

Unveiling the Relationship Between Sustainability Certification and Zero Deforestation on Financial Performance in Crude Palm Oil Plantation

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Abstract

The purpose of this research study is to investigate the relationship between key financial performance indicators and financial leverage in decision-making for achieving sustainable performance, as measured by sustainability certification and zero deforestation, in the palm oil industries of Indonesia and Malaysia from 2021 to 2023. This study employs panel data regression and logistic regression, using data from 25 palm oil plantations in Indonesia and Malaysia from 2021 to 2023. The data analysis was conducted using STATA software to process and interpret the multiple regression models. This research employs a dual-lens empirical framework, focusing on sustainable certification and zero deforestation. The results reveal that financial performance has a negative, yet insignificant, relationship with sustainable certification and zero deforestation. Confirming that sustainable practices do not heavily rely on financial structure. Nonetheless, financial leverage has a negative insignificant relationship with sustainable certification or zero deforestation. This suggests that a higher debt ratio is associated with a lower likelihood of adopting sustainable practices. Otherwise, other independent variables, such as liquidity, firm size, and ESG score in zero deforestation, have a positive and significant association, suggesting that larger firms with capital flexibility and a high ESG score are more likely to comply with the zero deforestation policy. For sustainable certification, only the ESG score shows a positive and significant association with sustainable certification. This suggests that palm oil plantations with consistently high ESG scores are more likely to obtain sustainable certification. This research provides broad insight for organizations related to sustainability and managerial insights to support the transparency and credibility of reporting sustainable performance of palm oil plantations in Indonesia and Malaysia.

Keywords: sustainability certification, zero deforestation commitments, financial performance, panel data regression, logistic regression

A. INTRODUCTION

Palm oil industries remain the most extensively traded and consumed vegetable oil globally. This industry remains dominated by Indonesia and Malaysia, which together contributed 59.5% and 22.8%, respectively, to the global production volume of 81.4 million tonnes, reaffirming their roles as the world's leading palm oil producers (Norlin, Khalid, et al., 2025). Additionally, the palm oil industry plays a significant role in shaping socio-economic conditions, particularly in countries that produce palm oil. Although the value of exported palm oil has a significant contribution to market share, this commodity-driven agriculture is the most significant driver of deforestation in Southeast Asia (Curtis P. G. et al., 2018), and Indonesia and Malaysia are part of this issue. Issues of deforestation have increased over the years; therefore, the concern over deforestation has become a global issue with explicit SDG targets (SDG 15.2), prompting a call for a halt to deforestation.

Additionally, the UN has initiatives such as the UN Strategic Plan for Forests (2017-2030), the UN Program for Reducing Emissions from Deforestation and Forest Degradation, and zero-deforestation commitments for producers and traders (Humphreys et al., 2019). Agricultural expansion remains the dominant cause of deforestation, responsible for approximately 80% of global forest land change (FAO, 2016). Agricultural commodities that contribute to deforestation include oil palm plantations in Southeast Asia, as well as cocoa, banana, and coffee, among others. In developing countries, more than half of this deforestation is attributed to large-scale commercial agricultural activities (Hosonuma et al., 2012). According to a study by Christopher (2024), on an acreage basis, net forest loss has been most significant in Brazil, the Democratic Republic of the Congo (DRC), and Indonesia.

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The European Union Deforestation Regulation (EUDR) is the recent addition to the EU regulatory framework, specifically addressing deforestation issues. The regulation requires that all phases of the supply chain for any products distributed within the EU be labelled as zero-deforestation compliant. Thus, the prohibition on importing goods that contain deforestation activity has a significant impact on palm oil producers. The impact of the EU campaign became apparent among palm oil producers through the implementation of the European Union Renewable Energy Directive (EU RED II), which resulted in a notable reduction in Malaysian palm oil exports to the European Union. Before the regulation of EU RED II, the EU had been a significant market for Malaysian palm oil, with approximately 9% to 11% of the country's total palm oil exports to the EU declining (MPOB, 2016). The challenges also faced by the palm oil firms arise, especially in those with export activities. Since the widely accepted "palm oil-free" labelling has led to discrimination through its unreasonable use, this practice has impacted the revenue of the firms. This is proven in India, where it is one of the largest importers of palm oil. A study (Norlin, Khalid, et al., 2025) suggests that the growing campaign for zero-deforestation labelled products is influencing the consumption of household products among higher-income groups, where palm oil is perceived as a more affordable option. This strengthens because India is a price-sensitive market.

However, the presence of RSPO could help tackle deforestation practices among firms in the palm oil industry. This voluntary certification provides an alternative approach to environmental sustainability, particularly in a global context. Some studies have supported the statement, as shown by Carlson et al. (2018), which indicates that RSPO compliance reduces deforestation. A supporting study (Ruysschaert & Salles, 2014) views the RSPO as a form of bargaining power in which growers "preserve areas of forest of high biodiversity value, to the benefit of palm oil processors and consumer goods manufacture." Additionally, Naidu et al. () state that certification can enhance export revenue by meeting the stringent requirements of importing countries, particularly in the European Union, which demands certified and sustainably produced palm oil. Several recent studies have been conducted to examine the relationship between financial performance and leverage toward sustainable practice in influencing firms' decisions, reporting contradictory results: a negative relationship between financial performance and RSPO certification (Suroso et al., 2021), negative relationship between leverage and sustainable Performance (Shahimi et al., 2023), and environmental labelling certification (ELC) has no impact on financial performances (Duojun, He et al., 2021). In addition, several studies have shown a positive correlation between financial performance and obtaining sustainability certification, including top global corporations (Ameer & Othman, 2012), small- to medium-sized enterprises (Cantele & Zardini, 2018), and 100 global companies (Olaf, Weber, et al., 2008).

This study contributes to the literature by examining the relationships between financial performance and sustainable Performance among Indonesia and Malaysia palm oil companies for the 2021-2023 periods. The study employs random-effects regression and clustered regression to assess the determinants of sustainable certification and logistic regression to model the probability of zero deforestation compliance. All estimations are conducted using STATA software. The findings reveal that in the first model regression, financial performance indicators do not significantly influence a firm's decision to obtain RSPO certification. Instead, the ESG scores emerge as the dominant predictor of certification status.

In contrast, the second model, leverage, exhibits a significant negative association with zero deforestation compliance. The novelty of this study lies in its dual analytical approach, which distinguishes between two dimensions of sustainable practices: sustainable certification and zero-deforestation commitments. Building on the prior research (Shahimi et al., 2023; Levy, 2022), this study investigated whether key financial indicators, such as lagged return on assets, liquidity, and leverage, serve as enabling or constraining factors in the adoption of sustainability standards. Despite the growing literature on sustainable practices and financial performance, as well as financial leverage, there remains a limited understanding of how specific financial structures shape voluntary sustainability adoption in high-risk sectors, such as the palm oil industry. This study addresses that gap by providing empirical evidence from 25 public palm oil plantations in Indonesia and Malaysia between 2021 and 2023.

Furthermore, this research contributes to signalling theory by examining how financial Performance and sustainable Performance serve as credible indicators of a long-term commitment to stakeholders. Furthermore, the model incorporates control variables such as firm size, sales growth, average selling price, ESG score, and operating profit. These firm characteristics enable a more robust

assessment of firm behaviour. Alongside that, this study will examine two countries, such as Indonesia and Malaysia, which have contributed significantly to the production of crude palm oil over the decades.

This paper is organized as follows: Section 2 presents a review of the relevant literature on the nexus between financial performance, leverage, and sustainable certification, as well as the development of hypotheses. Section 3 discusses the research methodology. Section 4 presents the empirical findings, and Section 5 provides the study's conclusion.

B. LITERATURE REVIEW

Theoretical Framework

This study is grounded in three interrelated theoretical perspectives that explain how and why firms engage in sustainable practices, including signalling theory, legitimacy theory, and the triple bottom line framework. Signalling theory provides a foundation for understanding corporate sustainability disclosures as strategic communications aimed at reducing information asymmetry and enhancing firm valuation (Rousseau, D. M., et al., 1998; Spence, 2002). A previous study (Sheridan, M. et al., 2006) has found that sustainability signals, such as sustainability reporting, are influenced by both internal motivations and external pressures. In contrast, legitimacy theory views corporate sustainability not only as a strategic choice but also as a response to social norms and institutional expectations (Loewe & Zintl, 2021; Suddaby et al., 2017). Prior research (Mabahwi et al., 2014) suggests that firms may selectively disclose sustainability information to maintain legitimacy while avoiding regulatory scrutiny, particularly in environmentally sensitive industries, such as the palm oil sector. Complementing these perspectives, the Triple Bottom Line framework (Elkington, 1994) offers a holistic approach by broadening firms' performance beyond profit to encompass people, the planet, and profit. While studies have applied TBL to justify integrated ESG metrics (Slaper, T. F., & Hall, 2011), few have differentiated how specific sustainable dimensions respond to distinct financial and institutional pressures. This research contributed to that gap by empirically contrasting the role of financial performance in shaping these two sustainability pathways. Unlike prior studies that examine aggregate ESG performance, this study distinguishes between types of sustainability commitments, thereby providing a more granular application of signalling and legitimacy theories within the high-stakes palm oil industry, which operates under evolving global sustainability standards.

