

## Integrating Green Accounting, Green Technology, and Sustainability Reporting for Carbon Tax Implementation

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### ABSTRACT

**Backgrounds:** Carbon-intensive industries such as mining face growing pressure to comply with Indonesia's carbon tax policy, and Green Accounting, Green Technology, and Sustainability Reporting have been proposed as mechanisms to support this compliance, though evidence on their actual effects remains limited.

**Objectives:** This study probes the extent to which Green Accounting, Green Technology, and Sustainability Reporting bear upon Carbon Tax Implementation within mining companies listed on the Indonesia Stock Exchange over the 2020–2024 period.

**Methodology:** Secondary data were analyzed quantitatively using purposive sampling and PLS-SEM via SmartPLS 4.

**Findings:** The results reveal that Carbon Tax Implementation is significantly and favorably influenced by Green Technology, whereas Green Accounting and Sustainability Reporting register no such significant effect. These findings suggest that the adoption of environmentally friendly technology is more strongly associated with carbon tax compliance than accounting-based environmental cost disclosures or sustainability reporting practices among mining companies.

**Conclusions:** Technological adoption, rather than accounting or reporting practices, appears to be the more decisive factor in supporting carbon tax implementation within the mining sector. Policymakers and corporate management should prioritize investment in green technology as a practical pathway toward carbon tax compliance, while further strengthening the substantive role of Green Accounting and Sustainability Reporting so that they translate into measurable environmental and regulatory outcomes.

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## 1. INTRODUCTION

Green Accounting is garnering growing international attention, as it is widely regarded as a viable instrument for addressing pressing environmental challenges, encompassing environmental degradation, climate change, and the unsustainable exploitation of natural resources (Rahman & Hossain, 2025). Green Accounting enables environmental costs to be incorporated into a company's financial reporting as part of the implementation of sustainable development (Wiguna & Hariyani, 2023). Green Accounting combines economic and environmental considerations to support sustainable development amidst a range of global challenges (Auliya & Nurhadi, 2023).

According to data furnished by the Ministry of the Environment, greenhouse gas emissions emanating from Indonesia's energy sector climbed to 727,330 Gg CO<sub>2</sub>e in 2022, roughly 727.33 million tonnes of CO<sub>2</sub>e, a marked increase from 595,860 Gg CO<sub>2</sub>e recorded in 2021 (Kementrian

Lingkungan Hidup dan Kehutanan, 2024). These elevated emission levels underscore the imperative to reinforce emissions control through initiatives that compel companies to monitor and curtail their carbon output. The Indonesian Government has established a legal framework for carbon taxation through Law No. 7 of 2021 on the Harmonization of Tax Regulations (HPP Law), which provides for the imposition of a carbon tax on goods containing carbon and activities generating carbon emissions, with a minimum rate of IDR 30 per kilogram of CO<sub>2</sub>e. However, the implementation of the carbon tax has not proceeded according to the original plan because it still faces obstacles related to business readiness, regulation, institutions, and emissions measurement and reporting systems. This condition shows that the existence of carbon tax regulation does not yet guarantee its comprehensive application among companies in Indonesia (Dewi & Dewi, 2022). This is relevant to examine in the mining sector because its operational activities are related to energy consumption and generate carbon emissions.

The application of green accounting in the presentation of corporate information accords with PSAK 1, which governs the presentation of relevant information, environmental activities among them (IAI, 2015). The recognition of provisions and liabilities relating to the environmental impact of operational activities is determined in accordance with PSAK 57 (IAI, 2017). POJK No. 51/POJK.03/2017 regulates the submission of Sustainability Reports by listed companies in Indonesia in order to support transparency and corporate accountability regarding social and environmental aspects towards stakeholders (OJK, 2017).

The implementation of a carbon tax in Indonesia remains suboptimal, hamstrung by the inadequacy of the technical regulations governing its execution (Sadewo et al., 2025). The metals and mining sector occupies a pivotal role within the national economy, yet its operations simultaneously constitute a principal source of carbon emissions (Purnaman & Basru, 2026; Sadewo et al., 2025). The fact that carbon emissions measurement and disclosure remain confined to a limited number of companies underscores the importance of integrating a carbon tax into corporate sustainability reporting (Sudjono & Setiawan, 2022).

Green Accounting plays a role in supporting the resolution of social and environmental issues and helps to monitor objectives that support sustainable development (Ruhayat & Suantha, 2025; Ulwiyah & Mahirun, 2024). The findings of Kusumah et al. (2025) reveal that green accounting exerts a favorable influence on sustainable development, manifested through heightened corporate awareness of environmental impacts, an enhanced reputation, strengthened competitiveness, and greater transparency of environmental information for stakeholders. The findings of Simorangkir and Machdar (2025) demonstrate a positive and significant relationship between green accounting and the effectiveness of carbon taxes, as its implementation enables companies to record environmental costs more transparently, calculate carbon tax liabilities more accurately, and support measurable emission reduction strategies. The findings of Rahmawati and Hamzah (2025) indicate that green accounting exerts a favorable influence on environmental performance, manifested through improved resource efficiency, enhanced waste management, and a reduction in carbon emissions.

