Challenges And Strategies Of Carbon Accounting Treatment In The Coal Mining Sector: An Empirical Study In East Kalimantan

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Received: April, 2025; Accepted: April, 2025; Published: June, 2025
Permalink/DOI:

ABSTRACT

The coal mining sector is facing increasing global pressure due to heightened awareness of climate change and growing demands for sustainable business practices. The decline in mining company stock values reflects escalating reputational and financial risks, compelling companies to preserve corporate value through strategies that align with green economic principles. This study aims to evaluate the treatment of carbon accounting as a component of environmental accounting within the context of coal mining, particularly in East Kalimantan. The research focuses on the recording, measurement, presentation, and disclosure of carbon emissions in financial statements, based on the Indonesian Financial Accounting Standards (PSAK) and international standards such as ISO 14064 and the GHG Protocol. Furthermore, this study analyzes the impact of carbon emission calculations and carbon sequestration offset capacity on corporate financial ratios, using a quantitative approach to estimate both lost and generated carbon emissions from production activities.

The findings draw upon prior research that emphasizes the importance of integrating environmental information into financial reporting to enhance corporate transparency and competitiveness. Consequently, this study contributes to the formulation of relevant and applicable carbon accounting strategies for the mining sector, while addressing the implementation challenges within Indonesia's regulatory and business frameworks.

Keywords: *Carbon Accounting, Environmental Accounting, Coal Mining, Carbon Emissions, Green Economy, Sustainable Business Strategy, Carbon Offset*

INTRODUCTION

Climate change has emerged as a pressing global issue, and Indonesia, as a developing country rich in natural resources, faces a dual challenge: maintaining economic growth while reducing greenhouse gas (GHG) emissions. Indonesia's commitment to sustainability is reflected in the integration of carbon emission reduction targets into the National Medium-Term Development Plan (RPJMN) 2020–2024, as well as the ratification of the Paris Agreement, which sets emission

reduction goals of 29% through domestic efforts and up to 41% with international assistance by 2030 (Ministry of National Development Planning/Bappenas, 2019). The mining sector, particularly coal mining, is a significant contributor to carbon emissions in Indonesia. East Kalimantan, which hosts the highest concentration of coal mining activities, is under increasing pressure to support the transition toward a green economy. However, these efforts are challenged by a dilemma between environmental sustainability and short-term economic interests, as coal remains a primary source of regional and national revenue. In this context, carbon accounting emerges as a critical instrument to record, measure, and report the environmental impacts of production activities in a transparent manner.

Previous studies, such as Dewi & Narayana (2020), have emphasized that corporate sustainability is no longer assessed solely based on financial performance, but also on the integration of non-financial information—particularly environmental impacts—into annual and sustainability reports. Nugroho & Munari (2021) further argue that the presence of environmental and carbon accounting influences investor perceptions of long-term corporate value, especially in high-risk sectors like mining. More recently, Sari & Pratiwi (2023) found that companies adopting carbon emission reporting and implementing carbon offset strategies were more capable of maintaining stock value stability amid post-pandemic market fluctuations.

The implementation of carbon accounting in Indonesia still faces numerous challenges, including the lack of technical standards, the absence of mandatory reporting regulations, and limited managerial awareness of the strategic importance of environmental information. It is within this context that this study becomes particularly relevant, focusing on identifying the challenges and formulating strategies for carbon accounting treatment in the coal mining sector, specifically in East Kalimantan.

This research not only aims to evaluate the extent to which mining companies have applied carbon accounting principles in accordance with PSAK and international frameworks such as the GHG Protocol and ISO 14064, but also to assess the impact on financial ratios and corporate image. Therefore, the findings of this study are expected to contribute both academically and practically to supporting the mining sector's transition toward a low-carbon and sustainable economy.

METHOD

This study employs a qualitative approach using a case study method, aiming to explore in depth how carbon accounting treatment is applied in the accounting practices of companies within the coal mining sector. The research is centered on mining companies operating in East Kalimantan, a region with a strategic role in national coal production and carbon emissions.