Signaling Theory

Signalling theory refers to the interaction between signal senders and recipients as participants in financial markets (Ambarish, R. et al., 1987). According to signal theory, the disclosure of information used to communicate with the public is an action taken by corporate management to reduce asymmetry costs, optimize financing costs, and enhance corporate brand value. Firms often employ the signalling theory to gather information from capital markets and mitigate asymmetric information in corporate activities, encompassing both financial and social aspects (Spence, 2002). The signal theory is particularly relevant in the context of corporate sustainability practices. As firms increasingly face scrutiny from investors, regulators, and global consumers, the decision to disclose information related to sustainability demonstrates accountability and secures stakeholder trust. For certain firms, sustainability signals function as a strategic tool for managing information disclosure (Rousseau, D. M. et al., 1998). A company's decision to signal or withhold sustainability information may depend on whether its sustainability efforts are driven by internal motivation or external pressures (Sheridan, M. et al., 2006). These actions not only serve to mitigate perceived information asymmetry but also potentially enhance the firm's market valuation and access to capital.

Legitimacy Theory

Legitimacy is a social contract between organizations and society's social expectations (Loewe & Zintl, 2021). According to (Suddaby, R. et al., 2017), legitimacy theory emphasizes the importance of demonstrating that an organization upholds societal expectations by adhering to specific standards, honouring cultural norms, and addressing the values and demands of the communities in which it operates. This theory suggests that companies inherently accept the responsibility to conduct their activities in a manner that adheres to a code of ethics and does not disrupt social structure, degrade environmental

conditions, or violate prevailing social norms, thereby securing their ongoing legitimacy and societal approval. According to (Mabahwi et al., 2014), environmental information disclosure theory posits that companies operating in environmentally degraded areas, often due to inadequate waste management practices, may strategically withhold full disclosure of their environmental impacts. Instead, these organizations tend to report only information that appears to meet formal compliance requirements. This selective disclosure is often a deliberate attempt to evade potential sanctions or scrutiny from environmental regulatory authorities—the theory of legitimacy used in firms as a tool for dual communication.

Triple Bottom Line

The theory of Triple Bottom Line, introduced initially by (Elkington, 1994) in the mid-1990s, began as an accounting framework aimed at expanding the conventional, financially focused evaluation of business performance by incorporating environmental and social dimensions. Firms nowadays use TBL as a framework, also known as the 3Ps: people, planet, and profits, and have reshaped perspectives on evaluating sustainability by promoting a more comprehensive approach to measuring organization performance (Slaper, T. F., & Hall, 2011). On the other hand, the three pillars of sustainable development have increasingly attracted the attention of stakeholders in sectors that operate within many stakeholders, especially related to the impact on the environment.

The Relationship Between Financial Performance And Sustainability Performance

This study uses conventional financial metrics to assess how this indicator impacts firms' decision in obtaining sustainable investment; therefore, this study uses three indicators: 1) Lagged Return on Assets; 2) Liquidity, measured by current ratio, in the book of (GARP, 2015) state that liquidity is essential for short-term problem caused by short-term unexpected liabilities and the funding requirements of long term liabilities that have adverse effect on firm financial performance; 3) Leverage, measure by debt-to-equity ratio. When correctly managed, leverage can serve as a powerful mechanism to enhance shareholder value by increasing returns on equity and providing tax benefits through the deductibility of interest expenses. The role of sustainability practices in enhancing corporate performance has garnered considerable attention within the palm oil industry. Among the various sustainability certification schemes, the Roundtable on Sustainable Palm Oil (RSPO) has emerged as a leading global standard for the palm oil industry. Empirical evidence has shown that RSPO certification can be linked to improved financial outcomes. For instance, (Teoh, 2010) states that the implementation of the RSPO standard has a positive relationship with the firm's performance for those companies that have at least 45% certified palm oil. Another study from (B.A.M, H.-S., Shahida & Fuad, 2018) shows that Companies with sustainability certification enjoy 2.3% higher profitability than non-certified companies. In terms of export activities, certification can enhance export revenue by meeting the stringent requirements of importing countries, particularly in the European Union, which demands certified and sustainably produced palm oil (Lakshmy Naidu et al., 2022). The benefit of using certification can increase access market to the premium market, and this aligns with a study from (Hutabarat et al., 2018) that states, although not universally observed, some studies indicate that certified companies can achieve premium prices for their products, which can offset the costs of certification and improve profitability. The empirical findings suggest that sustainability certification, particularly RSPO, can offer measurable financial advantages for palm oil companies.

Align with RSPO practices; zero deforestation has been attracting stakeholders in the palm oil sector over the years. The study (Setiyanto, 2024) stated that compliance with ZDCs can enhance market access, especially in regions with stringent sustainability requirements, such as the European Union. This can potentially lead to premium pricing for sustainably produced palm oil, although the financial benefits may not always offset the increased cost. However, beyond the potential of short-term financial incentives, the strategic value of complying with zero-deforestation commitments extends further. Adopting zero deforestation can mitigate long-term risks associated with deforestation, such as regulatory penalties, reputational damage, and a loss of access to the market. This can contribute to more stable financial performance over time (Lambin, E.F. et al., 2018). Although some of the companies have benefited from sustainability certification, there are some empirical findings that contradict the study from (Shahimi et al., 2023), showing that RSPO certification significantly reduces the profitability of the

world's top 20 CPO producers. Also (Bouslah et al., 2010) stated that there are indications that sustainability certification harms financial performance, particularly in the short term, especially when the certification is industry-led. In conclusion, while sustainability certification can offer potential financial benefits for some companies, the empirical study also highlights notable risks and short-term financial burdens associated with its adoption. Furthermore, for zero deforestation, there is some empirical evidence that is contradictory and can hurdle the financial decision. In a study by (Openko et al., 2019), deforestation negatively impacts the microclimatic conditions essential for agricultural production, forcing farmers to apply fertilizers more frequently to regulate the soil's water regime; the fact that this action will raise the overall cost of crop cultivation. Another study by (Chandra et al., 2024) states that companies often face challenges in achieving full traceability and compliance with zero deforestation, which can incur additional costs. This study draws on key theories to frame the relationship between financial performance and sustainable performance. According to signalling theory, firms strategically disclose sustainability commitments, such as RSPO certification, to reduce information asymmetry, build stakeholder trust, and enhance their market valuation (Rousseau, D. M. et al., 1998; Spence, 2002). On the other hand, legitimacy theory suggests that firms adopt sustainability practices to align with societal norms and secure social license to operate (Suddaby, R. et al., 2017). Therefore, based on the explanation of the nexus between sustainability performance and financial performance, the development of the hypothesis is found below:

Hypothesis 1: There is a positive relationship between financial performance and sustainability Performance after controlling firm size, growth of sales, ESG score, average selling price, and operating profit.

The Relationship Between Leverage And Sustainability Performance

The relationship between leverage and sustainability performance has garnered significant attention in recent academic literature. As leverage is often measured by debt ratio, it can influence a firm's capacity to invest in sustainable practices and affect its overall sustainability performance (Susilawati et al., 2022). By borrowing at fixed interest, firms can amplify returns on equity when investments perform well, but leverage also magnifies risk and potential losses if returns falter (Tome, 2017). There are several empirical evidence on the leverage study linked with sustainability. (Sheikh, 2019) shows that companies active in corporate sustainability reporting carry less debt on average, consistent with the idea that highly leveraged firms forgo some social investment due to financial constraints. This negative association is especially pronounced in highly competitive industries under intense product competition; firms appear less able to sustain both high debt and high CSR, so those committed to CSR keep more conservative leverage.

On the other hand, some evidence suggests leverage need not always hinder sustainability; a study by (Connors & Gao, 2011) found that firms with strong environmental performance had higher leverage and more debt financing available, implying that investing in cleaner technology and better environmental management did not compromise their capacity to borrow. The study by (Widarwati et al., 2023) explored the role of leverage and profitability as determinants of CSP among 22 SOEs listed in IDX; the study revealed that higher leverage negatively impacts sustainability performance, while profitability showed no significant effect. This indicates that excessive reliance on debt may constrain a firm's ability to engage in sustainable practices. Overall, excessive leverage tends to constrain sustainability performance, but the effect is neither universal nor unidirectional; high debt levels can pressure firms to focus on short-term solvency at the expense of voluntary sustainability initiatives, which is why higher-leveraged companies often show lower CSR engagement in various studies (Sheikh, 2019).

