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From Control Systems to Capital Structure: How Management and Environmental Control Packages Shape Leverage Decisions and Dual Performance in Indonesian Listed Coal Miners

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Abstract

Firms in carbon-intensive industries face rising sustainability pressures that increasingly shape financing conditions and performance outcomes. This study examines whether management control systems (MCS) and environmental management control systems (EMCS), conceptualized as control packages, influence capital structure decisions (leverage) and, in turn, dual performance (financial and environmental) among Indonesian listed coal-mining firms. Using a census of 28 firms and survey-based measures analyzed with PLS-SEM, we test direct and mediated relationships among MCS, EMCS, leverage, and performance. The results show that both MCS and EMCS positively affect leverage decisions. Leverage, in turn, has a strong positive effect on overall firm performance. EMCS also exhibits a significant direct effect on performance, whereas the direct effect of MCS on performance is not significant. Mediation analysis indicates that leverage fully mediates the MCS–performance relationship and partially mediates the EMCS–performance relationship. These findings suggest that, in a carbon-intensive setting, control packages contribute to sustainability-relevant outcomes primarily by improving the quality of financing choices that enable sustained investment and risk management. The study highlights leverage as a key financial mechanism linking sustainability governance to performance and offers implications for integrating environmental controls into budgeting and capital-structure policy to support transition readiness.

Keywords: capital structure; coal mining; dual performance; EMCS; leverage; MCS; PLS-SEM; sustainable finance; sustainability control

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1. Introduction

Energy transition pressures and decarbonization policies are increasingly reshaping how high-carbon industries, including coal mining, are assessed, funded, and managed (Krueger et al., 2020; Flammer, 2021). While coal remains crucial to energy supply and industrial supply chains, the sector is at the center of climate risk due to its emissions intensity, local ecological impacts, and increasing stakeholder expectations for measurable environmental performance (Busch & Lewandowski, 2018; Gunningham, 2021). This changing landscape is expanding the competitive landscape for companies beyond operational efficiency to the credibility of verifiable sustainability governance, particularly as access to financing and the cost of capital are increasingly sensitive to transition risk profiles and the quality of environmental management (Krueger et al., 2020; Flammer, 2021). Consequently, managerial and financial agendas are becoming increasingly interconnected: the quality of internal control and environmental controls are no longer understood solely as compliance tools, but rather as prerequisites for designing financing policies that support environmental investment and sustainable performance (Henri & Journeault, 2010; Hennig et al., 2023). This study contextualizes decarbonization pressures, environmental spending needs, and the financing dynamics of carbon-intensive sectors to examine the linkages between MCS–EMCS, capital structure decisions, and firm performance.

In carbon-intensive industries, green investments tend to be capital-intensive, long-term, and require stable funding. Therefore, capital structure decisions, particularly the composition of debt and equity, become a strategic arena that determines whether environmental commitments can be translated into sustainable programs and investments (Gamba & Triantis, 2008; Öztekin, 2015). However, various studies indicate the risk of an "implementation gap," a condition where environmental goals have been stated but not fully internalized in planning, budgeting, performance measurement, and investment decisions (Gond et al., 2012; Hennig et al., 2023). At this point, a control system becomes crucial. Without a control mechanism capable of translating environmental targets into trackable indicators, boundaries, and decisions, sustainability strategies risk stopping at the disclosure level and failing to generate substantive changes in corporate decisions (Henri & Journeault, 2010; Busch & Lewandowski, 2018). Therefore, this study views MCS and EMCS as "control infrastructure" that has the potential to influence the quality of capital structure decisions and, through this pathway, determine the achievement of financial performance as well as environmental performance in coal companies.

Conceptually, a Management Control System (MCS) is understood as a package of formal and informal mechanisms that direct organizational behavior to align with strategy through planning, budgeting, performance measurement, reporting, and incentive systems (Simons, 1995; Malmi & Brown, 2008). MCS is relevant to financing policy because the formation of leverage requires coordination across finance, operations, investment, and risk management functions to integrate cash flow information, project risk profiles, capital expenditure requirements, and financing constraints (Ferreira & Otley, 2009; Frank & Goyal, 2009). From an information asymmetry perspective, the quality of internal information systems and control discipline can reduce adverse selection, increase the company's credibility with investors and creditors, and ultimately influence the cost of capital and financing decisions (Bharath et al., 2009; Frank & Goyal, 2009). In a coal sector facing transition pressures, weak coordination can be quickly interpreted by the market as governance risk, while strong controls have the potential to clarify investment priorities, improve funding discipline, and strengthen companies' resilience to volatility (Krueger et al., 2020; Gunningham, 2021).

Unlike general MCS, Environmental Management Control Systems (EMCS) emphasize the integration of environmental objectives and information into the managerial cycle, including target setting, budgeting, capital budgeting, performance evaluation, and reporting (Henri & Journeault, 2010; Hennig et al., 2023). EMCS is important because in the coal sector, environmental issues constitute a source of costs, reputational risks, and regulatory risks; consequently, a company's ability to measure and control environmental impacts forms the basis for more disciplined investment decisions and more credible financing decisions (Busch & Lewandowski, 2018; Krueger et al., 2020). The eco-control literature suggests that integrated environmental controls can improve environmental performance and, under certain conditions, strengthen economic performance through channels of efficiency, legitimacy, and risk reduction (Henri & Journeault, 2010; Endrikat et al., 2014). Recent studies also confirm that EMCSs help companies internalize environmental goals into decision-making, although implementation costs and measurement complexity are often barriers (Hennig et al., 2023). Thus, EMCSs are not merely compliance tools, but managerial infrastructure that enables environmental goals to be translated into consistent corporate policies and decisions.