The case selection was conducted purposively, considering data availability and representativeness of sector characteristics. This study highlights the carbon accounting treatment by adopting an evaluative framework based on relevant Indonesian Financial Accounting Standards (PSAK), particularly PSAK 19 (Intangible Assets), PSAK 23 (Revenue), PSAK 32 (Financial Reporting by

Extractive Industries), and PSAK 57 (Provisions, Contingent Liabilities, and Contingent Assets).

The study relies on secondary data, which includes:

1) Consolidated financial statements of selected mining companies from the most recent fiscal year,
2) Estimated data on carbon emissions generated from production activities (e.g., coal combustion, use of heavy machinery),
3) Carbon pricing data from the international carbon market based on global carbon trading references,
4) The Bank Indonesia middle exchange rate as a reference for economic valuation of carbon,
5) Supporting documents such as Sustainability Reports, environmental audit reports, and ESG (Environmental, Social, and Governance) disclosure documents.

The analysis stages in this research consist of:

1) Identification and Measurement of Carbon Emissions

Calculation of total carbon emissions produced from production activities, including fossil fuel combustion and supporting operational activities, using the CO_2 equivalent (CO_2-e) approach. Measurements are conducted under two scenarios: surplus (emissions are offset through programs such as reforestation) and deficit (uncompensated emissions).

2) Analysis of Carbon Accounting Treatment

Assessment of the potential for recognition, recording, presentation, and disclosure of carbon-related information in financial statements. This stage refers to applicable accounting standards and considers the relevance, reliability, and measurability of carbon-related assets or liabilities arising from company activities.

3) Impact Analysis on Financial Ratios

Examination of the effect of carbon accounting implementation on key financial ratios, including Return on Assets (ROA), Debt to Equity Ratio (DER), and Net Profit Margin (NPM), to understand the economic implications of a carbon-based accounting approach.

4) Evaluation of Strategies and Implementation Challenges

Analysis of strategies that companies can adopt to integrate carbon accounting into their reporting systems, and identification of practical challenges faced, including regulatory, technical, and human resource constraints.

Through this approach, the study aims to provide both practical and theoretical contributions in supporting the adoption of carbon accounting in the mining sector and to serve as a reference for policymakers and stakeholders in formulating future environmental accounting regulations.

RESULTS AND DISCUSSION

1. Challenges in Carbon Accounting Treatment in the Coal Mining Sector

An empirical study conducted in East Kalimantan one of Indonesia's major coal mining hubs revealed several key barriers to the implementation of carbon accounting by mining companies. These findings are supported by prior research and recent official data, as outlined below:

a). Absence of Specific Carbon Accounting Standards

Most companies currently rely on PSAK 19 (Intangible Assets) and PSAK 57 (Provisions), neither of which explicitly regulate the recognition and valuation of carbon emissions. Rahmawati & Setiawan (2022) argue that the ambiguity in carbon accounting standards hampers the adoption of a consistent carbon reporting system in the mining sector.

b) Limited Emissions Monitoring Infrastructure

The technical capacity of companies to monitor and record carbon emissions remains limited. Many firms lack IPCC- or ISO 14064-based emissions measurement tools. This is consistent with the OJK & IDX (2024) report, which indicates that only 12% of mining companies in Indonesia have integrated carbon accounting systems.

c) Carbon Price Volatility and Valuation Assumptions

Translating emission volumes into monetary value requires assumptions about carbon pricing, which is highly volatile. For instance, while Walhi (2007) used an assumed price of USD 10 per ton of CO_2, Carbon Market Watch (2025) reports that the price has increased to USD 12.50 per ton of CO_2. Such fluctuations directly affect the valuation of assets and provisions recognized in financial statements.

d) Shortage of Competent Human Resources

As noted by Putri et al. (2023), limited awareness and understanding of environmental accounting principles hinder the implementation of carbon measurement practices. Only a few accounting staff are familiar with tools such as the ISPO calculator or IPCC Tier 1–3 methodologies, which are essential for calculating emissions from fuel use, production processes, and land-use changes.