A contrasting finding comes from Nisa et al. (2025) who reported that green accounting has yet to exert a significant influence on firm value, with its implementation still restricted and the economic benefits not yet directly felt by the firms in question. In a comparable manner, Ahyani et al. (2024) reveal that no significant effect on tax avoidance is produced by green accounting, its implementation being directed more at sustainability and social responsibility than at tax strategy. Utomo and Puspawati (2026) found that corporate performance is unaffected by the implementation of green accounting, as profitability in the basic materials sector has not improved through its application, and the economic benefits derived have consequently not been optimal.

Green technology encompasses an array of innovations and practices geared toward curtailing resource consumption, tempering pollution, and mitigating climate change (Rahman & Hossain, 2025). The findings of a study by Rahman and Hossain (2025) reveal that green technology exerts a favorable influence on the green economy, as its adoption underpins sustainable development practices and contributes to the advancement of green accounting. Similarly, the findings of Kafeel et al. (2024) indicate that green technology exerts a favorable influence on carbon emission control, given that heightened green innovation coupled with greater reliance on renewable energy can substantially diminish CO<sub>2</sub> emissions. Likewise, the findings of Laila et al. (2025) reveal that green technology exerts a favorable influence on corporate compliance with carbon accounting standards,

insofar as greater adoption of environmentally friendly technology corresponds with a higher degree of corporate diligence in reporting carbon emissions.

Conversely, the findings of Tchorzewska et al. (2022) reveal that green technology has not flourished optimally, as meager environmental tax rates prove ineffective in spurring the adoption of, or investment in, green technology. The findings of Salam (2026) indicate that carbon tax implementation has yet to serve as a meaningful catalyst for green innovation or sustainable investment, owing to persistently paltry tax rates, circumscribed sectoral coverage, and lackluster policy enforcement. The findings of Prananta et al. (2024) reveal that green technology has yet to exert a significant impact on green growth, as its adoption across the ASEAN region and Latin America remains unevenly distributed, and has thus proven insufficient to reduce emissions intensity or meaningfully propel green economic growth.

Sustainability reporting is the process of communicating information regarding an organization's performance as a form of support for sustainable development goals for both internal and external stakeholders (Yuliastuti et al., 2024). Research findings by Simorangkir and Machdar (2025) state that sustainability reporting has a positive impact on the effectiveness of carbon taxes as it provides accurate, comprehensive and relevant information and reflects a company's compliance with carbon tax regulations and its commitment to sustainability. The findings of Amalia et al. (2025) demonstrate that sustainability reporting has a positive impact on corporate performance, with increased disclosure of sustainability information serving to strengthen stakeholder trust and appreciation, thereby contributing to improved corporate performance. The findings of Chairanee et al. (2022) state that sustainability reporting has a positive effect on investor response through increased corporate transparency, investor confidence and interest in investing.

In contrast to the findings of Sambuaga (2024), which found that the disclosure of sustainability reports bears a deleterious impact on company performance. The findings of Ginting and Sarumpaet (2025) show that sustainability reporting has no significant impact on environmental performance, as sustainability reports are often merely symbolic, fail to demonstrate a genuine commitment to environmental action, and are prone to greenwashing practices. The findings of Ahadiat et al. (2024) show that sustainability reporting generally has a negative impact on company value.

Green Accounting and the Carbon Tax have been investigated in prior research by means of a literature review (Indarto & Ani, 2023), together with the effect of Green Accounting, Sustainability Reporting, and Environmental Performance upon carbon tax efficacy within energy sector firms (Simorangkir & Machdar, 2025). Within the mining sector, studies have likewise examined the bearing of Carbon Management Accounting and Green Intellectual Capital upon the Carbon Tax Policy Initiative (Suswandoyo, 2025). Extant research demonstrates that studies on the carbon tax have been undertaken using disparate variables and subjects; nevertheless, research integrating green accounting, green technology, and sustainability reporting to elucidate carbon tax implementation among mining sector companies in Indonesia remains scarce. This research makes a contribution by incorporating the three variables within a single model to investigate carbon tax compliance in mining sector companies listed on the Indonesia Stock Exchange during the 2020 to 2024 period. Through this integrated approach, prior studies are extended, yielding a more comprehensive grasp of the factors associated with carbon tax compliance in mining.

Environmental Cost is employed herein as a proxy for Green Accounting, so as to more faithfully capture the costs companies bear in relation to environmental impacts, thereby ensuring its relevance to the management of environmental impacts within the implementation of the Carbon Tax. Accordingly, this study addresses three research questions: how green accounting affects the implementation of a carbon tax in companies, how green technology affects the implementation of a carbon tax in companies, and how sustainability reporting affects the implementation of a carbon tax in companies.

## 2. LITERATURE REVIEW

### 2.1. Stakeholder Theory

In Strategic Management: A Stakeholder Approach, Freeman (2010) developed Stakeholder Theory, which sees the company as an organization tied to numerous parties who have a stake in the fulfillment of the company's objectives, extending beyond shareholders alone (Manalu et al., 2023). Companies need to weigh the interests of the government, investors, employees, customers, suppliers, and society when conducting operational activities in a sustainable manner (Wicaksono, 2024). This theory also emphasizes the importance of corporate policies and practices that reflect organizational values, regulatory compliance, respect for society and the environment, and contribution to sustainable development (Ahyani et al., 2024).