According to signalling theory, firms with high leverage may avoid voluntary sustainability actions, fearing such moves could signal financial weakness to investors or lenders (Cormier, D. et al., 2011; Spence, 2002). Suggests that well-capitalized firms may use sustainability certification as a signal of risk management competence and long-term viability. From a legitimacy theory lens, highly leveraged firms may prioritize compliance with short-term financial obligations over non-mandatory sustainability efforts, especially when operating in capital-intensive or highly scrutiny sectors (Suddaby, R. et al., 2017). Under such conditions, debt acts as a constraint on environmental legitimacy signalling, potentially reducing a firm's engagement with certification schemes or deforestation-free commitments. Collectively,

based on these prior studies and theories on how leverage affects firms' decisions in sustainable investment, it is hypothesized as follows.

Hypothesis 2: There is a positive relationship between leverage and sustainability performance after controlling firm size, growth of sales, ESG score, average selling price, and operating profit.

Research is developed to see a conceptual framework to examine the predictor of financial performance on obtaining sustainability performance in palm oil industries in Indonesia and Malaysia. Sustainable certification captures a firm's adherence to environmental, social, and governance standards. Meanwhile, zero deforestation captures companies' commitment to eliminating deforestation from their supply chain and operations. The research will use control variables based on firm characteristics to ensure the robustness of the model and effectively give the result of financial performance and leverage sustainable performance.

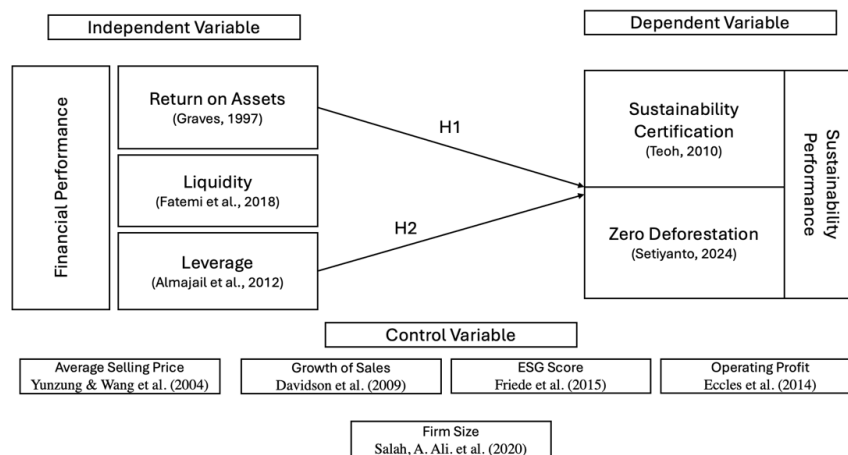


Figure 1. Conceptual Framework

Sources: Research Data, 2025

Based on the above discussion, it is apparent that most past studies centred on the effect of sustainability certification on the palm oil industry (Shahida et al., 2018; Hutabarat et al., 2018; Ruyschaert & Salles, 2014) and the effect of RSPO on firm profitability (Shahimi et al., 2023). There is no empirical evidence on what is the predictor of obtaining sustainability practice by firms in palm oil plantation sectors, which the present study expects to fill in the research gap.

C. METHODS

This study aims to examine and unveil the relationship between sustainability certification and zero deforestation on the financial performance of crude palm oil in Indonesia and Malaysia. This study will reveal the relationship among dependent, independent, and control variables. This aligns with a study from (Schneider et al., 2010) that linear regression is an important tool for statistical analysis; its broad spectrum of uses includes relationship description, estimation, and prognostication. Since the study has more than one independent variable, a multiple regression analysis will be used in this study. To assess the influence between the dependent and independent variables, this research study uses two methodologies. The first is panel data regression to test the relationship between Financial Performance and Sustainability Performance, and the second model is logistic regression using binary to test the relationship between Leverage and Sustainability Performance in Crude Palm Oil Companies in Indonesia and Malaysia.

The population of this research is CPO company that operates in Indonesia and Malaysia and are listed on SPOTT (Sustainability Policy Transparency Toolkit), an initiative by the Zoological Society of London (ZSL) that assesses and ranks companies (especially palm oil, timber, rubber) on public disclosure of their sustainability practice. The sample of this study will consist of 25 companies that consistently publish their percentage (%) of total RSPO (Roundtable Sustainability Palm Oil) certification and disclose their commitment to NDPE (No Peat No Deforestation) in the SPOTT website and sustainability report.

This research study has two dependent variables that are used to assess the financial performance approach: using financial performance as a proxy of return on asset lagged year and liquidity and leverage as a proxy of debt to equity ratio. The Sustainable Performance is collected from each sustainability report and website of SPOTT from 2021 until 2023. Specifically, the study develops two model regressions to

examine the firm's decision-making in sustainable compliance obtained from SPOTT. SPOTT (Sustainability Policy Transparency Toolkit) is an initiative by the Zoological Society of London (ZSL) that assesses and ranks companies (especially palm oil, timber, and rubber) on public disclosure of their sustainability practice. Based on the model by (Shahimi et al., 2023; Suroso et al., 2022), this study introduced a new variable that is ZD (Zero deforestation). ZD variable refers to zero deforestation compliance represented by a dummy variable, which takes the value one if the firm is declared to comply with NDPE (No Peat No Deforestation) in the annual report and sustainability report; otherwise, 0. Another dependent variable in this study is sustainable certification, measured by the percentage of land certification from SPOTT.

The data obtained in this study was analyzed using two different methodologies. The first model is measured through panel data regression, which identifies the positive relationship between financial performance and sustainability performance after controlling firm size, growth of sales, ESG score, average selling price, and operating profit. Based on the study variables, two regression equations were developed to address the research objectives. The models were estimated using random clustered regression. The general form of the model is presented as follows:

$$SC_{it} = \beta_0 + \beta_1 ROA_{it-1} + \beta_2 LEV_{it} + \beta_3 LIQ_{it} + \beta_4 GS_{it} + \beta_5 FS_{it} + \beta_6 ASP_{it} + \beta_7 ESGScore_{it} + \beta_8 OPROF_{it} + \mathcal{U}_i + \varepsilon_{it}$$

Model 1. Sustainability Certification (Sc) Using Panel Data Regression

Sources: Research Data, 2025

$$\Pr(ZD_i = 1|X_i) = \frac{1}{1 + \exp[-(\alpha + \beta_1 ROA_{it} + \beta_2 LIQ_{it} + \beta_3 LEV_{it} + \beta_4 FS_{it} + \beta_5 GS_{it} + \beta_6 ESGS_{it} + \beta_7 ASP_{it} + \beta_8 OPROF_{it})]}$$

Model 2. Zero Deforestation (ZD) Using Logistic Regression

Sources: Research Data, 2025

Where the Y in the model is sustainable performance measured by two variables, namely sustainable certification and zero deforestation at the firms i in year t; $[ROA]_{(i,t-1)}$ is the return on assets from the previous year; $[DER]_{it}$ is the ratio of debt to equity, $[LIQ]_{(i,t)}$ is the current ratio, $[GS]_{(i,t)}$ is the change in net sales from year t-1 to t, $[FS]_{(i,t)}$ is proxied by logarithm natural of firms total assets, $[ASP]_{(i,t)}$ is the average selling price of the firm at the year, $[ESGScore]_{(i,t)}$ is the ESG performance index, and $[OPROF]_{(i,t)}$ is operating income.

To ensure the validity of the regression models, several key statistics assumptions were tested. First, multicollinearity was examined using the variance inflation factor (VIF). All the independent variables yielded VIF below the commonly accepted threshold of 10, indicating no presence of multicollinearity concerns. Second, the assumption of homoscedasticity was assessed using the Breusch Pagan, which helped to determine whether heteroscedasticity was present in the panel data model. Where heteroscedasticity has appeared, robust standard errors were applied to correct for biased standard error estimation.

Furthermore, the Hausman test was conducted to compare fixed model effects and random model effect specification, guiding the selection of the most appropriate model for estimating causal relationships. To evaluate the robustness of the main results, additional diagnostic checks were carried out. Specifically, the regression models were re-estimated using robust standard errors to verify the consistency of the coefficient signs and significance levels.