In corporate finance literature, leverage is understood as a dynamic policy. Companies generally have a leverage target, but adjustments towards that target are gradual due to frictions and adjustment costs (Hovakimian et al., 2001; Leary & Roberts, 2005). Dynamic trade-off theory views capital structure as the result of balancing the benefits of debt, such as tax shields and managerial discipline, against distress costs, agency costs, and bankruptcy risk (Frank & Goyal, 2009; Öztekin, 2015). Furthermore, information asymmetry and market timing theories explain variations in financing instrument choices across companies and over time (Baker & Wurgler, 2002; Bharath et al., 2009). In the era of the energy transition, these dynamics take on a new layer: access to financing, credit spreads, and investor preferences are increasingly influenced by transition risks and a company's credibility in managing sustainability issues. Therefore, capital structure reflects not only conventional financial considerations, but also the company's capacity to manage ESG risks and finance environmental investments (Krueger et al., 2020; Flammer, 2021).

On the outcome side, the debate on the relationship between environmental performance and financial performance has evolved from a mere association to a discussion of the mechanisms and conditions under which environmental performance contributes to financial performance (King & Lenox, 2001; Endrikat et al., 2014). Meta-analytic evidence suggests that the average relationship between ESG/environmental performance and financial performance tends to be positive or at least not negative, but the magnitude of the effect is highly dependent on industry context, research design, measurement quality, and time horizon (Endrikat et al., 2014; Friede et al., 2015). In highly polluting industries, the financial benefits of improved environmental performance often emerge through risk reduction, process efficiency, legitimacy, and stable stakeholder relationships (Busch & Lewandowski, 2018; Krueger et al., 2020). Therefore, measuring performance as a "dual performance" combining financial and environmental performance is becoming increasingly relevant and aligns with the focus of this research.

Building on this phenomenon, this study develops a multi-layered theoretical argument to explain the relationship between MCS–EMCS, capital structure, and performance. First, dynamic trade-off theory explains why firms balance the benefits of debt and distress costs, and gradually adjust leverage toward target levels (Hovakimian et al., 2001; Leary & Roberts, 2005; Strebulaev, 2007). Second, information asymmetry theory asserts that information quality influences the cost of capital and preference for financing instruments; a stronger MCS has the potential to reduce information asymmetry and increase the credibility of financing decisions (Bharath et al., 2009; Ferreira & Otley, 2009). Third, the sustainability/eco-control literature emphasizes that EMCS helps firms convert environmental goals into internalized decisions and better environmental performance, which can further contribute to economic performance through efficiency and legitimacy (Henri & Journeault, 2010; Gond et al., 2012). The integration of these three foundations positions MCS–EMCS as a control infrastructure that shapes the quality of capital structure decisions, which then determine the company's ability to achieve financial and environmental performance simultaneously.

Although the capital structure literature is well established in identifying the determinants of leverage and adjustment dynamics (Frank & Goyal, 2009; Öztekin, 2015), most studies still emphasize financial and market determinants. The role of internal control systems as a micro-determinant explaining how financing decisions are shaped through organizational processes is relatively underexplored (Malmi & Brown, 2008; Ferreira & Otley, 2009). In contrast, the eco-control and sustainability control systems literature has emphasized the importance of EMCS/MCS in integrating sustainability issues, but many studies focus on the link between controls and environmental and economic performance without addressing capital structure as the primary financial mechanism enabling environmental investments and programs to be financed and sustained (Henri & Journeault, 2010; Hennig et al., 2023). At the same time, meta-analyses of the environmental-financial relationship have shown varied and context-dependent results, indicating the need for research that more explicitly examines organizational and financial mechanisms (Endrikat et al., 2014; Busch & Lewandowski, 2018). The context of coal companies in developing countries emphasizes this need, as the sector is capital-intensive, sensitive to commodity price cycles, and faces energy transition pressures and changing financing expectations that increase funding uncertainty (Krueger et al., 2020; Flammer, 2021). Therefore, empirical evidence is still needed that simultaneously examines how MCS and EMCS shape capital structure decisions and how these decisions serve as a connecting channel to dual performance (financial and environmental), particularly for listed coal companies in Indonesia.

Based on this gap, the novelty of this research lies in three main contributions. First, this study integrates the concept of MCS–EMCS as control packages with capital structure theory to explain leverage policies in carbon-intensive sectors, thus bridging the literature on management accounting, sustainability control, and corporate finance (Malmi & Brown, 2008; Frank & Goyal, 2009). Second, capital structure decisions are positioned as mediating variables that transmit the influence of MCS/EMCS to performance, thus clarifying the mechanism by which internal control can contribute to performance through financial channels (Leary & Roberts, 2005; Henri & Journeault, 2010). Third, this study measures performance as a combination of financial and environmental performance, thus aligning with the sustainability agenda and expanding performance evaluation beyond profitability alone (Endrikat et al., 2014; Busch & Lewandowski, 2018).

In line with this framework, this study aims to analyze the influence of MCS on capital structure decisions, the influence of EMCS on capital structure decisions, the influence of MCS on firm performance, the influence of EMCS on firm performance, the influence of capital structure decisions on firm performance, and the mediating role of capital structure decisions on the relationship between MCS/EMCS and firm performance in coal companies listed in Indonesia.