In this study, Stakeholder Theory is used to explain how stakeholder demands can encourage mining companies to implement environmental management practices. This pressure can produce different responses according to the characteristics of the practices implemented. Green Accounting relates to the recording of environmental costs and the environmental consequences of the company's operational activities, so it can support accountability in environmental management (Derisa & Purwanti, 2025). Meanwhile, Green Technology relates to the use of technology that supports resource efficiency and the reduction of environmental impact. Stakeholder pressure can encourage the adoption of green innovation, but its implementation also depends on operational needs and the company's ability to develop or use appropriate technology (Gurler et al., 2025). In the mining industry, the two practices have different mechanisms because the recording of environmental costs does not directly change the production process, whereas the application of green technology potentially affects operational processes and the emissions produced.

Stakeholder pressure can also encourage companies to disclose environmental information transparently through Sustainability Reporting. Investor interest in the quality of sustainability reports reflects the need for non-financial information to assess the company's responsibility and performance (Steelyana & Raharjo, 2024). Nevertheless, the disclosure of environmental information does not always indicate real changes in operational activities or a reduction in emissions. Therefore, Green Accounting and Sustainability Reporting are more related to recording, accountability, and transparency, whereas Green Technology is related to changes in operational processes. This difference becomes the basis for explaining the possible differences in the relationship between each variable and carbon tax implementation in mining companies.

In the context of carbon tax policy, support from the government and other stakeholders is needed to integrate the policy with sustainable finance initiatives (Zenever et al., 2025). However, Stakeholder Theory mainly explains the company's drive to respond to stakeholder demands, and does not directly explain increases or decreases in the carbon tax value. The size of the carbon tax burden also depends on the company's emission level, the tax imposition provisions, and the policy mechanisms in force. Thus, this theory serves as the basis for explaining the company's drive to implement Green Accounting, Green Technology, and Sustainability Reporting, whereas the relationship of these three variables with the carbon tax needs to be explained based on the mechanism of each variable and the policy context studied. This framework becomes the basis for developing hypotheses on the relationship between corporate environmental management practices and carbon tax implementation.

### 2.2. Green Accounting

Green Accounting integrates environmental and social aspects into accounting practices to support sustainable resource management and decision making (Dura & Suharsono, 2022). Its implementation includes the identification, classification, recording, and reporting of environmental costs arising from the company's operational activities (Kusumah et al., 2025). This information can serve as a basis for decision making by considering ecological and social consequences (Kirana et al., 2024).

Transparency of information about the company's environmental impact is likewise supported by the implementation of Green Accounting (Nisa et al., 2025), as is accountability, attained by evaluating the environmental costs and benefits associated with operational activities (Eviolina & Kurniawati, 2025). Environmental costs include expenditures to prevent, reduce, and manage

pollution and environmental damage resulting from the company's activities (Meliniyati et al., 2024). Although Green Accounting reflects the management of environmental costs, this information is not sufficient to explain its relationship with carbon tax implementation. Environmental expenditure does not always indicate the use of technology capable of reducing emissions, while disclosure in Sustainability Reporting does not necessarily reflect real environmental actions. Therefore, this study integrates Green Accounting, Green Technology, and Sustainability Reporting to examine the relationship between environmental costs, technology adoption, and sustainability transparency with carbon tax implementation in mining companies. This study uses environmental costs as a proxy for Green Accounting, transformed using the natural logarithm to obtain a more proportional data distribution (Maharani & Akbar, 2025).

$$GA = \ln(\text{Environmental Costs}) \quad (1)$$

Notes:

GA = Green Accounting

Environmental Costs = the total environmental costs disclosed by the company.

### 2.3. Green Technology

Green technology encompasses an array of innovations and practices geared toward curtailing resource consumption, tempering pollution levels, and mitigating the impacts of climate change by way of more environmentally benign technologies (Rahman & Hossain, 2025). In the context of sustainable development, investment in green technology is seen as a key factor in safeguarding environmental sustainability whilst promoting long-term economic development (Ammarnurhandyka, 2023). The adoption of green technology provides companies with a competitive advantage through responsible and environmentally conscious business practices (Laila et al., 2025). Digital transformation is, in like measure, propelling the adoption of green technology through the deployment of blockchain, big data, cloud computing, and the Internet of Things (IoT), thereby enhancing the caliber of environmental accounting information and engendering a more transparent, efficient, and accurate flow of information in support of sustainability practices across diverse economic entities (Yao et al., 2025). Green Technology is gauged by way of a disclosure index grounded in annual reports and sustainability reports, with scores assigned to each indicator.

$$GT = \frac{\text{The number of indicators disclosed}}{5} \quad (2)$$

Indicator description:

- 1) Energy-efficiency technologies
- 2) Emissions-reduction technologies
- 3) Environmentally friendly technologies
- 4) Renewable energy
- 5) Waste treatment technologies