Table 1. Definition of Variable

Variable	Formula	Definition	Reference	Data Source
Dependent Variable				
Sustainability Certification (SC)	% of certified land area	The proportion of plantation land certified under RSPO/ISPO standards	Teoh (2010)	RSPO, SPOTT reports
Zero Deforestation (ZD)	Dummy: 1 = ZD compliant, 0 = otherwise	Indicates whether the firm declares deforestation-free commitment	Setiyanto (2024)	SPOTT reports, sustainability reports
Independent Variable				
Return on Assets (ROA)	(Net Income / Total Assets) × 100	Measures financial performance through profitability	Graves (1997)	Financial reports

Variable	Formula	Definition	Reference	Data Source
Liquidity (LIQ)	Current Assets / Current Liabilities	Measures short-term financial flexibility	Fatemi et al. (2018)	Financial reports
Leverage (DER)	Total Debt / Total Equity	Measures the extent of debt financing relative to equity	Almajali et al. (2012)	Financial reports
Control Variable				
Firm Size (FS)	Ln(Total Assets)	Captures firm scale or size based on asset base	Davidson et al. (2009)	Financial reports
Growth of Sales (GS)	$(\text{Sales}_t - \text{Sales}_{t-1}) / \text{Sales}_{t-1}$	Measures annual revenue growth	Davidson et al. (2009)	Financial reports
ESG Score (ESG_S)	ESG index score (0–1)	Composite ESG score from third-party rating agencies	Friede et al. (2015)	SPOTT, company ESG ratings
Average Selling Price (ASP)	Log(Average Selling Price of CPO)	Represents market value of palm oil product	Yunzung & Wang et al. (2004)	Annual reports, market data
Operating Profit (OPROF)	EBIT / Total Assets	Measures operational efficiency and profitability	Eccles et al. (2014)	Financial reports

Sources: Research Data, 2025

This study also considers several internal factors consider as determinants of firm Performance: Firm Size. Firm size is often used as a proxy to capture the scale and capacity of a company, typically measured by total assets, sales, or number of employees. In this study, firm size is measured using total assets. Larger firms tend to exhibit higher performance because they have greater access to financial resources, strong bargaining power, and better economies of scale, which may enhance their ability to sustain Performance (Almajali et al., 2012). In contrast, small firms often struggle with limited resources, which can hinder their ability to invest in marketing and innovation capabilities effectively (Qian & Li, 1999; Rajan, 2014). Specifically, in the palm oil industry, it was found that firm size positively influences environmental performance as larger companies are more likely to invest in RSPO. Previous research has found that firm size has a positive relationship with sustainability certification (Jha & Kumar Mittal, 2024).

Growth of Sales

Growth of sales often serves as a primary indicator of a firm's ability to expand its market presence, sustain financial performance, and support long-term strategic objectives (Davidsson et al., 2009). Companies with high sales growth are generally better positioned to reinvest in innovation, pursue strategic acquisition, and enhance shareholder value. The prior research study has a similar statement, which is, Additionally (Penrose, 2009), variable sales growth is often used in financial analysis and corporate evaluation to assess a firm's prospects for future earnings and resilience in facing fluctuating market conditions.

ESG Score

The Environmental, Social, and Governance (ESG) score is increasingly recognized as a key metric for evaluating a firm's sustainability performance beyond financial indicators. ESG Scores significantly impact the investment attractiveness of companies; for instance, higher ESG scores can lead to better stock returns, particularly during crises (Kachalov & Finogenova, 2023). Previous research reported that the ESG score, which reflects sustainability performance, shows a positive correlation with financial Performance (Friede et al., 2015) (Eccles, R. G. et al., 2014)

Average Selling Price

The average selling price represents the mean revenue earned per unit of product sold and serves as a critical indicator of a firm's pricing strategy, market positioning, and product differentiation. ASP is often linked to the perceived value of a product in the market sentiment and reflects superior quality sustainability attributes. Previous research has identified that firms certified under RSPO schemes or those adopting zero-deforestation commitments are able to access premium markets and secure higher selling prices (Oosterveer et al., 2014). Furthermore (Hidayat et al., 2015) state that successful certification can

signal a commitment to sustainable practices, which is valued by buyers and can lead to price premiums above the global or regional average.

Operating Profit

Operating profit, often proxied by earning before interest and taxes (EBIT), represents a firm's core profitability derived from its principal business operations, excluding non-operational factors (Bouwens et al., 2019). Also, it is widely recognized as a robust indicator of managerial efficiency and operation performance, providing insight into the firm's ability to generate value from its recurring activities (Damodaran, 2012). Previous research has identified that operating profit has become a key enabler of a firm's adoption and maintain environmentally and socially responsible practices (Eccles, R. G. et al., 2014; Fatemi et al., 2018; Orlitzky et al., 2003). In summary, operating profit in the palm oil industry is not only a measure of financial performance but also a critical factor in enabling companies to pursue and maintain sustainability certification.

D. RESULTS AND DISCUSSION

Based on descriptive statistics, the result shows that only 35.7% of firms obtained sustainability certification amongst the sample. The average Return on Assets Lagged one year (lag roa) was 10.7%. Indicating relatively modest profitability among the sample. Leverage (DER) averaged 1.678, reflecting a moderate level of financial leverage. The liquidity (LIQ) showed substantial variability, with an average of 14.84 times, suggesting that some firms maintained exceptionally high liquid assets.

Table 2. Descriptive Statistics of Sustainability Certification

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99	Skew.	Kurt.
SC	75	.357	.359	0	.99	0	.99	.464	1.637
lag roa	75	.107	.28	-.126	2.37	-.126	2.37	7.207	58.768
DER	75	1.678	4.671	-2.198	30.7	-2.198	30.7	4.616	25.665
LIQ	75	14.839	65.346	.006	453.571	.006	453.571	5.434	32.896
GS	75	-1.084	2.125	-5.01	7.626	-5.01	7.626	2.275	10.921
FS	75	21.198	12.599	-6.888	39.544	-6.888	39.544	-1.034	2.868
ASP	75	16.403	.196	15.991	16.976	15.991	16.976	.398	2.886
ESG S	75	.621	.368	0	1.76	0	1.76	.391	4.15
OPROF	75	.281	.253	.021	1.158	.021	1.158	1.809	5.703

Sources: Research Data, 2025

The average growth of sales (GS) was negative (-1.08), implying a general contraction trend during the observed periods. Meanwhile, the firm size (FS), measured in the natural logarithm of total assets, was 21.20. the average selling price (ASP) of palm oil products was recorded at 16.403, with minimal deviation, indicating the average price is consistent across firms. The ESG score disclose averaged 0.621, highlighting a moderate level of sustainability reporting. Finally, the mean operating profit was 28.1%, with values ranging from 2.1% to 115.8%, showing wide variation among the firms. Table 2 provides descriptive statistics in this study, which reports the mean, standard deviation, skewness, and kurtosis of the study. According to (Park, 2015), a variable can be considered normally distributed if its skewness is close to 0 and kurtosis is around 3. Based on Table 3, Lagged ROA, DER, LIQ, and GS variables demonstrate high skewness and kurtosis. The result indicates the existence of outliers and distributional asymmetries in the data, which means the result can be defined as not normally distributed. Given that the normality assumption does not meet the standard, the application of Ordinary Least Square (OLS) regression would not be inappropriate. To tackle this issue, the Generalized Least Squares (GLS) estimation technique was employed, as it provides more robust estimates under conditions of nonnormality (Gujarati, 2003).

The Pearson correlation in Figure 2 is used to explain the bivariate relationship between independent variables, which means to see the strength and direction of the linear relationship between continuous variables. Furthermore, correlation analysis is often employed to detect multicollinearity with a correlation coefficient below 0.8 (Gujarati, D. N. & Porter, 2009; Tay, 2017). Based on Figure 2, the result is that the coefficient of each variable is below 0.8; this indicates there is no presence of multicollinearity, so each tested variable is eligible for further analysis. To ensure the reliability of the panel regression estimates, diagnostic tests were conducted to evaluate violations of classical assumptions. The Modified Wald test and the Wooldridge test indicate the presence of both

heteroscedasticity and autocorrelation. The result of the white test in Table 5 for groupwise heteroscedasticity produced a chi-square statistic of 644,805.61 with a p-value of 0.000. As the p-value is below the 00.05 significance threshold, the null hypothesis is rejected. Based on Table 6, the result of the Wooldridge test F-statistic ($F = 82.623$, $p < 0.01$), this test led to the rejection of the null hypothesis of no serial correlation. The results above from the Modified Wald test and the Wooldridge test indicate the presence of both heteroscedasticity and autocorrelation. To address these violations of classical assumption, the most appropriate is to imply the random effect model to be re-estimated using cluster-robust standard errors command in STATA. This approach adjusts the standard error to account for both heteroscedasticity across panels and serial correlation within panels, thereby improving the consistency and validity of the data (Hoechle, 2007).

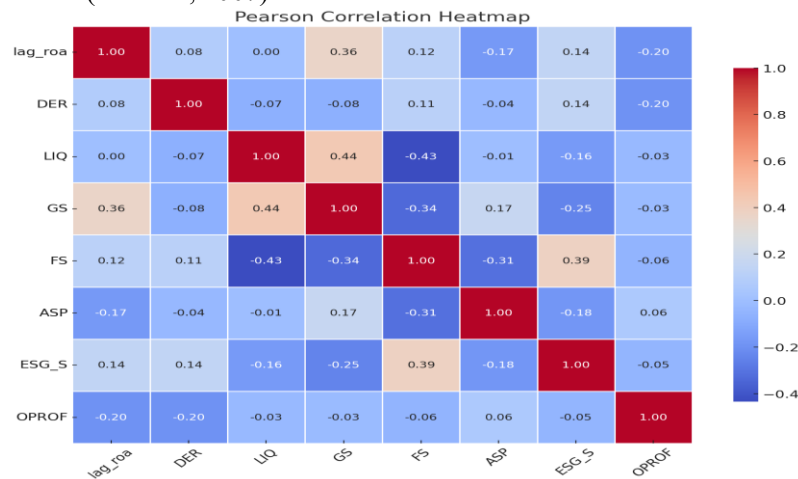


Figure 2. Pearson Correlation Heatmap Sustainability Certification
Sources: Research Data, 2025

Regression Result

Although Generalized Least Squares (GLS) are often proposed to correct when heteroscedasticity and autocorrelation are present, they require the correct specification of the error structure (e.g., AR(1) process and panel in specific heteroscedasticity). However, since the research study has a short panel ($T = 3$), using GLS may lead to downward biased standard errors if the assumed error structure is misspecified. As stated by (Wooldridge, 2010), caution must be exercised when using GLS in panels with a small time dimension. Therefore, instead of GLS, this research study is more fitted and employs the random effects model with cluster robust standard errors using the `xtreg, re vce (robust)` command in STATA. The study (Hoechle, 2007) states that this robust estimation technique accounts for both heteroscedasticity and autocorrelation, allowing for consistent inference even when the error structure is unknown.

