demands for transparency and responsible behaviour, particularly in sustainability practices (Hambrick & Mason, 1984). Signalling theory further suggests that companies that adopt AI to guide ESG initiatives can send positive and credible signals to stakeholders about their commitment to sustainability, provided that implementation is supported by adequate resources and economic balance. This theoretical perspective forms a framework for analysing the impact of AI adoption in ESG on corporate reputation and assessing the moderating role of financial performance. Empirically, no studies have explored how AI-supported ESG practices affect corporate reputation, nor how financial performance can strengthen or weaken this relationship.

Methodologically, previous research has relied on general ESG indices and has not incorporated AI-specific indicators, such as the Bloomberg AI Tag Score. This gap highlights the need for a more integrated model that links AI, ESG, financial performance, and reputation. This study expands the literature by integrating AI adoption into ESG recognition research through the lens of stakeholder theory and the concept of signalling, presenting a more comprehensive explanation of how and why AI influences stakeholder perceptions. Specifically, this study analyses the impact of AI adoption in ESG practices on corporate reputation variables in the context of emerging economies such as Indonesia.

ESG and Corporate Reputation

The relationship between the implementation of

Environmental, Social, and Governance (ESG) and corporate reputation can be analysed through the perspective of stakeholder theory (Hörisch *et al*., 2020), which emphasises that long-term business sustainability is not only determined by profits, but also by a company's ability to meet expectations and maintain good relationships with stakeholders. Stakeholders here include consumers, investors, employees, suppliers, regulators, local communities, and the wider community. Companies that are able to demonstrate a real commitment to implementing ESG principles will build social trust and legitimacy, two crucial elements that form the basis of a strong reputation (Eckert, 2017). When a manufacturing company consistently implements ESG practices, such as reducing greenhouse gas emissions, empowering communities around its factories, providing decent working conditions, and maintaining transparency in reporting, this creates positive signals for the market and stakeholders. These signals show that the company is not only focused on short-term profits, but also prioritises sustainability and ethical values. The trust that arises from ESG commitments can translate into perceptions of corporate morality, namely the view that the company has better business ethics than its competitors (Ifan & Ningtyas, 2024). This perception becomes reputational capital that provides protection when the company faces challenges or image crises (McBride *et al*., 2022).

In the context of the manufacturing industry, reputation has a very important strategic value. This industry is often in the public spotlight because its activities have the potential to cause negative impacts on the environment, such as industrial waste, air pollution, and high energy consumption (Ghuslan *et al*., 2021). Issues of workers' rights, occupational safety, and honest governance practices are also significant challenges. Therefore, manufacturing companies that effectively demonstrate their ESG commitment will gain a reputational advantage over competitors who ignore sustainability issues. For example, factories that invest in environmentally friendly technology or run programmes to empower surrounding communities will be more valued by stakeholders than companies that focus solely on production and profits. A good reputation has a domino effect on companies (Reddiar *et al*., 2012).

First, from the market perspective, a strong ESG reputation can increase consumer loyalty, especially in an era when consumers are increasingly concerned about sustainability and choose ethical and environmentally friendly products. Second, from a business perspective, a positive reputation makes it easier for companies to establish international partnerships, attract foreign investment, and win tenders from global companies that set strict ESG standards in their supply chains. Third, internally, a good reputation can boost employee morale, reduce turnover rates, and make the company the top choice for the best talent in the labour market. Conversely, manufacturing companies that fail to meet ESG standards risk significant reputational damage (Baah *et al*., 2021).

Issues related to environmental pollutants, unfair treatment of workers, or non-transparent business practices can quickly spread through the media and social media, triggering public criticism and even customer boycotts. The loss of investor and business partner trust is the next impact, which not only damages reputation but also has the potential to reduce the company's market value (Asante & Lambert, 2023; Sunarto *et al*, 2021). Therefore, ESG implementation can no longer be considered a trivial moral responsibility or external requirement. ESG is now a core business strategy that serves as a differentiator in competitive markets, strengthens a company's position in the global supply chain, and protects the company from damaging reputational risks. In an increasingly competitive manufacturing industry, ESG is key to creating sustainable competitive advantage, maintaining stakeholder trust, and ensuring the company's long-term sustainability.

Financial Performance as a Moderator

A company's financial performance has a very significant influence on the application of Artificial Intelligence (AI) in Environmental, Social, and Governance (ESG) strategies because financial conditions are a major determining factor in the extent to which companies can allocate resources to support technology-based sustainability initiatives (Uyar *et al*., 2020). Companies with sound financial performance, characterised by consistent profits, positive cash flow, and manageable debt levels, have considerable flexibility to make strategic investments. They can allocate budgets to purchase advanced AI software, build integrated virtual infrastructure, recruit professionals, and organise training programmes for employees to maximise the potential of this era (Pozzi & Dwivedi, 2023).

This financial function enables companies to apply AI for various ESG purposes, including monitoring and reducing carbon emissions, optimising energy performance, monitoring business partners' compliance with ethical standards, and improving the quality and transparency of sustainability reporting (Xiao, 2025). Strong financial support also enables companies to run ESG programmes consistently and sustainably, which in turn strengthens the company's image and reputation in the eyes of investors, consumers, and regulators (Lin & Zhu, 2025). On the other hand, companies with weak financial performance face significant limitations in applying AI for ESG. Conditions such as declining profits, negative cash flow, or high debt burdens make it difficult for companies to allocate budgets for technology investments (Zhang *et al*., 2021).

As a result, AI implementation is often limited, using outdated technology, or only to meet market and regulatory demands without being supported by a mature strategy. This half-hearted implementation risks causing problems, ranging from ineffective ESG programmes, flawed sustainability reports, to accusations of greenwashing that damage the organisation's reputation (Kim *et al*., 2023). Consequently, financial performance not only affects a company's technical ability to adopt AI, but also determines the depth, quality, and sustainability of ESG implementation, which ultimately shapes public perception and stakeholder confidence in the company. Therefore, financial performance not only affects a company's technical ability to adopt AI, but also determines the depth, quality, and sustainability of ESG implementation, which ultimately shapes public perception and stakeholder confidence in the company.

METHODS

Research Type and Approach

This study uses a quantitative approach with an explanatory research design, aiming to examine the causal relationship between Artificial Intelligence in ESG (AI_ESG), corporate reputation, and the moderating effect of financial performance. An explanatory design is considered appropriate because this study aims to examine whether (1) the adoption of AI in ESG activities enhances corporate reputation, and (2) financial performance strengthens or weakens this relationship. This approach is in line with previous ESG performance literature, which emphasises the importance of empirical causal testing (Monfort *et al*., 2026; Mulyana *et al*., 2025).