2. Materials and Methods

2.1. Theoretical Background and Research Position

This research starts from the premise that capital structure decisions in carbon-intensive companies are not only determined by conventional financial determinants, but also by *the control infrastructure* that shapes the quality of the decision-making process, especially when companies face sustainability pressures and large environmental investment needs. The framework is constructed through a multi *-layered theoretical approach* , namely: (i) grand theory to explain the general logic of capital structure and leverage adjustment behavior; (ii) middle-range theories to explain the information, risk, and legitimacy mechanisms that link control systems to financing decisions; and (iii) applied theories to operationalize the role of MCS–EMCS as a "control package" that directs leverage choices and produces *dual performance* (financial performance and environmental performance).

2.2. Grand Theory: Dynamic Trade-Off Theory and Adjustment Towards Target Leverage

Dynamic trade-off theory posits capital structure as the result of balancing the benefits of debt (e.g., *tax shields* and disciplinary effects) against the costs *of financial distress* , agency costs, and bankruptcy risk, allowing firms to move toward a *leverage target* deemed optimal (Frank & Goyal, 2009; Öztekin, 2015). However, adjustments toward the target do not occur immediately; empirical evidence suggests that firms adjust leverage gradually due to friction and adjustment costs (Leary & Roberts, 2005; Strebulaev, 2007). Thus, leverage policy is essentially a dynamic process: firms assess cash flow capacity, uncertainty, distress risk, and investment opportunities, then choose a debt-equity combination that minimizes the cost of capital while maintaining funding flexibility (Frank & Goyal, 2009; Öztekin, 2015).

An important implication of this dynamic perspective is that "organizational capabilities" to measure risk, manage cash flows, and control uncertainty are relevant factors in explaining variations in capital structure decisions. In carbon-intensive sectors, these capabilities are increasingly critical as companies face uncertainties related to the energy transition, commodity volatility, and environmental risks that can impact the cost of capital and access to financing. Therefore, this study positions management control systems and environmental control systems as micro-determinants suspected of strengthening the quality of leverage decisions, in line with the logic of leveraging, which requires disciplined internal information and cross-functional coordination (Frank & Goyal, 2009; Leary & Roberts, 2005).

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2.3. Middle-Range Theories: Information, Risk, and Legitimacy Mechanisms

To explain *how* MCS–EMCS influence capital structure and performance, this study utilizes two mid-level theoretical frameworks. First, information asymmetry theory asserts that information quality influences financing costs and instrument choice, as investors and creditors assess *adverse selection risk* and the credibility of a firm's prospects based on the quality of disclosure and internal capabilities to generate reliable information (Bharath et al., 2009; Frank & Goyal, 2009). In this context, MCS is understood as a mechanism that enhances planning, reporting, and monitoring discipline, thereby reducing internal uncertainty and strengthening the credibility of financing decisions. Meanwhile, EMCS expands the "information space" by incorporating environmental risk metrics and sustainability targets into corporate decisions, thereby reducing uncertainty related to environmental risks, which are increasingly being considered by capital markets.

Second, the environmental management–performance and ESG–financial performance literature suggests that environmental performance can be positively (or at least non-negatively) related to financial performance, primarily through risk reduction, operational efficiency, and stakeholder legitimacy (Endrikat et al., 2014; Busch & Lewandowski, 2018). Aggregate evidence also demonstrates a predominance of non-negative findings on the ESG–financial performance relationship, while emphasizing that the magnitude and direction of the relationship are *context-dependent* and depend on the underlying organizational mechanisms (Friede et al., 2015; Busch & Lewandowski, 2018).

2.4. Applied Theory: MCS–EMCS as "Control Packages"

This study adopts the perspective that management control works as a package (not a single instrument), namely a combination of formal and informal control mechanisms that complement each other to guide organizational behavior and ensure *strategic alignment* (Malmi & Brown, 2008; Bedford et al., 2016). Within the package framework, control effectiveness arises from *the fit* between control elements and the organizational context, so that variations in empirical results can be explained by differences in control configurations (Bedford et al., 2016).

In line with this logic, EMCS is positioned as a sub-package that integrates environmental objectives and information into the managerial cycle, from planning and budgeting to *capital budgeting* to performance evaluation, so that environmental issues do not remain mere rhetoric but become a traceable basis for decisions (Henri & Journeault, 2010; Hennig et al., 2023). Contemporary research confirms that the benefits of EMCS are more evident when EMCS is integrated into core business activities; this integration strengthens an organization's ability to channel stakeholder pressure into environmental and financial performance (Knels et al., 2025).

2.5. Conceptual Definition of Research Variables

MCS is defined as a set of formal and informal control mechanisms used by management to translate strategy into targets and actions through planning, budgeting, performance measurement, reporting, and evaluation and incentive systems (Malmi & Brown, 2008; Ferreira & Otley, 2009). In the context of financing, MCS plays a role in improving information discipline and cross-functional coordination so that leverage decisions are more consistent with the company's cash flow capacity and risk profile (Frank & Goyal, 2009; Bharath et al., 2009).

EMCS is defined as a control mechanism that internalizes environmental objectives and information into managerial processes (planning, budgeting, *capital budgeting* , evaluation, and reporting) so that corporate decisions systematically consider environmental risks and targets (Henri & Journeault, 2010; Hennig et al., 2023). The formal–informal integration of EMCS into core business activities is understood as a condition that strengthens the effectiveness of EMCS in driving environmental and financial performance (Knels et al., 2025).

Capital structure decisions are defined as dynamic policies regarding the composition of debt and equity used to finance assets and investments, with a tendency to move toward target leverage but adjusting it gradually due to frictions and adjustment costs (Leary & Roberts, 2005; Strebulaev, 2007). From a dynamic perspective, leverage is the result of evaluating the benefits of debt versus the costs of distress and the need for funding flexibility (Frank & Goyal, 2009; Öztekin, 2015).