### 2.4. Sustainability Reporting

Sustainability reporting discloses economic, social, and environmental performance as a manifestation of accountability toward stakeholders, demonstrates contributions to sustainability, and ensures compliance with regulations and reporting standards (Maharani & Akbar, 2025). Sustainability Reporting supports the implementation of sustainable accounting, green technology and Environmental, Social and Governance (ESG) principles to strengthen transparency, accountability and stakeholder trust (Rajendra, 2025). The deployment of blockchain, big data, cloud computing, and the Internet of Things (IoT) within digital technology can enhance the quality of sustainability reporting by furnishing transparent, reliable, and timely information conducive to informed decision-making (Yao et al., 2025). This sustainability reporting is measured using a disclosure index comprising five indicators relating to emissions and energy information contained in the company's sustainability report.

$$SR = \frac{\text{The number of indicators disclosed}}{5} \quad (3)$$

Indicator description:

- 1) Energy consumption
- 2) Energy intensity
- 3) Scope 1 emissions
- 4) Scope 2 emissions
- 5) Emissions reductions

## 2.5. Carbon Tax

Constituting a levy on emissions arising from the burning of fossil fuels, including coal, crude oil, and natural gas, a carbon tax is established as a Pigouvian tax to advance the net-zero emissions objective (Meila et al., 2024). It serves, moreover, as an instrument for bolstering environmental protection and management, as well as for tempering climate change (Arifin & Siagian, 2024). In Indonesia, the carbon tax is regulated under Article 13(8) and (9) of the HPP Act, which stipulates a minimum rate of Rp30 per kilogram of CO<sub>2</sub>e or its equivalent value (Meila et al., 2024).

Its implementation is still hampered by technical regulations that are not yet fully optimized, even though the government has demonstrated its commitment to reducing greenhouse gas emissions (Sadewo et al., 2025). The introduction of a carbon tax is becoming increasingly important, given that greenhouse gas emissions have the potential to worsen climate conditions and have a negative impact on the economy (Salsabila, 2023). The carbon tax is calculated based on an estimate of tax revenue using a rate of Rp30,000 per tonne of CO<sub>2</sub>e, with reference to Meila et al. (2024).

$$CT = P_i \times W_i \quad (4)$$

Notes:

- 1) CT = Carbon Tax
- 2) P<sub>i</sub> = Carbon tax rate
- 3) W<sub>i</sub> = Total carbon emissions (tonnes of CO<sub>2</sub>e)

Although green technology is generally expected to reduce carbon emissions, its relationship with the estimated carbon tax may differ depending on the scale of mining operations and the level of emissions produced. Therefore, the direction of the relationship between the two variables needs to be tested empirically in mining companies.

## 2.6. Research Framework

The research framework delineates the bearing of Green Accounting, Green Technology, and Sustainability Reporting upon the implementation of a carbon tax. These three variables are posited as factors anticipated to sway carbon tax implementation through the management of environmental costs, the adoption of environmentally friendly technologies, and the transparency of sustainability information. The relationships among the variables in this study are depicted in Figure 1.

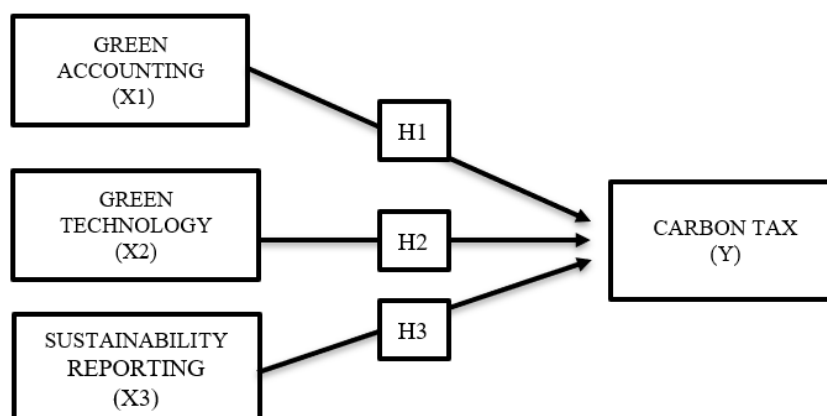


**Figure 1. Conceptual Framework Diagram**

Source: Author (2026)

## 2.7. Research Hypothesis

### 2.7.1. The Impact of Green Accounting on the Implementation of a Carbon Tax

Green Accounting incorporates environmental considerations into the accounting process, spanning from the identification through to the reporting of a company's activities that bear an impact upon the environment (Kusumah et al., 2025). The implementation of a carbon tax requires information on a company's emissions and environmental costs, which can be supported through transparent environmental reporting in Green Accounting (Simorangkir & Machdar, 2025).

Kusumah et al. (2025) research evinces the salutary bearing of Green Accounting upon sustainable development, while Simorangkir and Machdar (2025) research discloses a positive and significant relationship between Green Accounting and the effectiveness of corporate carbon taxes. Rahmawati and Hamzah (2025) study, for its part, evinces the salutary bearing of Green Accounting upon environmental performance, reflecting enhanced stewardship and control of a company's environmental impact. Building on these empirical findings, companies are anticipated to receive support from Green Accounting implementation in managing environmental information connected to the carbon tax's implementation. Hence, the following hypothesis is proposed:

**H1:** Green Accounting has a positive effect on the implementation of the carbon tax.

### 2.7.2. The Impact of Green Technology on the Implementation of the Carbon Tax

Green Technology sets out to curb environmental impacts by way of more efficient energy use, tighter carbon emission control, and the sustainable use of resources (Rahman & Hossain, 2025). Because the implementation of the Carbon Tax impels companies to keep carbon emissions in check, technologies that sharpen energy efficiency and pare down emissions can, in turn, help this policy take root (Kafeel et al., 2024).