Research Population and Sample

Research Population

The population consists of all 545 manufacturing companies listed on the Indonesia Stock Exchange (IDX) during the period 2019–2024. The manufacturing sector was chosen because it is capital-intensive, has complex supply chains, and has a high environmental impact, conditions that make the adoption of AI-based ESG practices highly relevant. Data Sources and Collection Techniques

Sampling Technique

The sample in this study was determined using purposive sampling, which is appropriate for research related to ESG and AI because not all companies publish sustainability disclosures, adopt AI technology, or provide complete financial information. Therefore, sampling must be based on data relevance and data availability. The sampling process began with a total population of 545 manufacturing companies listed on the Indonesia Stock Exchange (IDX) during the period 2019–2024. Several exclusion steps were applied to ensure that the best companies with reliable and complete information were included. First, organisations without ESG disclosures or incomplete sustainability statistics were eliminated. Second, institutions that did not have verifiable information regarding AI adoption based on Bloomberg's AI Adoption tag, corporate disclosures, and corporate reports were eliminated. Third, companies with incomplete financial statistics, particularly ROA, were excluded to maintain consistency in the regression analysis. The criteria used for sampling are shown in Table 1.

[Table 1. Sample Selection]

Data Sources and Collection Techniques

This study relies entirely on secondary data obtained from several credible and internationally recognised sources. The primary source is the Bloomberg Terminal, which provides standard ESG indicators, AI adoption tags, and reputation metrics that are widely used in global empirical research. Bloomberg's AI Adoption Tag is generated through machine learning-based classification of corporate disclosures, enabling accurate identification of companies that apply AI in sustainability activities. Additional data was collected from annual reports, sustainability reports, and the official IDX database to obtain company fundamentals and financial information. The integration of these sources ensures high reliability, consistency, and comparability between companies during the 2019–2024 period.

Variable Measurement

Artificial Intelligence in ESG

Artificial Intelligence in ESG (AI_ESG) is measured using Bloomberg's AI adoption tag, which identifies companies that use AI technology to guide sustainability-related activities. This tag covers AI applications in the areas of carbon emissions monitoring, energy optimisation, automated ESG reporting, and governance risk analysis.

To measure AI intensity, this study applies a 0-3 AI-ESG integration scale adapted from previous studies on ESG technology adoption. A score of zero represents companies with no AI adoption in ESG activities, while scores of 1, 2, and 3 indicate AI adoption in one, two, or all three ESG dimensions, respectively. This scale provides a tested and reliable evaluation of the depth of AI integration in corporate sustainability practices.

Corporate Reputation

Corporate reputation (CR) is measured using the Bloomberg Corporate Reputation Index, a comprehensive indicator frequently used in global empirical research. This index captures dimensions of reputation, including investor sentiment, favourable media publicity, governance credibility, and ESG-driven reputation indicators. By combining these components, the Bloomberg Reputation Index provides a reliable picture of how stakeholders view a company's integrity, performance, and sustainability commitment. The standardised methodology used allows for consistent assessment across companies and over time.

Financial Performance

Financial Performance (FP) is represented by return on assets (ROA), calculated as net profit divided by total assets. ROA was chosen because it measures a company's ability to effectively utilise its assets to generate profits and is widely used in sustainability and ESG performance research. Previous studies (Waddock & Graves, 1997) highlight that profitability plays a crucial role in enabling companies to invest in sustainability technologies, including AI-based ESG initiatives. In this study, ROA is used not only as an explanatory variable but also as a moderating variable to assess whether financial strength enhances the impact of AI adoption in ESG on company reputation.

Control Variables

Many control variables were included to account for company characteristics that could affect company reputation. Company Size (FS) was measured as the logarithm of total assets, reflecting the scale of the organisation and the availability of resources. Company Age (FA) represented the number of years since the company was established, reflecting the maturity and stability of the organisation. Leverage (Lev) is measured as the ratio of total liabilities to total assets, indicating exposure to financial risk. Growth is calculated as the percentage of annual change in revenue, reflecting the company's market growth. The addition of these variables helps to ensure a stronger estimation of the relationship between AI_ESG, economic performance, and corporate recognition.

Data Analysis Techniques

Data analysis in this study was conducted through several sequential stages to ensure the validity, reliability, and robustness of the empirical model. The first stage involved testing classical assumptions, including normality, multicollinearity, heteroscedasticity, and linearity tests.

The normality test ensures that the residuals follow a normal distribution, while multicollinearity is evaluated using the Variance Inflation Factor (VIF) and tolerance values to ensure that no predictor variables are overly correlated. The heteroscedasticity test is performed to verify the consistency of the error variance across observations, and the linearity test ensures that the relationship between variables has been modelled correctly.

After the assumption tests, the researchers conducted the first linear regression model to test the direct effect of Artificial Intelligence in ESG activities (AI_ESG) on corporate reputation. This baseline version assesses whether companies with higher AI integration in their sustainability efforts show stronger reputation outcomes. Next, a two-way moderation regression model (MRA) was used to test the moderating role of financial performance.This technique evaluates whether financial performance strengthens or weakens the effect of AI_ESG on corporate reputation, providing insight into whether profitable companies can leverage AI-supported ESG projects more effectively to increase reputation gains. To assess statistical significance, various tests were conducted, including the T-test for partial effects, the F-test for overall model significance, R^2 and ΔR^2 to evaluate the explanatory power of the model and the additional contribution of moderator variables. These metrics help determine the strength and clarity of the relationships between variables. Additionally, this study integrates resilience assessments as recommended by reviewers. This includes testing alternative moderator variables (ROE) to verify the consistency of moderation effects, applying methods to reduce the impact of extreme outliers, and evaluating fixed-effects and random-effects models to ensure the stability of results across various model specifications.

Research Model and Equations

This study analyses the impact of Artificial Intelligence (AI) implementation in Environmental, Social, and Governance (ESG) practices on corporate reputation, with financial performance proxied by Return on Assets (ROA) as a moderator variable. The conceptual framework illustrating the relationship between variables is presented in Figure 1.

As shown in Figure 1, the application of AI in ESG activities is expected to have a direct effect on corporate reputation. In addition, financial performance (ROA) moderates the relationship between AI_ESG and corporate reputation, indicating that the impact of AI-driven ESG practices on reputation may vary depending on the level of a company's financial performance.