Table 3. The Random Effect Robust Clustered Estimation

SC	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lag_roa	.051	.042	1.20	.23	-.032	.133	
DER	.003	.006	0.56	.574	-.008	.015	
LIQ	0	0	0.43	.666	-.001	.001	
GS	-.007	.006	-1.17	.242	-.019	.005	
FS	.002	.004	0.43	.668	-.007	.01	
ASP	-.012	.071	-0.18	.861	-.151	.126	
ESG_S	.659	.13	5.09	0	.405	.913	***
OPROF	-.027	.055	-0.50	.614	-.134	.079	
Constant	.099	1.17	0.08	.933	-2.194	2.391	
Mean dependent var		0.357	SD dependent var			0.359	
Overall r-squared		0.515	Number of obs			75	
Chi-square		39.319	Prob > chi2			0.000	

SC	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
R-squared within		0.246	R-squared between			0.523	
*** $p < .01$, ** $p < .05$, * $p < .1$							

Sources: Research Data, 2025

Based on the panel data regression analysis on the first equation model with sustainability certification as the dependent variable, it was found that the model used is a random effect model. As provided in Table 3, the model achieves an overall R-square of 0.515, indicating that approximately 51.5% of the variation in firms' certification outcomes is explained by the explanatory variables. In the presence of autocorrelation, the Wald test can be adjusted accordingly to provide a more reliable measure of model adequacy (S. C. Patricio, A. J. Q. Sarnaglia, 2021). Furthermore, the result of the Wald test shows that the chi-square statistic $X^2 = 337.796$ is statistically significant at the level ($p < 0.001$); this result supports the overall relevance of the model. The random effect model was obtained from the Hausman test; the result of the chi-square statistical value is 6.69 ($P < 0.05$). The coefficient analysis in the first regression equation showed that there is no statistically significant difference in the likelihood of obtaining sustainability certification based on conventional financial metrics. This is similar to the independent variable, which is financial performance, such as lagged return on assets, leverage, and liquidity. Also, control variables such as firm size, growth of sales, average selling price, and operating profit do not significantly influence firms in obtaining sustainability certification. In contrast, it was found that the ESG score affected sustainability certification.

The findings from Table 3 indicate that, within the palm oil industry, conventional financial metrics have no substantial impact on firms' likelihood of obtaining sustainability. Often, the additional cost associated with obtaining sustainability certification may act as a deterrent for firms for which the certification process entails both upfront and recurring expenses, which can adversely affect net income, particularly during the initial implementation period (Hutabarat et al., 2018). Also, the adoption of sustainability certification is influenced by various non-financial factors, including global economic pressure, socio-economic background, legality, group organization, plantation management practices, and local supply chain conditions (de Vos et al., 2023). Some studies state that firms may pursue certification to retain a market presence in the EU, where non-compliance could lead to exclusion from the market (Urugo et al., 2025; Gilbert, 2024; Luchese & Vaccarezza, 2023). While sustainability certifications such as RSPO often lead to premium access because of the opportunity to export in the EU, the empirical evidence from this study suggests otherwise. This result aligns with findings from (Shahimi et al., 2023), who highlighted that firms that RSPO certified may experience profitability trade-offs. Similarly, (Clarkson et al., 2011) found no robust association between firm profitability and voluntary environmental disclosure, indicating that firms may pursue initiatives for legitimacy or compliance reasons rather than for direct financial gain.

The link between past financial performance and sustainability decisions has been widely discussed in corporate sustainability research. In this study, lagged return on assets (*lag_roa*) was used to measure previous profitability and its effect on the likelihood of firms obtaining sustainability certification. The result shows that profitability from the prior year is not statistically significant ($t = 1.48$); a positive coefficient suggests that firms with higher ROA are slightly more likely to obtain sustainable certification. Since the finding is statistically insignificant, the effect is not strong enough to confirm that higher ROA from the previous year will lead to obtaining sustainability certification. This result aligns with (Schaltegger and Burritt, 2010), who suggest that while financial considerations are relevant, they are not necessarily the dominant factors influencing corporate sustainability initiatives. Sustainability certification is often a prerequisite for entering and competing in foreign markets, especially in The European Union. Firms often adopt certification to enhance reputation, trustworthiness, and operational efficiency, leading to better market performance.

Liquidity reflects a firm's ability to meet its short-term obligations, often measured by the current ratio, and the range of ideal value of the current ratio is 1.2 and 2 (Sukiennik, 2012). The liquidity variable (LIQ) in this study shows a statistically significant relationship with certification status ($\beta = 0.000$, $SE = 0.001$), indicating that firms with stronger short-term financial positions (higher current ratio) are more likely to be certified. This suggests that even firms with lower liquidity levels do not perceive RSPO certification as a constraint on cash flow or working capital. The result is consistent with (Myers, S. C.,

and Majluf, 1984), who argue that while liquidity is essential for daily operations, it is less influential in decisions involving long-term strategic investments.

Leverage (DER) is measured by debt to equity ratio; often, the decisions, particularly the balance between debt and equity, can significantly influence a firm's strategic behaviour, including its engagement in sustainability initiatives. The result of regression was found to be negative and insignificant associated with the likelihood of obtaining RSPO certification ($\beta = 0.003$, $p = 0.574$). Where ($p > 0.10$), this suggests that firms with higher levels of debt are deprioritized to pursue sustainability certification. This aligns with a study from (Demiraj et al., 2023) highlighting that firms with financial constraints may adopt sustainability initiatives to improve their external image.

Firm size has traditionally been regarded as a key factor influencing the adoption of sustainability practices. Larger firms are generally assumed to possess greater financial resources, more advanced administrative capacities, and heightened public visibility, all of which support the firm in obtaining sustainability investment. However, the finding in this study firm size (FS) does not have a statistically significant effect on the likelihood of obtaining RSPO certification ($\beta = -0.001$, $p = 0.003$). This result challenges the assumption that larger organizations are inherently more proactive in sustainability compliance. Studies from (Delmas, M. A., & Toffel, 2008) argue that firm size enables action that ultimately drives environmental behaviour. In the palm oil sector, small and medium-sized firms are increasingly subject to global buyer requirements and trade regulations, which may neutralize the influence of firm size on sustainability actions (Pacheco, P. et al., 2017). Therefore, certification decisions may be less function of firm scale and more reflective of external demands and strategic intent.

Sales growth is often viewed as a signal of operational success and expansion potential, which may increase a firm's ability or willingness to invest in sustainability initiatives. Nonetheless, the result of this study reveals that growth of sales (GS) does not significantly influence the likelihood of obtaining RSPO certification ($\beta = -0.017$, $SE = 0.017$). This suggests that firms experiencing higher revenue growth are not necessarily more likely to commit to sustainability compliance. Consequently, RSPO certification involves long-term planning and alignment with global environmental standards, which may not be prioritized during expansion or financial volatility. This aligns with a study from (Lozano and Huisingh, 2011), which emphasizes that financial growth alone does not automatically translate into sustainable practices, especially when sustainability is not integrated into the firm's core strategy.

Meanwhile, average selling price (ASP) is often interpreted for different product quality, market differentiation, and brand positioning. Often, an average selling price that is above the average global price can be specified as premium pricing. In this study, average selling price variables do not have strong factors that influence firms to obtain sustainability certification ($\beta = -0.012$, $p = 0.861$); this shows that premium prices above average selling price do not affect firms to obtain and maintain sustainability certification. This aligns with a study from (Renner et al., 2024), which indicates that RSPO-certified farmers do not consistently receive price premiums for their products. The benefits of certification are more likely to come from higher productivity and better management practices rather than direct price premiums.