Firm performance is positioned as a *dual performance* : financial and environmental performance. Meta-analytic literature suggests that environmental/carbon performance tends to be negatively correlated with emissions (better carbon performance means lower emissions) and is generally associated with better financial performance, although this relationship depends on the context and measurement method (Endrikat et al., 2014; Busch & Lewandowski, 2018). Aggregate ESG evidence also shows a majority of non-negative findings on the ESG–financial performance relationship, strengthening the relevance of dual performance measurement for sustainability research (Friede et al., 2015).

2.6. Research Framework

This research framework positions MCS and EMCS as determinants of the process that shapes the quality of financing decisions, with capital structure decisions (leverage) as a channel that channels the influence of the control system towards firm performance (financial and environmental). Under the dynamic trade-off, "more appropriate" leverage increases the probability of the company maintaining flexibility, avoiding unnecessary distress, and maintaining the cost of capital at a competitive level (Frank & Goyal, 2009; Öztekin, 2015).

MCS strengthens planning and reporting disciplines, clarifies *accountability* , and improves cross-functional coordination, enabling companies to better estimate cash flow capacity, assess distress risk, and set leverage aligned with targets (Malmi & Brown, 2008; Ferreira & Otley, 2009). EMCS extends these disciplines by incorporating environmental targets and metrics into investment and budgeting decisions, making environmental investments more structured and financially sustainable (Henri & Journeault, 2010; Hennig et al., 2023). When EMCS are integrated with core business activities, companies' ability to channel stakeholder pressure into performance outcomes is also strengthened (Knels et al., 2024). Ultimately, leverage is positioned as a mechanism that enables companies to allocate resources to environmental investments and improvements while maintaining financial performance, aligning with the ESG-performance literature that emphasizes risk, efficiency, and legitimacy channels (Endrikat et al., 2014; Busch & Lewandowski, 2018).

2.7. Hypothesis Development

2.7.1. MCS Has a Positive Influence on Capital Structure Decisions

Within the dynamic trade-off framework, near-target leverage decisions require disciplined cash flow estimation, risk monitoring, and funding capacity evaluation (Leary & Roberts, 2005; Frank & Goyal, 2009). MCS, as a suite of control mechanisms, strengthens cross-functional coordination and information disciplines through planning, budgeting, and performance measurement, thereby helping firms establish funding structures that are more consistent with risk and strategy (Malmi & Brown, 2008; Ferreira & Otley, 2009). From an information asymmetry perspective, improving the quality of internal information also has the potential to strengthen the credibility of funding decisions and improve financing conditions (Bharath et al., 2009). Based on these arguments, the following hypotheses are proposed:

H1. *MCS has a positive effect on capital structure decisions.*

2.7.2. EMCS Has a Positive Effect on Capital Structure Decisions

EMCS internalizes environmental targets and information into managerial decisions, including *capital budgeting* and budgeting, providing companies with a stronger basis for designing measurable environmental investment financing (Henri & Journeault, 2010; Hennig et al., 2023). Furthermore, integrating EMCS into core business activities has been shown to strengthen an organization's ability

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to channel stakeholder pressure into capabilities and outcomes, which conceptually can also enhance a company's credibility in the eyes of financiers (Knels et al., 2024). Therefore, the proposed hypothesis is:

H2. *EMCS has a positive effect on capital structure decisions.*

2.7.3. MCS Has a Positive Effect on Firm Performance

MCS is seen as improving *strategic alignment*, efficiency, and execution quality through structured planning, measurement, and evaluation mechanisms (Malmi & Brown, 2008; Bedford et al., 2016). In an organizational context facing high uncertainty, an effective control configuration helps companies maintain strategic consistency and reduce performance deviations. Therefore, the proposed hypothesis is:

H3. *MCS has a positive effect on firm performance.*

2.7.4. EMCS Has a Positive Impact on Firm Performance

Eco-control literature suggests that integrated environmental controls support improved environmental performance and can contribute to economic performance through efficiency and risk reduction (Henri & Journeault, 2010; Endrikat et al., 2014). Contemporary evidence also confirms the strong economic motivation behind EMCS implementation, particularly in companies with high pollution intensity, making EMCS a relevant instrument for performance improvement (Hennig et al., 2023). Therefore, the following hypothesis is proposed:

H4. *EMCS has a positive effect on firm performance.*

2.7.5. Capital Structure Decisions Have a Positive Effect on Firm Performance

The dynamic trade-off suggests that "more appropriate" leverage helps firms lower their cost of capital, maintain flexibility, and avoid unnecessary distress, ultimately enhancing performance (Frank & Goyal, 2009; Öztekin, 2015). In the context of environmental investments requiring sustainable funding, an appropriate funding structure also has the potential to strengthen a firm's ability to sustain environmental programs without compromising financial stability. Therefore, the following hypothesis is proposed:

H5. *Capital structure decisions have a positive effect on firm performance.*

2.7.6. Capital Structure Decisions Mediate the Effect of MCS on Firm Performance

MCS improves the quality of coordination and discipline of information relevant to leverage decisions (Malmi & Brown, 2008; Bharath et al., 2009), while more appropriate leverage enhances performance through the cost of capital and flexibility channels (Frank & Goyal, 2009). Thus, capital structure decisions are positioned as a mechanism that channels the influence of MCS toward performance. The proposed hypothesis is:

H6. *Capital structure decisions mediate the effect of MCS on firm performance.*

2.7.7. Capital Structure Decisions Mediate the Effect of EMCS on Firm Performance

An integrated EMCS encourages the internalization of environmental risks and targets into investment and budgeting decisions (Henri & Journeault, 2010; Hennig et al., 2023). When environmental targets are part of the decision-making process, companies have a stronger basis for designing financing structures compatible with environmental investments, making leverage a channel for *dual performance improvement* (Endrikat et al., 2014; Busch & Lewandowski, 2018). Therefore, the following hypothesis is proposed:

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H7. *Capital structure decisions mediate the effect of EMCS on firm performance.*

Based on a literature synthesis and theoretical arguments, this study proposes that managerial and environmental control packages (MCS and EMCS) shape the quality of capital structure decisions (leverage) and directly and indirectly influence firm performance. Specifically, capital structure decisions are positioned as financial mechanisms that channel the influence of MCS and EMCS on dual performance outcomes (financial and environmental performance). The conceptual framework of this study is summarized in Figure 1.

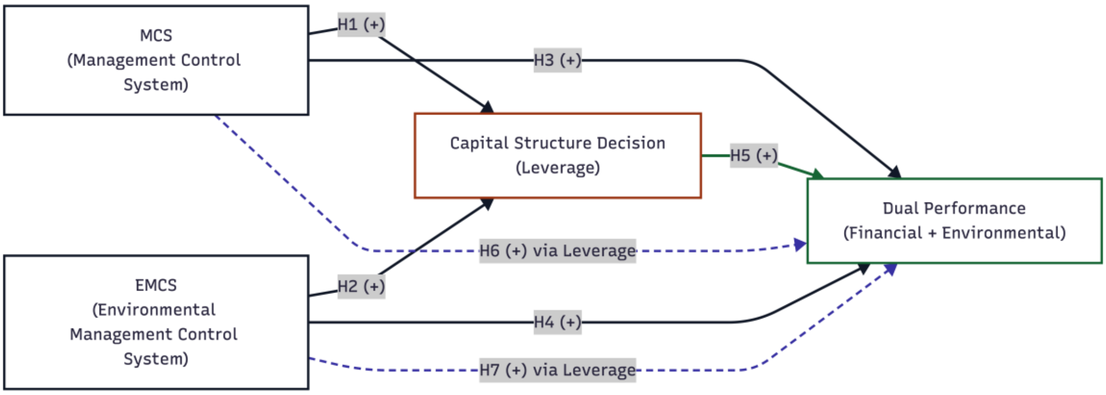

Figure 1. Conceptual framework of the study.

In line with Figure 1, this study tests five direct effects: (i) the effect of MCS and EMCS on capital structure decisions (H1–H2), (ii) the effect of MCS and EMCS on dual performance (financial and environmental) (H3–H4), and (iii) the effect of capital structure decisions on dual performance (financial and environmental) (H5). In addition, this study examines the mediating role of capital structure decisions as a channel explaining how MCS and EMCS translate into dual performance (financial and environmental), namely mediation in the MCS→performance (H6) and EMCS→performance (H7) relationships. With this framework, the next section explains the research design, data sources, construct measurements, and hypothesis estimation and testing procedures.

Overall, the theoretical development and hypotheses above confirm that MCS and EMCS, as a control package, are expected to shape the quality of leverage policy within the framework of target adjustment, and that leverage policy serves as an important channel that translates organizational control capabilities into dual performance (financial and environmental). This model expands the ESG-performance debate by positioning capital structure as a financial mechanism that allows investment and environmental improvement to go hand in hand with stable financial performance (Friede et al., 2015; Busch & Lewandowski, 2018).

2.8. Research Design

This study employs an explanatory (hypothesis-testing) research design to examine both the direct effects and the indirect (mediated) effects among the Management Control System (MCS), the Environmental Management Control System (EMCS), capital structure decisions (leverage), and firm performance, conceptualized as dual performance (financial and environmental). A cross-sectional approach is adopted because the proposed structural relationships are tested within a single observation period.

The population comprises 28 mining companies listed on the Indonesia Stock Exchange (IDX) in 2024. This study applies saturated (census) sampling, thereby including the full population to maximize representativeness. The unit of analysis is the firm. Perceptual data are collected from top management as key informants who are directly involved in, or have sufficient knowledge of, the firm's control systems and financing policies.

All constructs are operationalized using a construct–dimension–indicator scheme to translate conceptual definitions into transparent empirical measures. Data are collected using a closed-ended questionnaire with an ordinal (Likert-type) response scale.

The constructs are operationalized as follows:

1. MCS is measured as a control package comprising six dimensions: interactive, diagnostic, cybernetic, planning, administrative, and responsibility centers.
2. EMCS is measured using two dimensions: formal EMCS and informal EMCS.
3. Capital structure decisions (leverage) are measured through four dimensions: financing timing, bank relationship, management view, and existing structure.
4. Firm performance (dual performance) consists of: (a) financial performance and (b) environmental performance.

To clarify measurement sources, financial performance is treated as an archival (report-based) measure, proxied by ROE, ROI, and EPS, and obtained from firms' annual financial statements/annual reports. Environmental performance is measured using (i) ISO 14,001 adoption as an indicator of a formal environmental management system and (ii) GHG emissions information referenced to ISO 14064, obtained primarily from sustainability reports/annual reports and, where disclosure is incomplete, complemented by managerial survey confirmation to ensure construct coverage.