To empirically test the proposed relationship, this study uses Moderated Regression Analysis (MRA) with two regression models. Model 1 tests the direct effect of AI_ESG on corporate reputation while controlling for specific company characteristics, including Company Size (FS), Company Age (FA), Leverage (Lev), and Growth (Grow). Model 1 is formulated as follows:

$$(1)\quad RP_{i,t} = \alpha + \beta_1 AI\_ESG_{it} + \beta_3 FS + \beta_4 FA + \beta_5 Lev + \beta_6 Grow + \varepsilon_{it}$$

In addition, Model 2 expands on the basic model by including financial performance (ROA) and the interaction term between AI_ESG and ROA to test for a moderating effect. The regression equation for Model 2 is specified as follows:

$$(2)\quad RP = \alpha + \beta_7 AI\_ESG_{it} + \beta_8 ROA + \beta_9 AI\,(AI\_ESG * ROA)$$

$$\beta_{10}FS + \beta_{11}FA + \beta_{12}\,Lev + \beta_{13}\,Grow + \varepsilon_{it}$$

Explanation:

RP = Company Reputation

AI_ESG = Application of Artificial Intelligence in ESG

ROA = Financial Performance

AI_ESG * ROA = Moderating variable (interaction)

α = Constant

β = Regression coefficient

ε = error term

In accordance with the research framework illustrated in Figure 1, the term AI_ESG*ROA interaction captures the moderating role of financial performance in the relationship between AI-driven ESG implementation and corporate reputation. The statistically significant interaction coefficient indicates that the effect of AI_ESG on corporate reputation depends on the company's financial performance.

[Figure 1. Research Model of AI in ESG on Reputation with Financial Performance Moderation]

Hypothesis

Artificial Intelligence (AI) in ESG has a positive effect on corporate reputation

Artificial Intelligence (AI) software within the Environmental, Social, and Governance (ESG) framework is one of the vital improvements that can transform the way organisations build their reputation in the eyes of stakeholders. AI enables businesses to process large amounts of data quickly, identify potential sustainability risks, and provide efficient technology-based solutions. For example, in the environmental aspect, AI can be used to monitor carbon emissions in real time, predict the environmental impact of manufacturing processes, and optimise energy use to be more environmentally friendly. In the social aspect, AI can help manage the supply chain by ensuring suppliers comply with ethical working standards, human rights, and sustainable business practices. On the governance side, AI can improve accountability and transparency by generating accurate sustainability reports, minimising human error, and being easily verifiable by regulators and investors.

With this role, AI not only supports company operations, but also creates a positive reputation narrative that the company has a real commitment to responsible business practices. Investors tend to trust companies that integrate technology to ensure ESG is properly implemented, while consumers see this as a form of genuine social and environmental concern, not just a marketing claim. A number of studies support this relationship. (Ghuslan *et al.*, 2021) shows that the adoption of AI in business processes increases transparency and accountability, two important pillars of ESG success that lead to a stronger reputation.

(Baah *et al.*, 2021) also observed that the use of AI in ESG reporting reduces the risk of greenwashing allegations, i.e. the practice of claiming sustainability without real evidence, thereby making companies appear more credible. Additional empirical evidence also reinforces this relationship. (Li *et al.*, 2024) reveal that AI-driven sustainability analytics improve the reliability of ESG disclosures and significantly influence corporate recognition in global markets. (Lei, 2021) argues that automation and machine learning improve the statistical assurance of ESG, making stakeholders more confident in the accuracy of reported sustainability performance.

(Pozzi & Dwivedi, 2023) found that companies adopting AI in their sustainability systems achieve higher ESG scores because AI reduces human bias and error in the reporting process. Stakeholder theory explains that companies must meet the expectations and needs of diverse stakeholders, including investors, regulators, consumers, and the community, to maintain legitimacy and build a strong reputation.

In the context of ESG practices, the adoption of Artificial Intelligence improves transparency, accuracy, and responsiveness, thereby strengthening stakeholder trust and reinforcing the social legitimacy of the company. When companies use AI to improve ESG reporting and sustainability performance, they demonstrate responsible behaviour. This system is in line with signalling theory, which states that companies convey information to the market through observable actions.

AI-supported ESG disclosure serves as a high-quality signal because it is difficult to imitate and requires significant technological and organisational investment. With this evidence, this study believes that the higher the level of AI adoption in ESG implementation, the stronger the company's reputation in the eyes of the public, investors, and other stakeholders.

H1: Artificial Intelligence (AI) in ESG implementation has a positive impact on corporate reputation.

Artificial Intelligence (AI) in ESG has a positive impact on corporate reputation with moderate financial performance

Corporate reputation is not only determined by the effectiveness of AI implementation in ESG practices, but also by its underlying financial condition. Solid financial performance provides room for companies to invest further in AI technology to strengthen ESG, thereby strengthening their reputation. A company's financial performance is widely recognised as an important factor in determining market reputation. Companies with superior economic results are generally viewed more positively by stakeholders, which in turn increases their operational credibility and social responsibility (Sklavos *et al.*, 2024). While companies demonstrate strong financial performance, they tend to be

better able to invest in sustainable practices, including the application of AI technology for ESG compliance and improvement.

AI funding for ESG purposes can be seen as a reflection of an organisation's commitment to ethical and sustainable practices, which ultimately strengthens its reputation in the eyes of consumers and buyers. Furthermore, integrating AI into ESG frameworks can significantly enhance a company's ability to collect and analyse data related to its social and environmental impact. This capability complements the transparency and accuracy of reporting (Jing & Zhang, 2024). When organisations use AI to improve ESG performance, the credibility and relevance of ESG tasks also increase, positively impacting reputation, especially when supported by solid economic performance. For example, companies that use AI to optimise energy consumption or monitor responsible supply chains can build a reputation as visionary and responsible entities, leading to greater loyalty from investors and consumers (Budennyy *et al*., 2022).

The interaction between good financial performance and AI-based ESG strategies further highlights the influence of financial performance as a moderating variable on reputation. From an empirical perspective, several studies show that ESG performance is often critically evaluated when companies experience financial difficulties, as stakeholders want to ensure that commitments to sustainability are real rather than merely symbolic (Saxena *et al*., 2022). Organisations with high economic performance typically face less pressure regarding CSR claims and AI-based ESG tasks, allowing them to maximise positive perceptions from stakeholders (Hughes *et al*., 2021). Conversely, companies in vulnerable financial situations tend to face close scrutiny of their ESG efforts, thereby reducing the reputational benefits of AI investments in sustainability. Furthermore, the relationship between financial performance and AI in ESG has important implications for stakeholder considerations. When making decisions regarding engagement or investment, stakeholders tend to consider that financial elements must be aligned to build and maintain a company's reputation (Ahmad *et al*., 2023; Musleh *et al*., 2022).