Furthermore, operating profit (OPROF) in this study does not have a statistically significant effect on certification ($\beta = -0.027$, $p = 0.614$). This suggests that higher operational earnings do not necessarily turn the firms into a greater commitment to sustainability certification. This aligns with a study from (Suroso et al., 2021) states that sustainable certification had no significant impact on the financial and market performance of Indonesian palm oil companies, suggesting that certification alone may not directly influence firms to obtain RSPO. Surprisingly, the variable ESG_S coefficient is 0.659 and is significant at the 1% level ($p < 0.01$), indicating that firms with higher ESG performance are substantially more likely to obtain sustainability certification. These findings align with studies from (Xin Yang et al., 2025) and (Chatterji et al., 2015) that firms that obtain sustainability improve their reputation, and the strategic importance of ESG activities motivates firms to pursue formal sustainability credentials. Meanwhile, ESG_S is highly significant in its effect on SC at 69.7%.

The panel regression results indicate that financial leverage has a statistically significant negative effect on sustainability certification; this rejects hypothesis 2. This supports both signalling theory and legitimacy theory, suggesting that highly leveraged firms are less likely to pursue voluntary sustainable practices due to financial constraints and risk aversion. At the same time, the first regression model measured by sustainability certification has shown that only leverage and ESG score positively

significantly; meanwhile, other conventional financial performances like profitability and liquidity are not the regressors of firms obtaining RSPO. The second model was built to broaden the perspective and address the issues among palm oil firms in Indonesia and Malaysia. The second model method is suitable for assessing the probability of binary outcomes to examine financial performance influences the likelihood of complying with zero deforestation practices. As zero deforestation represents a core objective of the European Union, incorporating this model provides a more holistic and comprehensive perspective on how firms in Indonesia and Malaysia demonstrate their environmental commitment in practice.

Logistics Model Regression

To understand how a company's internal financial conditions affect its decision to adopt sustainable practices, such as zero deforestation practices, this study applies a binary logistic regression model. Previous studies across a range of fields have widely employed logistic regression to examine binary outcomes. The application of logistic regression has proven effective in modelling categorical decisions, including research on firm sustainability behaviour and technology adoption. In recent years, logistic regression has become particularly valuable in environmental, social, and governance (ESG) research, such as estimating the effects of ESG scores on corporate credit ratings. Unlike linear regression, which estimates continuous values, the primary function of logistic regression is to predict the probability of a binary event occurring (e.g. yes/no, success/failure) based on one or more predictor variables. The model transforms the linear combination of predictor variables into a log-odds scale, allowing the estimation of regression coefficients that represent the odds ratios (Srinivasan et al., 2024). The dependent variable in this second model, which is zero deforestation, is binary, meaning it has two variable outcomes (e.g. comply with zero deforestation or otherwise). The control variables in this study are FS, GS, ASP, ESG_S, and OPROF. It can provide a nuanced understanding of the financial condition under a firm's decision to engage with sustainable practices. Therefore, logistic regression is adopted in this study to capture the complex relationship between corporate financial performance and sustainable decision practices. The general form binary logistic regression model is presented as follows:

$$\text{logit}(P_i) = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_k X_{ki}$$

Where P represents the probability that the firms adopt a sustainable practice which is zero deforestation ($ZD = 1$, otherwise $= 0$), and $X_1, X_2, \dots, X_K$ are the firm financial predictors, including lagged return on asset (L1.ROA), liquidity (LIQ), leverage (DER), firm size (FS), growth of sales (GS), ESG score (ESG_S), average selling price (ASP), and operating profit (OPROF). The coefficient β_1 measures the effect of a one-unit change in each explanatory variable on the log odds of the firm complying with sustainability standards, holding other variables constant. The probability can then be derived using the logistic transformation, as mentioned before,

This modelling approach is often adopted in sustainability and corporate governance research due to its robustness in estimating binary outcomes and accommodating non-linear relationships between predictors and the dependent variable (Wooldridge, 2010). In the context of sustainable practices, previous studies have emphasized the critical role of a firm's financial condition in determining its ability to commit to voluntary environmental goals; some studies (Fatemi et al., 2018) found that firms with stronger financial performance and lower debt levels are more likely to engage in and disclose sustainability practices. Also (Galbreath, 2010) identified internal financial strength as a key enabler for firms to adopt long-term sustainability strategies.

Through this modelling framework, the present study evaluated the likelihood that a palm oil company complies with zero-deforestation commitments based on its key financial performance and firm characteristics. This approach provides broader, meaningful insights into how internal financial indicators may facilitate or restrict a firm's capacity to align with a global deforestation-free supply chain, as promoted by the RSPO and recent EU Deforestation Regulation (EUDR) standards.

Results

Descriptive statistics and correlation analysis

Table 4 provides summary statistics for all variables employed in the logistic regression model predicting zero deforestation compliance. The dependent variable, Zero deforestation, is binary, and the result indicates that 76% of firms in the sample adopted zero-deforestation commitments. This high rate of compliance is consistent with increasing global pressures from buyers and regulatory bodies to align with sustainable sourcing practices, particularly in the palm oil industry. The average return on assets (ROA) is 9.3%, though the range spans from 12.6% to 237%, reflecting substantial heterogeneity in firms' financial performance. However, most firms report modest profitability, with a large proportion clustered below 5%, suggesting overall operational returns are limited. From a short-term perspective, the liquidity in most firms has wide variability, which is proved by the mean and median liquidity ratios exceeding 1400% and 196%, respectively, while the first quartile lies closer to 83%, implying the majority of firms maintain adequate current assets relative to liabilities. In terms of leverage, the debt-to-equity ratio averaged 168%, though values range from negative equity positions to highly leveraged profiles exceeding 3000%, suggesting each firm has major differences in financing its internal finance. Firm size, measured by the log of total assets, ranges widely, capturing both small-scale and large enterprises. Sales growth is negative on average, indicating contraction in many firms, possibly due to trade barriers. The average selling price remains stable across firms, which is typical for global commodities.

Meanwhile, the average score is 0.62, with values ranging from 0 to 1.76, indicating moderate but uneven environmental, social, and governance performance. Operating profitability also varies, with most firms earning between 2% and 28%, though a few report margins above 100%. These results demonstrate a high degree of dispersion across financial and sustainability indicators, reflecting significant differences in firms' capacities, priorities, and readiness to comply with environmental standards such as zero deforestation.

Table 4. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ID	100	13	7.247	1	25
Year	100	2021.5	1.124	2020	2023
ZD	75	.76	.43	0	1
ROA	100	.093	.244	-.126	2.37
LIQ	75	14.839	65.346	.006	453.571
DER	75	1.678	4.671	-2.198	30.7
FS	75	21.198	12.599	-6.888	39.544
GS	75	-1.084	2.125	-5.01	7.626
ESG S	75	.621	.368	0	1.76
ASP	75	16.403	.196	15.991	16.976
OPROF	75	.281	.253	.021	1.158
L ROA	99	.094	.245	-.126	2.37
est logit model	100	.75	.435	0	1

Sources: Research Data, 2025

The Pearson correlation coefficients for the study variables are displayed in Figure 3. The matrix reveals generally weak to moderate relationships among the independent variables, indicating a low risk of multicollinearity. The Zero Deforestation (ZD) shows a positive correlation with firm size (FS) and ESG Score (ESG_S), suggesting that larger firms and those with stronger ESG credentials are more likely to comply with zero-deforestation commitments. Conversely, ZD is negatively correlated with liquidity (LIQ) and leverage (DER), suggesting that firms with tighter financial flexibility or higher debt levels may be less likely to engage in deforestation-free practices. This supports the idea that environmental investments, such as land certification and traceability infrastructure, require a healthy financial position. The correlation between leverage (DER) and liquidity (LIQ) is moderately negative, indicating that firms with stronger short-term financial positions tend to rely less on external debt. Liquidity (LIQ) also displays weak but significant negative associations with both ESG score (ESG_S) and operating profit (OPROF), suggesting that firms allocating more resources toward sustainability or core operations may hold fewer liquid assets. Also, a weak negative correlation is observed between firm size and sales growth, implying that smaller firms in the sample are growing at a relatively faster rate.

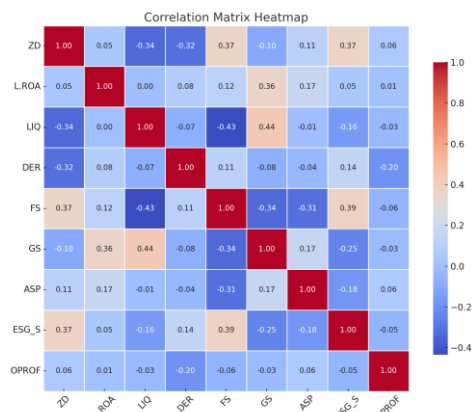


Figure 3. Pearson Correlation Heatmap Zero Deforestation
 Source: Research Data, 2025

Multicollinearity

To assess the overall fit of the logistics regression model for zero deforestation compliance, the Hosmer-Lemeshow (H-L) test was employed. The test yields a chi-square statistic of 10.11 with 8 degrees of freedom and a corresponding p-value of 0.2575. Since the p-value exceeds the conventional 0.05 threshold, the null hypothesis that the model fits the data well cannot be rejected. This indicates that the predicted probabilities align closely with the observed outcomes across deciles of risk, and there is no evidence of poor fit in this study.