The hypotheses are tested using Partial Least Squares Structural Equation Modeling (PLS-SEM), which is suitable for models involving latent constructs and mediation testing. Because several key constructs are collected via questionnaire responses, the study applies procedural remedies to mitigate potential common method bias, including clear and consistent instructions, concise and specific item wording, and a questionnaire structure that separates constructs to reduce respondents' tendency to provide artificially consistent answers. These remedies follow widely cited recommendations for survey research (Podsakoff et al., 2003).

3. Results

3.1. Profile of the Coal Industry in Indonesia

The coal mining industry in Indonesia is a strategic sector that contributes to energy supply and the economy, as well as being a crucial subsector in the capital market. This study population included 28 coal mining companies listed on the Indonesia Stock Exchange (IDX).

The main characteristics of this subsector are capital-intensive and sensitive to commodity price dynamics, making financing policies and capital structure crucial for maintaining operational sustainability. At the same time, companies face increasingly stringent environmental management demands through the implementation of environmental systems and standards, which have implications for investment requirements and internal controls.

The heterogeneity of coal issuers' business models, ranging from integrated producers to service/contractor-based companies, creates variations in MCS–EMCS configurations, leverage decisions, and financial and environmental performance outcomes.

3.2. Measurement Model Analysis

At the outer model stage, this study first evaluates construct reliability to ensure that the indicators used are able to measure the construct consistently. In PLS-SEM, reliability is generally assessed through Composite Reliability (CR) and Cronbach's Alpha (α), while convergent validity is assessed through Average Variance Extracted (AVE). In general, the commonly used criteria are CR ≥ 0.70, $\alpha \geq 0.70$ (especially for confirmatory research), and AVE ≥ 0.50 as evidence that the construct explains an adequate proportion of the indicator variance (Hair et al., 2019; Henseler et al., 2015).

The following is a summary of the results of the reliability and AVE tests for each variable and its dimensions as shown in Table 1.

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Table 1. Reliability (AVE, Composite Reliability, and Cronbach's Alpha).

Variables	Dimensions	AVE	Composite Reliability	Cronbach's Alpha
Management Control System (MCS)		0.764	0.990	0.990
	Interactive system	0.785	0.975	0.971
	Diagnostic system	0.786	0.948	0.930
	cybernetics	0.871	0.953	0.925
	planning	0.893	0.944	0.881
	administrative	0.843	0.942	0.906
	Management	0.737	0.957	0.947
Environmental Management Control System (EMCS).		0.502	0.961	0.957
	Formal	0.657	0.851	0.739
	Informal	0.571	0.794	0.598
	Constitution	0.660	0.852	0.740
	Cost	0.714	0.882	0.797
	Stakeholders	0.677	0.862	0.760
	Environment	0.779	0.913	0.858
	Ownership	0.683	0.810	0.556
	EMS	0.576	0.870	0.813
Capital Structure Decisions		0.666	0.965	0.961
	Time	0.701	0.903	0.856
	Banking	0.684	0.915	0.883
	Management Perspective	0.664	0.856	0.747
	Choice	0.870	0.930	0.850
Financial performance		0.742	0.920	0.883
	Finance	0.867	0.929	0.847
	Environment	0.785	0.879	0.726

(Source: Primary data processed by SmartPLS, 2025).

Based on Table 1, all main constructs generally demonstrate strong measurement quality. The MCS variable has an AVE of 0.764, a CR of 0.990, and an α of 0.990, indicating very high reliability and convergent validity. All MCS dimensions (interactive, diagnostic, cybernetic, planning, administrative, and management) also consistently have high CR and AVE > 0.50, thus supporting the internal stability of the indicators in each dimension (Hair et al., 2019).

For EMCS, the construct value shows an AVE of 0.502 with a CR of 0.961 and an α of 0.957, indicating that the construct meets the minimum AVE threshold (≥0.50) and has excellent reliability. At the dimension level, Formal demonstrates adequate reliability (CR 0.851; α 0.739), while Informal has a CR of 0.794 but an α of 0.598. In the context of PLS-SEM, such conditions are generally still acceptable to a limited extent if the CR is adequate and the indicators continue to show good consistency in further evaluations, but should be considered as an indication that the dimension may need item strengthening or improvement in the next stage of instrument development (Hair et al., 2019; Henseler et al., 2015).

The Capital Structure Decision Variable (Leverage) shows strong results (AVE 0.666; CR 0.965; α 0.961) and all its dimensions (Time, Banking, Management Perspective, and Choice) meet the AVE and CR criteria, so the leverage construct is considered reliable for testing structural relationships (Hair et al., 2019).

Furthermore, in the performance construct (dual performance), the financial performance component demonstrated good reliability (AVE 0.742; CR 0.920; α 0.883). Several additional dimensions/components in the table also showed adequate CR, although some sections had α values below 0.70 (e.g., "Ownership" α 0.556). This condition reiterates the need for careful interpretation: for confirmatory research, a low α value is usually a signal to review the consistency of the indicators, while in the PLS-SEM approach, reliability assessment is more emphasized on CR and convergent validity (Hair et al., 2019; Henseler et al., 2015).

Overall, the results in Table 1 show that the majority of constructs and dimensions have met the threshold of reliability and convergent validity, so that the model can proceed to the next stage, namely the evaluation of discriminant validity and testing the structural model (inner model) to test hypotheses H1–H7 (Hair et al., 2019; Henseler et al., 2015).