For example, organisations that successfully combine the ethical use of AI with accurate economic performance can be considered models of corporate excellence, creating a positive cycle in which financial capital and reputation reinforce each other (Hao & Demir, 2024). In the context of corporate governance, the ability of the board of directors to oversee the integration of AI into ESG is also related to financial performance. Boards of directors that emphasise strong governance principles tend to produce better financial performance, which in turn supports the use of AI for ESG reporting and accountability, further strengthening corporate reputation (Naveed *et al*., 2025).

Strong financial performance enables companies to prioritise ethical governance practices, optimise the use of AI, and strengthen their commitment to CSR, thereby enhancing their perception as trustworthy entities. In addition, the role of AI in driving ESG innovation can serve as a differentiator and strengthen corporate reputation in competitive markets. Companies that develop AI-based sustainability practices can leverage these innovations for marketing and positioning strategies, especially when supported by strong financial performance (Sætra, 2023; Samieva *et al*., 2023). However, there are complexities to consider: if technology promotion is not aligned with financial capacity, it can trigger negative reactions that actually damage reputation, highlighting the importance of integration between financial aspects and AI implementation (Saftiana *et al*., 2014; Tong *et al*., 2022). Conversely, weak ESG commitments exacerbated by ineffective AI implementation can trigger a rapid decline in corporate reputation, especially when the market detects a gap between claimed values and operational reality (Alexander, 2025). Therefore, financial performance not only serves as a facilitator but also as a critical lens that influences stakeholder perceptions and their impact on reputation.

Stakeholder Theory explains that companies must meet the expectations and needs of diverse stakeholders, such as investors, regulators, consumers, and the community, to maintain legitimacy and build a strong reputation. In the context of ESG practices, the adoption of Artificial Intelligence increases transparency, accuracy, and responsiveness, thereby strengthening stakeholder trust and reinforcing the company's social legitimacy. When companies use AI to improve ESG reporting and sustainability performance, they demonstrate accountability and ethical commitment, which stakeholders interpret as a signal of reliability and responsible behaviour. This process is in line with Signalling Theory, which states that companies convey information to the market through observable actions. AI-supported ESG disclosure serves as a high-quality signal because it is difficult to imitate and requires significant technological and organisational resources. Companies with strong financial conditions have more assets to invest in advanced AI systems, comprehensive sustainability tasks, and credible ESG communication, which strengthens both the quality and visibility of the indicators presented to stakeholders.

In the evaluation, companies with weak financial conditions may send weaker or less credible signals, causing stakeholders to doubt their long-term commitment to ESG practices. As a result, when economic performance is high, stakeholders view AI-driven ESG projects as more appropriate, sustainable, and strategically aligned with long-term value recognition, thereby increasing their positive impact on the company's reputation. The interaction between AI, ESG practices, and economic performance shows that companies strategically manage investments in technology and sustainability to optimise reputation control.

H2: Financial performance moderates the influence of Artificial Intelligence (AI) in ESG practices on corporate reputation, making this influence stronger in companies with high financial performance.

RESULTS AND DISCUSSION

Research Results

Descriptive Statistics of Variables

Table 2 presents descriptive statistics for all research variables, including the number of observations, mean, minimum, maximum, and standard deviation. The results show that the level of AI adoption in ESG practices (AI_ESG) has an average score of 4.829, with values ranging from 0.200 to 18.500, indicating a relatively low but highly variable implementation of AI in ESG activities among companies. The profitability variable (ROA) recorded a median of 8.29 per cent, with a minimum value of 0.0278 per cent and a maximum of 25.189 per cent. showing that the maximum company size (FS), measured using the natural logarithm of total assets, has a median of 14.289 and ranges from 12.100 to 17.800, indicating that the sample covers years ranging from 5 to 65, reflecting a combination of younger and more established companies.

Leverage (Lev) has an average of 0.390, with values ranging from 0.081 to 0.878, indicating moderate use of debt across companies. Meanwhile, growth (develop) has an average of 0.129, ranging from -0.281 to 0.389, indicating that although companies generally experience good revenue growth, some show declining performance. The descriptive results show significant variation between companies, particularly in the adoption of AI for ESG activities and financial characteristics, providing an appropriate context for analysing the proposed relationship in this study. The descriptive statistical results in this study are presented in Table 2.

[Table 2. Descriptive Statistics]

Correlation Matrix

Based on the results of the heteroscedasticity test in Table 3, the regression model shows no heteroscedasticity, as the significance value is above the acceptable threshold. AI_ESG shows a high-quality and statistically significant correlation with ROA (r=0.416***), indicating that companies that primarily implement AI for ESG activities are generally positive institutions with company size (r=0.328***), company age (r=0.211*), leverage (r=0.326**), and boom (r=0.337** *). These results indicate that larger, more mature companies with lower leverage and stronger growth potential are more likely to adopt AI for ESG initiatives. ROA shows a strong and significant correlation with company characteristics such as Company Size (r = 0.493***), Company Age (r = 0.225*), Leverage (r = 0.390***), and Growth (r = 0.301**), indicating that profitable companies tend to be larger, older, more leveraged, and experience stronger growth.

[Table 3. Heteroscedasticity]

Company Size is positively related to Company Age (r = 0.192*), Leverage (r = 0.234*), and Growth (r = 0.217*). Company Age shows a significant positive relationship with Leverage (r = 0.227*) and Growth (r = 0.280**), while Growth also has a positive relationship with Leverage (r = 0.327**). Importantly, no correlation coefficient exceeds 0.80, indicating no multicollinearity issues.

Multicollinearity (VIF)

Table 4 displays the results of the multicollinearity test, showing that there is no multicollinearity among the independent variables. The results of the multicollinearity check indicate that each independent variable is within an appropriate range, suggesting that multicollinearity is not a problem in this model. The variance inflation factor (VIF) values range from 1.29 to 2.18, all of which are below the general threshold of 10 for detecting high multicollinearity. Simultaneously, the tolerance values range from 0.267 to 0.679, all above the minimum acceptable limit of 0.10. These results confirm that the independent variables do not show a strong linear relationship with each other.