Classification Statistics

The classification table reveals that the model correctly classifies 92% of the cases. It achieves a sensitivity of 96.49%, indicating high accuracy in identifying ZD-compliant firms, and a specificity of 77.78%, showing acceptable performance in recognizing non-compliant firms. The positive predictive value is 93.22%, while the negative predictive value stands at 87.50%, both indicating robust predictive capability across groups.

Logistic Regression and Marginal Effect Result

The marginal effects and corresponding logit interpretation in this section will provide a broad understanding of how firms at the financial level and characteristics influence zero deforestation compliance. Starting with prior financial performance, a one-unit increase in lagged return on assets (L_ROA) changes the log odds of zero deforestation compliance by a statistically insignificant negative coefficient. The marginal effect $dy/dx = -0.065$ implies that it reduces the probability of commitment with zero deforestation practices in the next year by 6.5%, holding all other factors constant. This indicates that historical profitability does not meaningfully drive firms' commitment to sustainability practices. These findings align with the study.

The marginal effect of leverage (DER) was found to be -0.032, indicating that a one-unit increase in the debt-to-equity ratio decreases the probability of zero deforestation compliance by 3.2%. This suggests that firms with higher financial obligations may deprioritise long-term strategy in sustainable commitment due to constrained resources. This finding supports earlier research highlighting that highly leveraged firms face capital constraints that limit their engagement with voluntary environmental programs (Fatemi et al., 2018). Similarly to previous research, (Ng & Rezaee, 2015) find that leverage negatively affects sustainability reporting and environmental disclosure levels, as firms prioritize financial performance over social or environmental responsibilities. Also, (Lins et al., 2017) further show that firms with stronger financial fundamentals are better positioned to generate positive stakeholder responses to sustainability actions, emphasizing how constraint leverage hinders environmental strategy.

Similarly, liquidity (LIQ) has a statistically significant negative logit coefficient, with a marginal effect $dy/dx = -0.001$, suggesting that tighter short-term financial flexibility decreases the probability of compliance by 0.1%. This highlights that firms facing liquidity constraints may deprioritize long-term environmental goals. (Jayachandran, 2013) state that firms facing liquidity constraints may participate in

environmental programs not merely for ecological benefit but to access alternative value, including reputational gains and improved market access.

Table 5. Logistic Regression Result Predicting Zero Deforestation Compliance

ZD	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
L	-.757	1.705	-0.44	.657	-4.099	2.585	
LIQ	-.017	.006	-2.58	.01	-.029	-.004	**
DER	-.367	.105	-3.51	0	-.572	-.162	***
FS	.105	.048	2.19	.028	.011	.198	**
GS	.476	.372	1.28	.2	-.252	1.204	
ASP	6.709	2.963	2.26	.024	.901	12.517	**
ESG S	3.981	1.839	2.16	.03	.376	7.586	**
OPROF	.265	1.118	0.24	.813	-1.926	2.456	
Constant	-111.27	49.089	-2.27	.023	-207.482	-15.059	**
Mean dependent var		0.760	SD dependent var		0.430		
Pseudo r-squared		0.490	Number of obs		75		
Chi-square		30.545	Prob > chi2		0.000		
Akaike crit. (AIC)		60.147	Bayesian crit. (BIC)		81.004		

*** p<.01, ** p<.05, * p<.1

Sources: Research Data, 2025

Table 6. Marginal Effects

Delta-method						
	dy/dx	Std. Err.	z	P>z	[95%Conf.	Interval]
L ROA	-0.065	0.141	-0.460	0.645	-0.342	0.212
LIQ	-0.001	0.000	-2.910	0.004	-0.002	-0.000
DER	-0.032	0.005	-6.950	0.000	-0.040	-0.023
FS	0.009	0.003	2.820	0.005	0.003	0.015
GS	0.041	0.028	1.480	0.138	-0.013	0.095
ASP	0.576	0.216	2.660	0.008	0.152	1.000
ESG S	0.342	0.117	2.910	0.004	0.112	0.572
OPROF	0.023	0.096	0.240	0.812	-0.165	0.210

Source: Research Data, 2025

Conversely, certain structural and strategic variable indicators positively influence firms to commit to zero deforestation practices, suggesting that firm capacity and sustainability alignment play a critical role in shaping environmental commitments. Firm size (FS) has a positive and statistically significant logit coefficient, with a marginal effect $dy/dx = 0.009$, indicating that larger firms are 0.9% more likely to adopt zero deforestation practices. Larger firms often have more resources, which enables them to implement environmental practices more extensively compared to smaller firms (Balasubramanian, Sreejith. et al., 2020) (Dzeraviaha, 2022). Also aligned with the result, larger firms are more likely to integrate sustainability into their business models, which positively impacts their economic and social performance (Jum'a et al., 2024).

Although growth of sales (GS) shows a positive relationship with zero deforestation compliance, the coefficient is statistically insignificant. The marginal effect $dy/dx = 0.041$ indicates a 4.1% increase in compliance probability, yet the lack of significance suggests that growth alone may not determine sustainability orientation. Different strategic orientations, such as consumer, competitive, and emotional orientations, significantly impact sustainability orientation, which is crucial for achieving sustainable performance rather than growth in sales itself (Wan Mustapa et al., 2022) (Shou et al., 2019).

Commonly known as the driver factor for profitability, average selling price (ASP) in this study exhibits a statistically significant positive coefficient and a substantial marginal effect $dy/dx = 0.576$, indicating that firms with higher price products are 57.6% more likely to comply with zero deforestation. This may reflect the reputational and market premium benefits of sustainable branding. For instance, this aligns with a study from (Hidayat et al., 2015). WWF also supported smallholders by connecting them with companies to receive technological assistance; through the collaboration, the smallholders were able to sell their RSPO certificates through the GreenPalm trading platform, an established channel for accessing sustainable palm oil markets and earning premium prices.

Similarly, the ESG score (ESG_S) demonstrated a positive and significant logit coefficient, with a marginal effect $dy/dx = 0.342$, meaning that a unit increase in ESG score boosts the probability of zero deforestation compliance by 34.2%, supporting the role of ESG alignment in corporate sustainability. This finding reinforces studies that position ESG scores not only as outcome indicators but also as enablers of proactive environmental strategy (Semenova & Hassel, 2015)(Clark et al., 2015). This is supported by another study that strong ESG performance can serve as a form of reputational safeguard, as firms with higher sustainability standards are more likely to earn stakeholder trust and face reduced scrutiny from investors and regulatory authorities (Godfrey, 2005) (Godfrey, PC. et al., 2009).

Finally, operating profit (OPROF) presents a positive but insignificant coefficient with a marginal effect $dy/dx = 0.023$. This indicates a 2.3% increase in compliance probability but suggests that profitability from operations alone may not significantly influence zero deforestation decisions by firms. This aligns with a study from (Muhammad et al., 2019), which shows that while profitability can provide financial space for sustainable investments, the presence of strategic intent and institutional pressure are more critical drivers of environmental performance than operational earning alone. As of June 2020, NDPE policies have covered 83% of the refining capacity of palm oil in Indonesia and Malaysia, with 78% of companies implementing the policies (Chain Reaction Research, 2020). In Malaysia, stricter compliance with NDPE policies has resulted in reduced palm oil production supplied from deforested or peatlands, which contributes slower the expansion of palm oil cultivation. In the Indonesia context, based on the sample, only 9 of 12 firms that declared commitment to NDPE reported in their annual report from 2021-2023, meanwhile for Malaysia indicate that 10 out of 13 firms has declare NDPE.

Discussion

The findings of this study contribute important insights into the organization and industry's determinants of sustainability performance in the palm oil industry, particularly focusing on the implementation of sustainability certification, which is RSPO and zero deforestation compliance. The significant negative relationship between financial performance and sustainable performance underscores the instrumental role of conventional financial performance, including lagged return on assets, liquidity, and leverage, which do not exert a statistically significant influence on the likelihood of obtaining RSPO certification. These findings align with prior research suggesting that financial performance is not the dominant driver of voluntary sustainable adoption (Schaltegger & Burritt, 2010). Instead of financial performance, the ESG score consistently emerged as the most robust predictor of RSPO certification, highlighting the central role of governance and global situation alignment in shaping sustainability behaviour. The observed relationship underpins legitimacy theory, where the firms align their actions with societal expectations to maintain social license, for example, the use of RSPO. This underscores that sustainability certification may be strategically used to reinforce external legitimacy rather than purely relying on financial motivation.

The negative and statistically significant underscores the relationship between leverage and sustainable performance. This result implies that firms with higher financial leverage, as firms rely more heavily on debt financing, become less likely to comply with zero deforestation commitments, not because firms do not recognize the value but because financial constraints, risk aversion, and short-term priorities outweigh long-term sustainability investments. This aligns with prior results from (Fatemi et al., 2018), suggesting that firms with higher financial obligations may deprioritize long-term strategy in sustainability.