2. ***Strategies for Implementing Carbon Accounting: Comparative Study and Adaptation***

a) Adapting Best Practices from Other Industries

The model adopted by Eagle High Plantations (EHP) in the palm oil industrymparticularly the development of the Sukadamai Biogas Power Plant (PLTBg) with a capacity of 2,400 kW and emission reductions of up to 24,000 tons of CO_2 per year can be adapted for use in coal mining. Specifically, such practices may be applied in the management of methane emissions from tailing waste and acid mine drainage (AMD). The EHP study also highlights the use of an ISPO-based emissions calculator and the recognition of carbon assets as intangible assets in accordance with PSAK 19.

b) Utilization of Carbon Calculation Formulas

A formula-based approach is used to measure the economic value of carbon sequestration or reduction, incorporating updated market carbon prices (p) and the Bank Indonesia exchange rate (b). As of April 2025, the BI middle exchange rate stands at IDR 15,842 per USD.

$$Y = (\Sigma(n_{x1} \times \alpha_{x1}) + (n_{xi} \times \alpha_{xi})) \times p \times b$$

c)Reclamation and Conservation as Carbon Assets

Reclaimed land that successfully supports new vegetation growth can be recognized as a carbon sink and recorded as an intangible asset, with a useful life corresponding to the carbon sequestration period. This also creates opportunities for mining companies to obtain carbon credits through both voluntary carbon trading mechanisms and national regulatory frameworks.

3. Impact on Financial Statements and Financial Ratios

a) Changes in Balance Sheet Composition

The recognition of carbon provisions as current liabilities and carbon assets as intangible assets results in structural changes to the balance sheet. Putri et al. (2023) noted that the recording of carbon provisions leads to a reduction in equity, as the expense is recognized concurrently with the revenue contribution, in accordance with the matching principle in accounting.

b) Decrease in Liquidity Ratios

The inclusion of carbon provisions under current liabilities causes a decline in financial ratios such as the Current Ratio and Quick Ratio, due to a significant increase in the denominator of these ratios.

2. Alignment with SDGs and NZE 2060

The carbon accounting strategy contributes to the achievement of Sustainable Development Goal 13 (Climate Action) and supports Indonesia's national target of reaching Net Zero Emissions (NZE) by 2060. The implementation of carbon accounting will position mining companies not only as economic agents but also as key players in the energy transition and climate change mitigation efforts.

CONCLUSION

This study reveals that the treatment of carbon accounting in the coal mining sector particularly in East Kalimantan faces complex challenges in the recording, recognition, and disclosure of transactions related to potential carbon sequestration and environmental service costs. The provisions within PSAK 19 (2010), PSAK 23 (2010), PSAK 32 (2007), and PSAK 57 (2009) serve as the primary framework for recognizing carbon potential either as contingent assets or intangible assets, as well as for accounting for costs and revenues associated with environmental services and carbon surplus.

However, the application of these standards remains inconsistent and continues to face technical implementation barriers and limited accounting capacity at the company level. Accounting strategies—such as the early-period recognition of provisions for estimated environmental costs—have shown significant impacts on financial statement preparation and the financial ratios of mining companies. This study finds that the implementation of carbon accounting treatment may lead to a decrease in liquidity and profitability ratios, as well as variations in solvency ratios, depending on a company’s funding structure and management policy regarding carbon accounting.

Therefore, a comprehensive and integrated strategy is essential for the effective implementation of carbon accounting treatment. This includes enhancing understanding of accounting standards, strengthening regulations and

implementation guidelines, and improving transparency and accountability in corporate financial reporting. Such efforts are critical to supporting the sustainability of the mining sector and contributing to climate change mitigation through a credible and reliable carbon recording mechanism

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