[Table 4. Multicollinearity]

Specifically, AI_ESG shows a VIF of 1.92 and a tolerance of 0.617, indicating a low level of shared variance with other predictors. ROA (VIF = 1.82, Tolerance = 0.278) and Firm Size (VIF = 1.90, Tolerance = 0.267) are also within the safe range, indicating that adding both does not cause detrimental multicollinearity in the model.

Firm Age has a VIF of 2.10, while Leverage records the highest VIF of 2.18; however, both remain below the critical threshold. Growth shows the lowest VIF value (1.29), indicating that it contributes very little to potential collinearity. Overall, these findings confirm that the regression model is free from multicollinearity issues, and all independent variables can be reliably used in further regression analysis without causing biased or unstable coefficient estimates.

Regression Results

Table 5 presents the regression results. Model 1 analyses the direct effect of the independent variable Artificial Intelligence in ESG practices (AI_ESG) on corporate reputation, while controlling for financial performance (ROA), company size (FS), company age (FA), leverage (Lev), and growth (Grow). The results show that AI_ESG has a positive and statistically significant coefficient ($\beta = 0.112$; $p = 0.001$***), indicating that the adoption of AI to support ESG activities contributes significantly to improving corporate reputation. Furthermore, ROA, FS, FA, and Leverage also show significant effects, indicating that corporate reputation is shaped not only by the use of ESG-related AI but also by financial strength, organisational scale, maturity, and capital structure.

[Table 5. Regression Results]

Model 2 includes the ESGROA interaction variable to test whether financial performance strengthens the relationship between AI_ESG and corporate reputation. Although ROA itself remains significant ($\beta = -8.245$; $p = 0.000$**), the ESG*ROA interaction term is not statistically significant ($\beta = 0.090$; $p = 0.923$). This indicates that financial performance does not moderate the impact of AI-based ESG practices on corporate reputation. Although the interaction term coefficient is positive, its insignificance indicates that the reputational benefits of AI-supported ESG activities do not depend on whether a company has high or low profits.

Artificial Intelligence (AI) in ESG implementation has a positive impact on corporate reputation.

Based on the results of model 1, hypothesis 1 receives strong empirical support. The AI_ESG variable shows a significant and very large impact on corporate reputation (β = 0.112; p = 0.001***). These results indicate that companies that integrate AI technology into ESG reporting and sustainability tasks tend to be viewed more positively by stakeholders. AI improves the accuracy, transparency, and credibility of ESG data, which in turn strengthens stakeholder trust and enhances the perceived legitimacy of the company. Consequently, H1 is supported.

Financial performance moderates the influence of AI in ESG practices on corporate reputation, such that this influence is stronger in companies with high financial performance.

The moderation analysis conducted in Model 2 shows that the ESG*ROA interaction term is not statistically significant (β = 0.090; p = 0.923). This means that financial performance does not strengthen the relationship between AI-supported ESG practices and corporate reputation. The reputational impact generated by AI-ESG implementation appears to be independent of a company's profit level. In other words, both highly profitable and less profitable companies derive similar reputational benefits from adopting AI in ESG activities. Consequently, H2 is not supported.

Robustness Test

Table 6 presents the robustness of the main findings, a robustness test was conducted using return on equity (ROE) as an alternative measure of financial performance. In Model 1, which analyses the direct impact of AI adoption in ESG on corporate reputation, the AI_ESG coefficient remains positive and statistically significant (β = 0.115, P < 0.01). This confirms that the positive relationship between AI-supported ESG practices and corporate reputation remains strong across various levels of financial performance.

[Table 6. Robustness Test]

In Model 2, the moderating effect of financial performance is tested by including ROE and the AI-ESG * ROE interaction term. The results show that ROE significantly moderates the impact of AI_ESG on corporate reputation (β = 0.088, p < 0.10), indicating that companies with better equity-based performance can more effectively leverage AI_ESG practices to enhance their reputation.

The main effect of AI_ESG remains positive and significant (β = 0.110, p < 0.01), further supporting the robustness of the original findings. Variables such as company size, company age, leverage, and growth continue to show similar directions and levels of significance as in the base version, indicating model stability.

Overall, the robustness test using ROE shows that the positive relationship found between AI-enabled ESG practices and corporate reputation, as well as the moderating role of financial performance, is not sensitive to the choice of financial performance indicators. These results reinforce the validity of the research conclusions and highlight the importance of operational and equity-based financial strength in enhancing the reputational benefits of AI adaptation in ESG projects.

Hypothesis Discussion

The impact of this research provides critical insights into the role of Artificial Intelligence (AI) in enhancing corporate reputation through Environmental, Social, and Governance (ESG) practices, as well as the conditioning effect of financial performance that has a positive impact on corporate reputation (Sklavos *et al*., 2024). The integration of AI into ESG activities enables improved accuracy, reliability, and transparency in sustainability reporting and operational monitoring. From a Stakeholder Theory perspective, this strengthens corporate legitimacy, as stakeholders increasingly value credible, technology-enabled sustainability efforts. Similarly, based on Signalling Theory, the adoption of AI serves as a strong signal of the company's commitment to sustainability, reducing the perception of symbolic ESG practices. This strengthens stakeholder trust and shapes the company's public image positively (Saftiana *et al*., 2014; Tong *et al*., 2022).

Consequently, speculation 1 is supported, indicating that AI-supported ESG practices contribute significantly to increased corporate popularity (Ahmad *et al*., 2023; Musleh *et al*., 2022). On the other hand, the findings do not support the proposition that financial performance moderates the relationship between AI in ESG practices and corporate popularity.

Evidence shows that the reputational benefits of AI-driven ESG projects do not vary between companies with high and low economic performance (Hao & Demir, 2024). This means that the effectiveness of AI-based ESG efforts in building reputation operates independently of company profits. Even companies with moderate economic performance can still reap reputational benefits from adopting AI to improve the quality and credibility of their ESG projects. Therefore, hypothesis 2 is not supported, as financial performance does not strengthen the influence of AI in ESG practices on company popularity. Overall, the results of this study emphasise that although AI plays an important role in improving ESG effectiveness and reputation, this relationship is not strengthened by the level of financial performance.

CONCLUSION

This study provides new empirical evidence on the role of artificial intelligence (AI) in strengthening corporate reputation through ESG practices. The findings prove that the application of AI in ESG activities definitely contributes to reputation building. By improving the transparency, accuracy, and credibility of ESG reporting, AI facilitates companies to strengthen trust and legitimacy in the eyes of stakeholders. These results are consistent with stakeholder theory and signalling theory, suggesting that technology-enabled ESG efforts are perceived as more authentic and reliable by stakeholders. As a result, AI serves not only as a technological tool but also as a strategic tool for enhancing corporate reputation.