Rahman and Hossain (2025) find that green technology bears a favorable impact on the development of the green economy, mirroring headway in the adoption of sustainable practices that ease the shift toward a green economy. Kafeel et al. (2024), for their part, find that green technology exerts a favorable impact on carbon emission control. Laila et al. (2025), meanwhile, show that Green Technology bears positively on carbon accounting standards, suggesting that as companies lean further into environmentally friendly technology, their compliance with carbon emissions reporting tends to firm up. Insofar as Green Technology can sharpen energy efficiency and keep emissions in check, its adoption is expected to underpin the implementation of a carbon tax within companies.

**H2:** Green Technology has a positive impact on the implementation of the Carbon Tax.

### 2.7.3. The Impact of Sustainability Reporting on the Implementation of the Carbon Tax

Sustainability reporting lays bare economic, social, and environmental information as a form of accountability toward stakeholders (Maharani & Akbar, 2025). The effectiveness of carbon tax policy in curbing emissions and prompting shifts in corporate behavior hinges considerably on the caliber of reporting and corporate governance (Simorangkir & Machdar, 2025).

The findings of Simorangkir and Machdar (2025) research disclosed a positive relationship between sustainability reporting and the effectiveness of the carbon tax, underpinned by its support for corporate carbon emissions management. Amalia et al. (2025) findings demonstrated the salutary impact of sustainability reporting on corporate performance and a heightening of stakeholder confidence in sustainability practices. Chairanee et al. (2022) study indicates that sustainability report disclosure bears a favorable impact on investor response, stemming from bolstered investor confidence in the company. Enhancements in the caliber of sustainability reporting are anticipated to buttress the transparency of environmental information requisite for the implementation of a carbon tax.

**H3:** Sustainability reporting has a positive influence on the implementation of a carbon tax.

### 3. METHOD

This research adopts a quantitative approach, with secondary data collected from annual reports, sustainability reports, official company websites, and the Indonesia Stock Exchange (IDX). The use of secondary data has limitations because the completeness and depth of the information depend on the disclosure transparency of each company. In addition, the information reported by companies potentially contains reporting bias, including the possibility of greenwashing. Therefore, the research results need to be interpreted by considering the limitations of the information available in the companies' official disclosures.

Included in the research population are mining sector companies listed on the IDX during the 2020 to 2024 period. Using a purposive sampling technique based on the established criteria, the sample was chosen, namely (1) mining sector companies listed on the IDX during the research period; (2) companies that published annual reports and/or sustainability reports during the 2020 to 2024 period; and (3) companies that provided adequate information to measure the variables of Green Technology, Green Accounting, Sustainability Reporting, and carbon tax implementation. These criteria produced a final sample of 20 companies meeting the requirements for data availability and relevance during the research period. To test the relationships among variables and the research hypotheses, the data underwent analysis through the Partial Least Squares Structural Equation Modeling (PLS-SEM) method, supported by SmartPLS 4 software.

### 4. RESULTS AND DISCUSSION

#### 4.1. Research Results

The structural model examines the relationships among Green Accounting, Green Technology, and Sustainability Reporting with respect to the implementation of a carbon tax, employing PLS-SEM via SmartPLS 4. The model estimation results are set out in Figure 2.

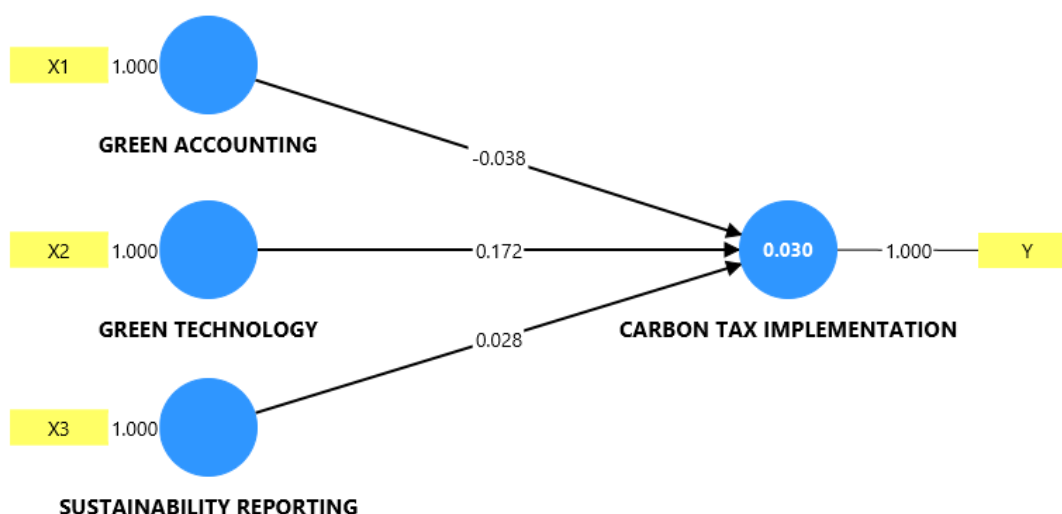


**Figure 2. Results of the Outer Model Analysis (PLS Algorithm)**

Source: SmartPLS 4 (2026)