After the construct reliability (AVE, Composite Reliability, and Cronbach's Alpha) is declared adequate, the next stage in the outer model evaluation is to test the convergent validity through the factor loading value of each indicator against its dimension. In PLS-SEM, a loading ≥ 0.70 is generally considered ideal because it indicates the indicator represents the construct strongly, while a loading of 0.50–0.70 is still acceptable, especially in explanatory/preliminary studies, as long as the construct reliability and AVE remain adequate (Hair et al., 2019; Henseler et al., 2015). In addition to the magnitude of the loading, the statistical significance of the indicator is also assessed through the t-statistic and p-value of the bootstrapping results, with the general criteria of t> 1.96 in a two-tailed test (α = 5%) (Hair et al., 2019).

A summary of the loading factor values between dimensions–indicators for first-order constructs is presented in Table 2.

Table 2. Loading Factors Between Dimensions–Indicators (1st Order).

Variables	Dimension-Indicator	Loading factor (λ)	SE(λ)	t count	P Values
***Management Control System* (MCS)**	MCS1 <- Interactive system	0.821	0.023	35,658	0.000
	MCS2 <- Interactive system	0.850	0.023	36,934	0.000
	MCS3 <- Interactive system	0.822	0.027	30,492	0.000
	MCS4 <- Interactive system	0.823	0.026	31,806	0.000
	MCS5 <- Diagnostic system	0.883	0.018	48,074	0.000
	MCS6 <- Diagnostic system	0.684	0.063	10,894	0.000
	MCS7 <- Diagnostic system	0.752	0.045	16,729	0.000
	MCS8 <- Cybernetic control	0.810	0.037	22,001	0.000
	MCS9 <- Cybernetic control	0.786	0.033	23,535	0.000
	MCS10 <- Cybernetic control	0.807	0.029	27,891	0.000
	MCS11 <- Planning control	0.845	0.023	36,858	0.000
	MCS12 <- Planning control	0.853	0.025	33,978	0.000
	MCS13 <- Administrative control	0.734	0.052	14,160	0.000
	MCS14 <- Administrative controls	0.809	0.025	32,239	0.000
	MCS15 <- Administrative control	0.637	0.057	11,255	0.000
	MCS16 <- Management control	0.834	0.018	45,569	0.000
	MCS17 <- Management control	0.709	0.036	19,558	0.000
	MCS18 <- Management control	0.790	0.029	27,338	0.000
	MCS19 <- Management control	0.755	0.036	20,689	0.000
	MCS20 <- Management control	0.682	0.038	17,960	0.000
	MCS21 <- Management control	0.780	0.033	23,278	0.000
	MCS22 <- Management control	0.673	0.057	11,783	0.000
	MCS23 <- Management control	0.782	0.036	22,011	0.000
***Environmental Management Control System* (EMCS).**	EMCS1 <- EMCS formal	0.808	0.035	23,254	0.000
	EMCS2 <- EMCS formal	0.730	0.054	13,513	0.000
	EMCS3 <- EMCS formal	0.776	0.043	18,026	0.000
	EMCS4 <- informal EMCS	0.839	0.025	33,174	0.000
	EMCS5 <- informal EMCS	0.732	0.043	16,947	0.000
	EMCS6 <- informal EMCS	0.853	0.025	33,562	0.000
	EMCS7 <- Regulation in the environmental field_ _	0.830	0.032	26,305	0.000
	EMCS8 <- Regulations in the environmental field_ _	0.722	0.041	17,425	0.000
	EMCS9 <- Regulations in the environmental field_ _	0.882	0.016	54,044	0.000
	EMCS10 <- Environmental costs	0.825	0.030	27,797	0.000

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	EMCS11 <- Environmental costs	0.767	0.031	24,977	0.000
	EMCS12 <- Environmental costs	0.845	0.031	27,194	0.000
	EMCS13 <- External stakeholders of the company	0.770	0.043	17,919	0.000
	EMCS14 <- External stakeholders of the company	0.715	0.057	12,473	0.000
	EMCS15 <- External stakeholders of the company	0.711	0.058	12,310	0.000
	EMCS16 <- External stakeholders of the company	0.690	0.041	16,722	0.000
	EMCS17 <- Proactive environmental strategies	0.654	0.052	12,655	0.000
	EMCS18 <- Proactive environmental strategies	0.822	0.027	30,514	0.000
	EMCS19 <- Proactive environmental strategy	0.738	0.041	17,845	0.000
	EMCS20 <- Proactive environmental strategy	0.759	0.041	18,362	0.000
	EMCS21 <- Proactive environmental strategy	0.616	0.066	9,368	0.000
	EMCS22 <- Ownership type	0.849	0.032	26,757	0.000
	EMCS23 <- Ownership type	0.866	0.029	29,805	0.000
	EMCS24 <- Environmental Management System__	0.790	0.034	23,327	0.000
	EMCS25 <- Environmental Management System__	0.576	0.063	9,086	0.000
	EMCS26 <- Environmental Management System__	0.809	0.035	22,867	0.000
	EMCS27 <- Environmental Management System__	0.737	0.055	13,520	0.000
	EMCS28 <- Environmental Management System__	0.599	0.082	7,351	0.000
Capital Structure Decisions.	SM1 <- Time for new investment financing	0.921	0.012	74,654	0.000
	SM2 <- Time for new investment financing	0.857	0.022	38,421	0.000
	SM3 <- Time for new investment financing	0.824	0.026	32,021	0.000
	SM4 <- Relationship with banking	0.896	0.012	74,006	0.000
	SM5 <- Relationship with banking	0.871	0.019	46,613	0.000
	SM6 <- Relationship with banking	0.800	0.029	28,041	0.000
	SM7 <- Relationship with banking	0.725	0.044	16,476	0.000
	SM8 <- Relationship with banking	0.897	0.015	60,879	0.000
	SM9 <- Management perspective	0.836	0.018	45,911	0.000
	SM10 <- Management perspective	0.771	0.039	19,988	0.000
	SM11 <- Management perspective	0.872	0.018	47,999	0.000
	SM12 <- Options for existing capital structure	0.874	0.018	49,041	0.000
	SM13 <- Options for existing capital structure	0.895	0.011	83,815	0.000
Firm performance	KP1 <- Financial Performance	0.853	0.019	44,061	0.000
	KP1 <- Firm performance	0.863	0.018	47,708	0.000
	KP2 <- Financial Performance	0.858	0.020	42,863	0.000
	KP2 <- Firm performance	0.841	0.020	41,387	0.000
	KP3 <- Financial Performance	0.827	0.027	30,237	0.000
	KP3 <- Firm performance	0.774	0.032	24,209	0.000
	KP4 <- Environmental Performance	0.875	0.018	49,693	0.000
	KP4 <- Firm performance	0.804	0.023	35,148	0.000
	KP5 <- Environmental Performance	0.900	0.012	76,232	0.000
	KP5 <- Firm performance	0.892	0.016	56,845	0.000