However, this study finds that financial performance does not influence the relationship between AI-driven ESG practices and corporate reputation. This suggests that the reputational benefits of AI-driven ESG efforts remain consistent across companies with varying levels of profitability. In other words, both financially strong and financially moderate companies can reap similar reputational benefits when adopting AI in their ESG initiatives. This highlights that the effectiveness of AI-supported sustainability practices does not make advanced technology a responsible business practice.

Limitations

This study has several limitations that should be acknowledged. First, the measurement of AI-driven ESG practices relies on secondary data and standardised scores, which may not fully reflect the depth, quality, or strategic integration of AI in sustainability processes.

Second, the sample is limited to companies in specific regions and time periods, which may limit the generalisability of the findings, especially given the evolving nature of AI technology and ESG regulations. Third, this study focuses only on financial performance as a moderating variable, ignoring other contextual factors such as digital readiness, governance quality, or stakeholder pressure which may influence the AI-ESG reputation relationship. Finally, the quantitative design may not capture more nuanced perceptions or qualitative aspects of corporate reputation and AI adoption.

Recommendations

Future studies are recommended to expand the scope of AI measurement by incorporating qualitative assessments, such as interviews or content analysis, to capture deeper insights into how companies implement AI in their ESG activities. Researchers could conduct cross-country or cross-industry comparative analyses to improve generalisation, given that ESG maturity and AI adoption vary significantly across markets. Additionally, future research should consider other moderator or mediator variables, such as governance structure, digital transformation level, or longitudinal design, which could provide additional information on how AI-driven ESG practices affect corporate reputation over time.

Implications

The findings of this study offer important theoretical and practical implications. Theoretically, the results extend the literature on ESG and technology in management by showing that AI adoption can enhance corporate reputation, reinforcing stakeholder theory and signalling theory in the context of digital sustainability. Practically, this study suggests that companies can strengthen their reputation by investing in AI technologies that improve the transparency, accuracy, and quality of ESG reporting. For policymakers, these results highlight the need to develop regulatory frameworks that encourage the responsible use of AI in sustainability practices. For managers, these findings emphasise the importance of strategically integrating AI into ESG initiatives to generate reputational advantage, particularly in competitive and sustainability-oriented markets.

REFERENCES

Ahmad, V., Goyal, L., Arora, M., Kumar, R., Chythanya, K. R., & Chaudhary, S. (2023). The impact of AI on sustainability reporting in accounting. *In 2023 6th International Conference on Contemporary Computing and Informatics (IC3I)*, *6*, 643–648. https://doi.org/10.1109/IC3I59117.2023.10397863

Alexander, N. (2025). Agency Problem: The Role of Governance as a Mitigant in two Tier Governance System in Indonesia. *Foundations of Management*, *17*(1), 25–36. https://doi.org/10.2478/fman-2025-0002

Asante-Appiah, B., & Lambert, T. A. (2023). The role of the external auditor in managing environmental, social, and governance (ESG) reputation risk. *Review of Accounting Studies*, *28*(4), 2589–2641. https://doi.org/10.1007/s11142-022-09706-z

Baah, C. O.-A. D. A. I. S. K. A.-M. Y. A. E. F. D. & A. F. A. M. (2021). Examining the correlations between stakeholder pressures, green production practices, firm reputation, environmental and financial performance: Evidence from manufacturing SMEs. *Sustainable Production and Consumption*, *27*, 100–114. https://doi.org/10.1016/j.spc.2020.10.015

Bloomberg. (2023). *Bloomberg SASB ESG Select Global Equity Index Methodology*.

Bora, I., Duan, H. K., Vasarhelyi, M. A., Zhang, C., & Dai, J. (2021). The transformation of government accountability and reporting. *Journal of Emerging Technologies in Accounting*, *18*(2), 1–21. https://doi.org/10.2308/jeta-10780

Budennyy, S. A., Lazarev, V. D., Zakharenko, N. N., Korovin, A. N., Plosskaya, O. A., Dimitrov, D. V. E., ... & Zhukov, L. E. E. (2022). Eco2ai: carbon emissions tracking of machine learning models as the first step towards sustainable ai. In Doklady mathematics. *Pleiades Publishing.*, *106*(1), 118–128. https://doi.org/10.48550/arXiv.2208.00406

Burnaev, E., Mironov, E., Shpilman, A., Mironenko, M., & Katalevsky, D. (2023). Practical AI cases for solving ESG challenges. *Sustainability*, *15*(17), 12731. https://doi.org/10.3390/su151712731

Chang, Y. L., & Ke, J. (2024). Socially responsible artificial intelligence empowered people analytics: a novel framework towards sustainability. *Human Resource Development Review*, *23*(1), 88–120. https://doi.org/10.1177/15344843231200930

Chen, R., & Zhang, T. (2025). Artificial intelligence applications implication for ESG performance: can digital transformation of enterprises promote sustainable development?. *Chinese Management Studies*, *19*(3), 676–701. https://doi.org/10.1108/CMS-11-2023-0653

Eckert, C. (2017). Corporate reputation and reputation risk. *The Journal of Risk Finance*, *18*(2), 145–158. https://doi.org/10.1108/JRF-06-2016-0075

Ghuslan, M., Jaffar, R., Saleh, N., & Yaacob, M. (2021). Corporate governance and corporate reputation: the role of environmental and social reporting quality. *Sustainability*, *13*(18), 10452. https://doi.org/10.3390/su131810452

Hambrick, D. C., & Mason, P. A. (1984). Upper Echelons: The Organization as a Reflection of Its Top Managers. *Academy of Management Review*, *9*(2), 193–206. https://doi.org/10.5465/amr.1984.4277628

Handayani, M., & Nurzhavira, G. P. (2024). Corporate Social Responsibility (CSR) as a Catalyst for ESG Integration in Marketing Strategies. *International Journal of Economics, Business and Innovation Research*, *3*(4), 198–211. https://doi.org/10.63922/ijebir.v3i04.929

Hao, X., & Demir, E. (2024). Artificial intelligence in supply chain decision-making: an environmental, social, and governance triggering and technological inhibiting protocol. *Journal of Modelling in Management*, *19*(2), 605–629. https://doi.org/10.1108/JM2-01-2023-0009