Figure 2 sets out path coefficients of  $-0.038$  for the relationship between Green Accounting and carbon tax implementation,  $0.172$  for Green Technology and carbon tax implementation, and  $0.028$  for Sustainability Reporting and carbon tax implementation. These figures indicate that Green Technology bears the strongest positive relationship with Carbon Tax Implementation, whereas Green Accounting exhibits an inverse relationship, and Sustainability Reporting a positive one, albeit with a comparatively paltry coefficient.

#### 4.1.1. Test of the Coefficient of Determination (R-squared)

**Table 1. R-Square Results**

|                                  | <b>R-square</b> | <b>R-square adjusted</b> |
|----------------------------------|-----------------|--------------------------|
| <b>Carbon Tax Implementation</b> | 0.030           | -0.001                   |

Source: SmartPLS 4 (2026)

According to the test results summarized in Table 1, the combined ability of Green Accounting, Green Technology, and Sustainability Reporting to explain variation in carbon tax implementation is very limited. A small share of that variation is all the model can account for, while the bulk of the remaining variation relates to factors outside the research model. After adjusting for the number of predictors, no adequate gain in the model's explanatory power is evident either. This indicates that carbon tax implementation is probably associated with other factors not covered by the research model.

#### 4.1.2. Significance Test Results (Bootstrapping)

The significance of the inter-variable relationships was tested by means of a bootstrapping procedure employing a resampling technique in SmartPLS, with the bootstrapping results set out in Table 2.

**Table 2. Bootstrapping Results**

| <b>Variable</b> | <b>O</b> | <b>M</b> | <b>STDEV</b> | <b>T statistic</b> | <b>P-values</b> |
|-----------------|----------|----------|--------------|--------------------|-----------------|
| GA-CT           | -0.038   | -0.032   | 0.051        | 0.749              | 0.454           |
| GT-CT           | 0.172    | 0.170    | 0.074        | 2.317              | 0.021           |
| SR-CT           | 0.028    | 0.030    | 0.080        | 0.352              | 0.725           |

Source: SmartPLS 4 (2026)

Evaluation of the significance of relationships among variables, based on the t-statistic and p-value, relies on the bootstrapping results. Should the t-statistic exceed 1.96 and the p-value be less than 0.05, the relationship is declared significant. Based on these criteria, only Green Technology shows a significant relationship with carbon tax implementation, while Green Accounting and Sustainability Reporting do not show significant relationships. These results become the basis for determining support for each research hypothesis. A summary of the hypothesis testing is set out in Table 3.

**Table 3. Results of the Hypothesis Test**

| <b>Relationships</b> | <b>Coefficient (<math>\beta</math>)</b> | <b>T-Statistic</b> | <b>P-Value</b> | <b>Decision</b> |
|----------------------|-----------------------------------------|--------------------|----------------|-----------------|
| GA $\rightarrow$ CT  | -0.038                                  | 0.749              | 0.454          | Rejected        |
| GT $\rightarrow$ CT  | 0.172                                   | 2.317              | 0.021          | Accepted        |
| SR $\rightarrow$ CT  | 0.028                                   | 0.352              | 0.725          | Rejected        |

Source: Processed data (2026)

According to the hypothesis test results, a positive and significant relationship exists between Green Technology and carbon tax implementation, so H2 is supported. This indicates that the greater the extent to which companies apply Green Technology, the higher their level of carbon tax implementation tends to be. However, this relationship does not necessarily show that green technology increases carbon tax obligations. This positive relationship may be related to differences in company scale, emission intensity, or level of exposure to carbon regulation. This explanation still requires further testing.

In contrast, Green Accounting and Sustainability Reporting do not show significant relationships with carbon tax implementation, so H1 and H3 are not supported. The direction of the Green Accounting relationship tends to be negative, while Sustainability Reporting shows a positive direction. However, both relationships do not yet provide adequate statistical evidence to conclude that there is an effect on carbon tax implementation. This finding shows that the application of

environmental accounting practices and sustainability disclosure is not necessarily directly related to carbon tax implementation in this research model.

According to the test results, only Green Technology exhibits a positive and significant relationship with carbon tax implementation. This indicates that the application of green technology has a more concrete connection to carbon tax implementation compared with environmental accounting practices and sustainability disclosure. Conversely, no statistically significant relationships have emerged for Green Accounting and Sustainability Reporting. Practically speaking, these results highlight the relevance of green technology in carbon tax implementation, whereas the part played by environmental accounting and sustainability reporting remains in need of further study.