On the other hand, some control variables underpinned the insight that first firm size was positively and significantly associated with zero deforestation compliance. This indicates that larger firms often have more resources, which enables them to implement environmental practices more extensively compared to smaller firms (Balasubramanian, Sreejith. et al., 2020; Dzeraviaha, 2022). Second, the average selling price was positively significant, suggesting that firms capable of commanding premium pricing, likely due to quality or sustainability positioning, are better able to absorb the cost of compliance. This aligns with a prior study that sustainability performance can reinforce product differentiation and market advantage (Oosterveer et al., 2014). These findings emphasize the heterogeneity in the predictors of sustainability behaviour. While ESG scores are critical for both RSPO and zero deforestation compliance, financial structure variables such as leverage and liquidity play a stronger role in shaping zero deforestation outcomes. This differentiation implies that while certification may serve more as a

reputational signal, deforestation-free commitments require deeper operational restructuring and capital allocation, making these variables more sensitive to financial constraints.

Overall, the results from the two models highlight that corporate sustainable performance in the palm oil sector is influenced not only by internal financial health but also by external legitimacy pressures, governance policy, and market positioning. The asymmetric information effects across sustainability certification and zero deforestation model suggest the need for tailored policy and financing interventions that consider the varying financial and institutional barriers faced by palm oil companies in adopting sustainability practices.

Theoretical and Practical Implication

The study makes a substantive contribution to the theoretical understanding of corporate sustainability behaviour by engaging with two frameworks such as signalling theory and legitimacy theory, as a key concept and foundation of this study. The finding based on two models shows that the ESG score has consistently positive significance, not financial metrics like L.ROA, DER and LIQ, which shows that the ESG score provides robust support for legitimacy theory. This underscores that sustainability certification may strategically be used to reinforce external legitimacy rather than purely relying on financial motivation. Moreover, the study also supports the signalling theory, particularly in the context of ESG disclosure. Firms with higher ESG scores are more likely to comply with sustainability initiatives, which suggests that ESG performance is used as a credible signal to external stakeholders, including investors, regulators, and customers, of the firm's commitment to sustainable values. The observed negative association between leverage and sustainable performance, such as zero deforestation compliance, further refines the theoretical narrative by indicating that firms with limited financial flexibility are less able to respond to global pressure, such as EUDR, even when such responses are strategically advantageous.

From managerial and policymakers, the results yield actionable insights for palm oil corporations, regulators in Indonesia and Malaysia, and investors in the palm oil sector. First, the significant association between ESG scores and both sustainability certification and zero deforestation compliance highlight the strategic value of ESG performance management. Firms should consider ESG not as a mandatory reporting requirement but as a core strategy that enhances compliance capability and long-term reputation. Second, the study reveals that firms with higher leverage and tight liquidity are less likely to commit to zero deforestation practices, which suggests that voluntary sustainable adoption is constrained by financial health. Policymakers, especially those in export markets, must recognize these internal constraints when designing regulatory frameworks. There may be a need to introduce financial incentives, such as access to green financing or preferential trade terms, to support sustainable compliance among financially vulnerable firms. Third, the positive influence of firm size and average selling price suggests that market-leading firms play a critical role in setting industry norms. These firms should be encouraged to lead by example through stronger ESG disclosure, transparent certification efforts, and supply chain engagement, thereby encouraging smaller firms to follow suit. This study provides a nuanced understanding of how internal firm characteristics and ESG metrics interact with external regulators and social pressures in shaping corporate sustainability behaviour. The insights inform both academic and practical efforts to mainstream sustainable practices in the global palm oil supply chain.

E. CONCLUSION

This study offers novel insight into the intersection between financial performance and financial leverage on sustainable performance practices in the palm oil sector. It demonstrates that while liquidity and ESG scores support sustainability adoption, high financial leverage remains a significant barrier. These findings add theoretical depth to the existing literature by bridging signalling theory, legitimacy theory, and triple-bottom-line frameworks. The prior studies in its comparative model treat certification and deforestation policies as distinct, interrelated sustainability pathways. Practically, the findings provide targeted recommendations for firms, investors, and regulators. For firms, the results highlight the importance of considering sustainability as a core corporate strategy since the leverage has no significant factors for firms obtaining sustainability practices, indicating that firms do not rely on capital structure; the results highlight the importance of financial resilience and ESG transparency in maintaining market

access and stakeholder trust. For policymakers, the study underscores the urgency of designing compliance mechanisms that are sensitive to financial reality, especially under frameworks like the EUDR.

Since the concept of sustainable development and responsible investment increasingly attract and value stakeholders in the corporation, it also comes from global communities such as The European Union and Roundtable Sustainable Palm Oil (RSPO). In this research, a sample of 25 companies listed in SPOTT over the last three years, period 2021-2023, was used; ESG Score, percentage of land certification and financial data were used to construct two models, including panel data regression and logistic regression. Sustainability certification through the RSPO certificate and zero deforestation commitment was taken as the object of the study. The findings from two different methodologies, from the first hypothesis, the financial performance indicator is not a significant influence for firms obtain sustainability certification in the prior year, suggesting that firms do not necessarily pursue RSPO based on financial capability but often comes from global pressure, regulatory from Indonesia and Malaysia governance, or reputational drivers. However, in the first model, the ESG score contributes a significant relationship for firms to obtain sustainable certification, which means firms that maintain their reputation in sustainable practice or are active in voluntary platforms like SPOTT most likely will continue the commitment.

To predict commitment to sustainable practices such as zero deforestation, the logistic regression was employed to give a broader insight into what organizational factors drive firms to comply with sustainable practices. Based on the logistic regression, it was found that leverage was found to have a negative and statistically significant effect on zero deforestation compliance; it contradicts the result with the first regression using panel data; for instance, DER has positively influenced firms to obtain sustainability certification. This indicates that although the firm has greater constraints and appears less willing to undertake intensive environmental commitments like zero deforestation, somehow, the firms most likely prioritize certified RSPO to maintain the reputation and appear to increase brand image.

Although the results for both the sustainability certification and zero deforestation models did not align with the initial hypothesis, several variables appear to significantly influence the likelihood of obtaining sustainable investment. Firm characteristics such as firm size, average selling price, and ESG score showed a probability on the likelihood of zero deforestation compliance, indicating their role as key drivers in sustainable investment decisions. These findings indicate that larger firms are characterized by greater operational scale, firms that have indicated beyond the average selling price, which means premium price and firms with strong ESG scores are more likely to integrate sustainability as core business. Collectively, these characteristics serve as critical indicators of the firm's propensity to pursue and attract sustainable investment. There are also positive incentives for forest protection, such as a price premium associated with forest conservation, which may enhance the protection of forested areas through certification schemes. Currently, approximately 20% of global palm oil production is RSPO-certified, indicating substantial potential for the certification system to influence tropical land cover change.

Research Findings and Limitations

Based on the findings, this research provides novel insights by distinguishing financial performance, financial leverage and sustainable performance in the context of palm oil plantations. Unlike prior research that treated sustainability performance as a unified construct, this study adopts a dual empirical framework to capture the differentiated financial implications of each initiative. The findings demonstrate that while financial performance indicators such as profitability and leverage do not significantly influence firms' adoption of sustainability standards, ESG scores and liquidity are significant predictors, particularly for zero deforestation compliance. Meanwhile, these results challenge conventional assumptions that strong financial metrics alone drive environmental commitment and instead highlight the critical role of transparency, stakeholder accountability, and non-financial reputational assets. This study also contributes to adding the newest dimension, which is zero deforestation, to optimize the research findings.

Despite its contributions, this study also presents several limitations that are offered for future research. First, the analysis relied on binary indicators such as SC and ZD, which may not fully capture the depth or quality of sustainability implementation. Future studies could imply ordinal measures for zero deforestation, such as forest risk disclosure or scoring from NDPE (No Peat, No Deforestation). Second, the scope of the study is limited to firm-level quantity data; future research could incorporate

qualitative insights from managers in palm oil companies or from NGOs in palm oil sectors to validate the result and a better understanding of strategic moves and institutional pressures behind sustainability adoption from EUDR. Additionally, while this study used ESG scores as a significant predictor in both models, this study did not disaggregate ESG dimensions (environmental, social, and governance). Future work could examine the relative influence of each ESG component, providing a more granular understanding of how different sustainability governance affects firm behaviour in decision-making.

However, taking into account the scarcity of corporate default data in Indonesia and Malaysia, this study only evaluates 25 firms. Long-term data and comprehensive observations are few because of limited information since ESG research is still in its initial stages, especially using logistics regression in Indonesia. Also, complex models with time-related indicators are challenging because of limited time (e.g., the annual report for 2024 has not been published yet). After more developed ESG research is constructed, future research could incorporate a range of time series factors and integrate zero deforestation information to ordinal scoring to get a more accurate evaluate the relationship between sustainable performance and leverage on financial performance in crude palm oil companies in Indonesia and Malaysia.

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