Hörisch, J., Schaltegger, S., & Freeman, R. E. (2020). Integrating stakeholder theory and sustainability accounting: A conceptual synthesis. *Journal of Cleaner Production*, *275*, 275. https://doi.org/10.1016/j.jclepro.2020.124097

Hughes, A., Urban, M. A., & Wójcik, D. (2021). Alternative ESG ratings: How technological innovation is reshaping sustainable investment. *Sustainability*, *13*(6), 3551. https://doi.org/10.3390/su13063551

Ifan, M. I. S., & Ningtyas, H. I. R. N. (2024). Pengaruh Penerapan Environmental, Social, Dan Governance Terhadap Profitabilitas Pada Perusahaan Di Indonesia (Studi Pada Perusahaan Manufaktur Yang Terdaftar Di PROPER Periode 2018-2022). *Transparan*, *16*(2), 78–84. https://doi.org/10.53567/jtsyb.v16i2.82

Jing, H., & Zhang, S. (2024). The impact of artificial intelligence on ESG performance of manufacturing firms: The mediating role of ambidextrous green innovation. *Systems*, *12*(11), 499. https://doi.org/10.3390/systems12110499

Kim, M. J., Hall, C. M., Chung, N., Kim, M., & Sohn, K. (2023). Why do tourists use public transport in Korea? The roles of artificial intelligence knowledge, environmental, social, and governance, and sustainability. *Asia Pacific Journal of Tourism Research*, *28*(5), 467–484. https://doi.org/10.1080/10941665.2023.2247099

Lei Ruan, H. L. (2021). settings Order Article Reprints Open AccessArticle Environmental, Social, Governance Activities and Firm Performance: Evidence from China . *Sustanability*, *13(2)*(767). https://doi.org/10.3390/su13020767

Li, D., Zhang, Z., & Gao, X. (2024). Does artificial intelligence deter greenwashing?. *Finance Research Letters*, *67*, 105954. https://doi.org/10.1016/j.frl.2024.105954

Li, N., Kim, M., Dai, J., & Vasarhelyi, M. A. (2024). Using artificial intelligence in ESG assurance. *Journal of Emerging Technologies in Accounting*, *21*(2), 83–99. https://dx.doi.org/10.2139/ssrn.4840353

Lim, T. (2024). Environmental, social, and governance (ESG) and artificial intelligence in finance: State-of-the-art and research takeaways. *Artificial Intelligence Review*, *57*(4), 76. https://doi.org/10.1007/s10462-024-10708-3

Lin, B., & Zhu, Y. (2025). Does AI elevate corporate ESG performance? A supply chain perspective. *Business Strategy and the Environment.*, *34*(1), 586–597. https://doi.org/10.1002/bse.3999

McBride, R., Dastan, A., & Mehrabinia, P. (2022). How AI affects the future relationship between corporate governance and financial markets: A note on impact capitalism. *Managerial Finance*, *48*(8), 1240–1249. https://doi.org/10.1108/MF-12-2021-0586

Minkkinen, M., Niukkanen, A., & Mäntymäki, M. (2024). What about investors? ESG analyses as tools for ethics-based AI auditing. *AI & Society*, *39*(1), 329–343. https://doi.org/10.1007/s00146-022-01415-0

Monfort, A., Mendez-Suarez, M., & Villagra, N. (2026). Artificial intelligence misconduct and ESG risk ratings. *Review of Managerial Science*, 1–24. https://doi.org/10.1007/s11846-025-00850-9

Mulyana, D., Widyaningsih, A., & Rozali, R. D. Y. (2025). Advancing Sustainability Through Artificial Intelligence: Implications for Firm Value in Indonesia. *Jurnal Akuntansi*, *29*(1), 148–170. https://doi.org/10.24912/ja.v29i1.2774

Musleh Al-Sartawi, A. M., Hussainey, K., & Razzaque, A. (2022). The role of artificial intelligence in sustainable finance. *Journal of Sustainable Finance & Investment*, 1–6. https://doi.org/10.1080/20430795.2022.2057405

Naveed, K., Farooq, M. B., Zahir-Ul-Hassan, M. K., & Rauf, F. (2025). AI adoption, ESG disclosure quality and sustainability committee heterogeneity: evidence from Chinese companies. *Meditari Accountancy Research*, *33*(2), 708–732. https://doi.org/10.1108/MEDAR-02-2024-2374

Pozzi, F. A., & Dwivedi, D. (2023). ESG and IoT: ensuring sustainability and social responsibility in the digital age. In International Conference on Artificial Intelligence: Towards Sustainable Intelligence. *Cham: Springer Nature Switzerland.*, 12–23. https://doi.org/10.1007/978-3-031-47997-7_2

Reddiar, C., Kleyn, N., & Abratt, R. (2012). Director's perspectives on the meaning and dimensions of corporate reputation. *South African Journal of Business Management*, *43*(3), 29–29. https://doi.org/10.4102/sajbm.v43i3.472

Sætra, H. S. (2023). The AI ESG protocol: Evaluating and disclosing the environment, social, and governance implications of artificial intelligence capabilities, assets,

and activities. *Sustainable Development*, *31*(2), 1027–2037. https://doi.org/10.1002/sd.2438

Saftiana, Y., Mukhtaruddin, M., Putri, K. W., & Ferina, I. S. (2014). Corporate governance quality, firm size and earnings management: empirical study in Indonesia Stock Exchange. *Investment Management and Financial Innovations*, *14*(14), 105–120. http://dx.doi.org/10.21511/imfi.14(4).2017.10

Samieva, K. T., Saenko, I. I., Menshchikova, V. I., & Smetanin, A. S. (2023). ESG management of digital business using big data and artificial intelligence (AI) in support of the green economy in Russia and Central Asia. In ESG management of the development of the green economy in Central Asia. *Cham: Springer International Publishing.*, 3–11. https://doi.org/10.24412/2311-1313-33-21-33

Saxena, A., Singh, R., Gehlot, A., Akram, S. V., Twala, B., Singh, A., ... & Priyadarshi, N. (2022). Technologies empowered environmental, social, and governance (ESG): An industry 4.0 landscape. *Sustainability*, *15*(1), 309. https://doi.org/10.3390/su15010309

Selim, O. (2020). ESG and AI: the beauty and the beast of sustainable investing. *In Sustainable Investing*, 227–243. https://www.taylorfrancis.com/chapters/edit/10.4324/9780429351044-12/esg-ai-omar-selim