## 4.2. Discussion

### 4.2.1. The Impact of Green Accounting on the Implementation of a Carbon Tax

The research findings indicate that Green Accounting exerts no effect on the implementation of a Carbon Tax; H1 is, accordingly, rejected. The adoption of Green Accounting among mining companies remains insufficiently robust to drive the implementation of the Carbon Tax, insofar as the recording and disclosure of environmental costs have not been fully harnessed as a basis for carbon emissions management or the implementation of Carbon Tax policy. Under Stakeholder Theory, pressure exerted by stakeholders figures as one of the factors driving the adoption of Green Accounting, this being a form of corporate response to environmental demands (Derisa & Purwanti, 2025). In the context of carbon tax implementation, the adoption of green accounting ought, in principle, to underpin the provision of environmental information that companies require to answer stakeholder demands concerning carbon emissions management; the findings of this study, however, suggest that such adoption remains insufficient to propel carbon tax implementation.

These findings align with those of Ahyani et al. (2024), which show that Green Accounting bears no significant effect on tax avoidance, its implementation being oriented more toward social responsibility and sustainability than toward corporate tax objectives. Corroborating this, Nisa et al. (2025) note that Green Accounting has yet to yield benefits directly felt by companies, given that its implementation remains suboptimal. Research by Utomo and Puspawati (2026) likewise indicates that Green Accounting bears no impact on corporate performance, its implementation having yet to enhance the company's capacity to generate profits. Taken together, these findings suggest that Green Accounting has not yet functioned as a driver of carbon tax implementation within mining companies, remaining confined to reporting functions and not yet woven into carbon emissions management strategies.

The implementation of Green Accounting and sustainability reporting among mining companies has not yet been fully substantive, remaining oriented instead toward satisfying disclosure requirements and shaping corporate image. Nasih et al. (2024) show that non-financial companies in Indonesia may use sustainability reporting as a form of impression management, such that sustainability disclosure does not always reflect substantive change in corporate practices. In line with this, Nasih et al. (2024) also show that sustainability reporting obligations do not automatically generate substantive transparency, as companies may respond to regulation through disclosure that is symbolic in nature. This condition may cause the environmental information produced through Green Accounting to remain insufficiently integrated into carbon emissions management strategies, such that environmental recording and disclosure practices are not yet robust enough to drive Carbon Tax implementation.

Beyond the factor of symbolic adoption, this relationship may also be influenced by regulatory conditions and Carbon Tax enforcement mechanisms. Carbon Tax constitutes a policy instrument whose implementation depends on regulatory certainty, emission measurement mechanisms, and the government's capacity for oversight and enforcement. Rahma et al. (2025) show that Carbon Tax implementation in Indonesia faces policy challenges and sectoral impacts. Therefore, Green Accounting at the company level is not necessarily the primary determining factor in Carbon Tax implementation when the relationship among corporate environmental information, emission reduction obligations, and carbon tax enforcement mechanisms has not been firmly established. Accordingly, the insignificant effect of Green Accounting found in this study can be understood as an indication that the mere existence of environmental accounting practices is not yet sufficient to

drive Carbon Tax implementation without the support of consistent regulation, effective oversight, and the integration of emissions information into carbon policy mechanisms.

#### **4.2.2. The Impact of Green Technology on the Implementation of the Carbon Tax**

The research results show that Green Technology has a positive relationship with carbon tax implementation, so H2 is accepted. This finding shows a relationship between the application of environmentally friendly technology and the carbon tax implementation variable used in this study. However, this positive relationship cannot be directly interpreted to mean that the use of green technology increases the company's readiness to face carbon tax policy or reduces carbon emissions. The interpretation of the results needs to consider that the value of the carbon tax implementation variable in this study is a measure related to the company's obligations, which can increase along with the size of emissions. From the perspective of Stakeholder Theory, stakeholder pressure is one of the factors related to the adoption of green innovation by companies (Gurler et al., 2025). Thus, the relationship between green technology and carbon tax implementation may reflect the link between the company's response to environmental demands and the characteristics of its carbon obligations, but it does not prove a causal relationship between the two.

The findings of this study accord with the research of Kafeel et al. (2024), which explains that green technology is related to carbon emission reduction through the adoption of green innovation and the use of renewable energy. Laila et al. (2025) also show the link between green technology and company compliance with carbon accounting standards. Rahman and Hossain (2025) emphasize the role of green technology in green economic development through improved resource efficiency and reduced environmental impact. Although these studies provide a foundation for understanding the relevance of green technology in environmental management, their results do not necessarily explain the positive relationship found in this study. This difference may be related to differences in variable measurement and research context. Therefore, the positive relationship found cannot be directly concluded as evidence that green technology reduces emissions or strengthens carbon tax implementation.