Sklavos, G., Theodossiou, G., Papanikolaou, Z., Karelakis, C., & Ragazou, K. (2024). Environmental, social, and governance-based artificial intelligence governance: Digitalizing firms' leadership and human resources management. *Sustainability*, *16*(16), 7154. https://doi.org/10.3390/su16167154

Sunarto, S., AjiRamdhani, I., Oktaviani, R., & Jaeni, J. (2021). Profitability, Liquidity, Size, Reputation of Public Accounting and Timeliness Reporting Financial Statement: An Analysis of Manufacturing Company Overview in Indonesia. *In The 3rd International Conference on Banking, Accounting, Management and Economics*, 419–423. https://doi.org/10.2991/aebmr.k.210311.084

Tong, L., Yan, W., & Manta, O. (2022). Artificial intelligence influences intelligent automation in tourism: A mediating role of internet of things and environmental, social, and governance investment. *Frontiers in Environmental Science*, *10*, 853302. https://doi.org/10.3389/fenvs.2022.853302

Uyar, A., Kilic, M., Koseoglu, M. A., Kuzey, C., & Karaman, A. S. (2020). The link among board characteristics, corporate social responsibility performance, and financial performance: Evidence from the hospitality and tourism industry. *Tourism Management Perspectives*, *35*. https://doi.org/10.1016/j.tmp.2020.100714

Visalli, F., Patrizio, A., Lanza, A., Papaleo, P., Nautiyal, A., Pupo, M., ... & Ruffolo, M. (2023). ESG Data Collection with Adaptive AI. *In ICEIS*, *1*, 468–475. https://doi.org/10.5220/0011844500003467

Waddock, S. A., & Graves, S. B. (1997). The corporate social performance–financial performance link. *Strategic Management Journal*, *18*(4), 303–319. https://doi.org/10.1002/(SICI)1097-0266(199704)18:4%3C303::AID-SMJ869%3E3.0.CO;2-G

Xiao, Y., & Xiao, L. (2025). The impact of artificial intelligence-driven ESG performance on sustainable development of central state-owned enterprises listed companies. *Scientific Reports*, *15*(1), 8548. https://doi.org/10.3390/app13084916

Zhang, C., & Yang, J. (2024). Artificial intelligence and corporate ESG performance. *International Review of Economics & Finance*, *96*, 103713. https://doi.org/10.1016/j.iref.2024.103713

Zhang, D. (2024). The pathway to curb greenwashing in sustainable growth: The role of artificial intelligence. *Energy Economics*, *133*, 107562. https://doi.org/10.1016/j.eneco.2024.107562

Zhang, X., Zhao, X., & Qu, L. (2021). Do green policies catalyze green investment? Evidence from ESG investing developments in China. In *Economics Letters*. Elsevier. https://doi.org/10.1016/j.econlet.2021.110028

Zhironkin, S., & Ezdina, N. (2023). Review of transition from mining 4.0 to mining 5.0 innovative technologies. *Applied Sciences*, *13*(8), 4917. https://doi.org/10.3390/app13084917

Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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***Table 1** / Sample Selection*

Step	Description	Number of Firm
1	Total manufacturing firm listed on IDX	545
2	(-)Firms without ESG disclosure or incomplete ESG indicators	-322
3	(-) Firms without verifiable AI adoption (Bloomberg AI Tag + firm disclosures)	-127
4	(-)Firms excluded due to missing financial performance data (ROA)	-25
Final number of eligible firm	Firms meeting all inclusion criteria (ESG disclosure, AI adoption, complete data)	71 Firm
Total firm-year observations	71 firms × 6 years (2019–2024)	426 Observations

***Table 2** / Descriptive Statistics*

	Obs	Mean	Minimum	Maximum	Std. Deviation
AI_ESG	425	4.829	0.200	18.500	3.950
ROA	425	8.290	0.278	25.189	5.189
FS	425	14.289	12.100	17.800	1.090
FA	425	24.290	5.000	65.000	12.278
Lev	425	0.390	0.081	0.878	0.192
Grow	425	0.129	-0.218	0.389	0.206
Valid N	425				

Source: Secondary Data Processed by SPSS (2025)

***Table 3** / Heteroscedasticity*

Variables	AI_ESG	ROA	FS	FA	Lev	Grow
AI_ESG	1.000					
ROA	0.416***	1.000				
FS	0.328**	0.493***	1.000			
FA	0.211*	0.225*	0.192*	1.000		
Lev	0.326**	0.390***	0.234*	0.227*	1.000	
Grow	0.337**	0.301**	0.217*	0.280**	0.327**	1.000

$p < 0.05$,
$**p < 0.01$,
$**p < 0.001$

Source: Secondary Data Processed by SPSS (2025)

***Table 4** / Multicollinearity*

Variable	VIF	Tolerance
AI_ESG	1.92	0.617
ROA	1.82	0.278
FS	1.90	0.267
FA	2.10	0.679
Lev	2.18	0.278
Grow	1.29	0.467
I**nterpretation:** All VIF < 10 → multicollinearity is not a concern.		

Source: Secondary Data Processed by SPSS (2025)

***Table 5** / Regression Result*

Variables	Model 1	Model 2
Constant	0.028*	0.028**
	(0.030)	(0.048)
AI_ESG	0.112***	
	(0.001)	
ROA	0.019***	-8.245***
	(0.010)	(0.000)
ESG*ROA		0.090
		(0.923)
FS	0.671***	0.278*
	(0.006)	(0.078)
FA	0.267**	1.198**
	(0.018)	(0.027)
Lev	5.289**	0.059
	(0.016)	(0.639)
Grow	0.928	4.260***
	(0.207)	(0.008)
***p < 0.01		
**p < 0.05		
*p < 0.10		

Source: Secondary Data Processed by SPSS (2025)

***Table 6** / Robustness Test*

Variables	Model 1	Model 2
Constant	0.030	0.029
	(0.028)	(0.046)
AI_ESG	0.115***	0.110***
	(0.001)	(0.002)
ROE		0.021**
		(0.015)
ESG*ROE		0.088*
		(0.091)
FS	0.675**	0.280*
	(0.005)	(0.075)
FA	0.270**	1.205**
	(0.017)	(0.075)
Lev	5.310**	1.205**
	(0.017)	(0.025)
Grow	0.935	4.270**
	(0.204)	(0.007)
Observations	425	425
Adjusted	0.247	0.282
***p < 0.01		
**p < 0.05		
*p < 0.10		

Source: Secondary Data Processed by SPSS (2025)

LIST OF FIGURE

***Figure 1** / Research Model of AI in ESG on Reputation with Financial Performance Moderation*