In contrast to Green Technology, the research results show that Green Accounting and Sustainability Reporting do not have a significant relationship with carbon tax implementation. This condition may occur because the application of Green Accounting and Sustainability Reporting does not always reflect substantive changes in the company's emissions management. Green Accounting can be used as part of administrative compliance and efforts to obtain corporate legitimacy, while Sustainability Reporting gives companies room to choose which environmental information to disclose. Thus, the existence of environmental information in company reports does not always indicate operational changes related to emission reduction. Widhiastuti et al. (2025) show that environmental disclosure can be symbolic or substantive, while Xu et al. (2023) show that environmental disclosure can be symbolic or substantive, Liu et al. (2024) show that environmental disclosure becomes more relevant under stricter environmental regulation and effective enforcement, while Hu and Xu (2025) found that environmental regulatory penalties are related to increased disclosure of environmental information by companies. Nevertheless, these factors cannot be confirmed as the cause of the insignificance in this study. The research results only show that Green Accounting and Sustainability Reporting do not have a significant relationship with the carbon tax implementation variable in the tested model. Therefore, further research is needed to determine whether this relationship is influenced by disclosure quality, substantive compliance, emission characteristics, or the prevailing regulatory conditions.

#### **4.2.3. The Impact of Sustainability Reporting on the Implementation of the Carbon Tax**

The research findings indicate that sustainability reporting bears no significant impact on the implementation of the carbon tax; H3 is, accordingly, rejected. These results suggest that the sustainability information disclosed by companies remains insufficient to drive the implementation of carbon tax policy. Viewed through the lens of Stakeholder Theory, shareholder pressure bears upon the caliber of sustainability reports, insofar as investors are attentive to a company's non-financial information (Steelyana & Raharjo, 2024). Sustainability reporting serves as a company's response to stakeholders' information needs; however, the disclosure of information regarding environmental aspects does not necessarily indicate that the company is taking concrete action to

manage emissions and implement the carbon tax. This situation suggests that transparency in sustainability information does not directly reflect a company's readiness for the implementation of the carbon tax.

The findings of this study align with the research of Ginting and Sarumpaet (2025), which shows that sustainability reporting bears no significant impact on environmental performance, given that sustainability reports may remain largely symbolic and have yet to reflect a company's genuine commitment to environmental management. This is corroborated by Sambuaga (2024), who notes that the disclosure of sustainability reporting does not necessarily translate into improved corporate performance. Ahadiat et al. (2024), for their part, revealed a deleterious impact of sustainability reporting disclosures on firm value, insofar as the sustainability information furnished has failed to enhance market perceptions of the firm. Sustainability reporting cannot, therefore, yet be regarded as a driving factor behind the implementation of a carbon tax, as the caliber of sustainability disclosures has not been fully matched by the actual implementation of carbon emissions management policies.

This condition may also be related to the gap between symbolic disclosure and substantive environmental action, as well as limitations in regulatory enforcement. Although sustainability reporting provides information concerning environmental activities, it does not automatically create an obligation for companies to translate such disclosure into measurable emission reductions or carbon tax compliance. Tang et al. (2023) found that environmental reporting may be decoupled from actual environmental performance, particularly when regulatory enforcement is insufficient to encourage substantive environmental practices. Cepêda et al. (2025) similarly highlight the possibility of decoupling between corporate sustainability communication and actual sustainability practices. In the context of carbon tax, this gap becomes particularly relevant because implementation requires more than environmental disclosure; it requires clear regulatory requirements, emission measurement and verification, monitoring, compliance mechanisms, and effective enforcement. Putranti et al. (2025) identify limitations in enforcement mechanisms and institutional readiness as challenges to the implementation of carbon tax policy in Indonesia. Therefore, the insignificant effect of sustainability reporting found in this study may reflect the fact that environmental disclosure alone is insufficient to drive carbon tax implementation when it is not accompanied by substantive environmental practices and adequate regulatory enforcement.

## 5. CONCLUSION

According to the research results, a positive and significant effect on carbon tax implementation is produced by green technology in mining companies listed on the Indonesia Stock Exchange during the 2020 to 2024 period, while no significant effect is shown by green accounting and sustainability reporting. This finding indicates that investment in environmentally friendly technology needs to be a corporate priority to support carbon tax implementation, among others through the use of low-emission technology, improved energy efficiency, and the development of more environmentally friendly production processes. On the other hand, the effectiveness of green accounting and sustainability reporting needs to be improved through strengthened oversight and regulatory enforcement, standardization of environmental information disclosure, and integration of emissions data and environmental costs into the carbon tax examination process. Thus, sustainability reporting not only functions as a means of transparency, but also becomes the basis for verifying company compliance with carbon tax obligations. This implication is in line with Stakeholder Theory, which emphasizes the importance of corporate accountability to stakeholders through measurable sustainability practices. Future research is recommended to expand the sample coverage and observation period and to consider other variables, such as corporate governance, environmental performance, green innovation, company size, and profitability.

## Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this paper.

### Author Contributions

**A.F.M.P.:** Conceptualization, Investigation, Writing – Original Draft.

**R.S.:** Methodology, Supervision, Validation, Writing – Review & Editing.

**H.N.A.:** Software, Data Curation.

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### Informed Consent

Not applicable. This study did not involve human participants; it relied exclusively on secondary data obtained from publicly available annual reports, sustainability reports, corporate official websites, and the Indonesia Stock Exchange (IDX).

### Ethical Approval

Not applicable. This study did not involve human or animal subjects and therefore did not require ethical approval from an institutional review board.

### Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### Declaration of Generative AI and AI-assisted Technologies

During the preparation of this work, the authors used generative AI or AI-assisted technologies, specifically ChatGPT, for the purpose of language editing and translation. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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