(Source: Primary data processed by SmartPLS, 2025).

Based on Table 2, the majority of indicators show high loading factors (mostly ≥ 0.70), which confirms that the indicators used have adequately represented the dimensions/constructs. All indicators also have p-values of 0.000 and very high t-tests, so they are statistically significant in measuring their constructs (Hair et al., 2019).

For the MCS construct, almost all indicators in the dimensions of interactive systems, diagnostic systems, cybernetic control, planning control, administrative control, and management control showed strong loadings (generally ≥ 0.70). There were several indicators with relatively lower loadings (e.g., around 0.63–0.69), but they were still above the minimum threshold of 0.50 and

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remained significant, so they could still be maintained if the construct consistency (CR/AVE) had met the criteria (Hair et al., 2019).

In the EMCS construct, indicators for the formal and informal dimensions generally have good loadings (many are ≥ 0.70). However, several indicators in the environmental/EMS block show moderate loadings (e.g., around 0.576; 0.599; and 0.616). In PLS-SEM, indicators with loadings of 0.50–0.70 can be retained if (1) they are significant, and (2) their removal does not substantively improve the quality of the construct or risk reducing content validity (conceptual representation), especially if the indicator is theoretically important (Hair et al., 2019; Henseler et al., 2015). Because all indicators in Table 4.2 are significant and the EMCS construct in the reliability/AVE test has met the minimum threshold, these moderate indicators are still acceptable for further structural analysis, with caution in interpreting the results (Hair et al., 2019).

For the Capital Structure Decision (Leverage) construct, all indicators in the dimensions of financing time, banking relationships, management perspective, and capital structure choice show high loadings (around ≥ 0.70 to > 0.90), indicating very strong convergent validity in the financing decision construct (Hair et al., 2019). Similarly, for firm performance, indicators in financial and environmental performance show adequate loadings (many are ≥ 0.70) and are significant, thus supporting consistent dual performance measurement (Hair et al., 2019).

Overall, the results in Table 2 confirm that the measurement model meets convergent validity, as the majority of indicators have strong loadings and all indicators are significant. Thus, the evaluation of the outer model can proceed to the next stage, namely discriminant validity, before testing the structural model (inner model) and hypotheses H1–H7 (Hair et al., 2019; Henseler et al., 2015).

After convergent validity on the first-order indicators (indicators → dimensions) is met, the outer model evaluation continues on the second-order constructs (2nd order) to ensure that the high-level latent variables (e.g., MCS and EMCS as control packages) are truly shaped strongly by their dimensions. In hierarchical component model (PLS-SEM), the measurement quality of second-order constructs is generally assessed through the loading values between the second-order constructs and the first-order dimensions, as well as their significance based on bootstrapping. High loadings (generally ≥ 0.70) indicate that the dimensions are strong representations of the high-order constructs, while significance (e.g., $t > 1.96$; $p < 0.05$) confirms that the construct-dimension relationship does not occur by chance (Hair et al., 2019; Sarstedt et al., 2019).

A summary of the loading factor values between latent-dimensional variables (2nd order) is presented in Table 3.

Table 3. Loading Factor Between Latent-Dimensional Variables (2nd Order).

Variables	Dimension-Indicator	Loading factor (λ)	SE(λ)	t count	P Values
Management Control System (MCS)	Management Control System (MCS)-> Administrative control	0.941	0.009	100,270	0.000
	Management Control System (MCS)-> Cybernetic control	0.954	0.008	118,251	0.000
	Management Control System (MCS)-> Management control	0.981	0.004	275,398	0.000
	Management Control System (MCS)-> Planning control	0.803	0.034	23,475	0.000
	Management Control System (MCS)-> Diagnostic system	0.934	0.009	102,538	0.000
	Management Control System (MCS)-> Interactive system	0.942	0.010	93,671	0.000
Environmental Management Control System (EMCS)	Environmental Management Control System (EMCS)-> Environmental costs	0.914	0.016	58,661	0.000
	Environmental Management Control System (EMCS)-> formal EMCS	0.865	0.022	40,076	0.000

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	Environmental Management Control System (EMCS)-> informal EMCS	0.920	0.015	63,369	0.000
	Environmental Management Control System (EMCS)-> Environmental Management System_ _	0.842	0.038	22,138	0.000
	Environmental Management Control System (EMCS)-> External stakeholders	0.901	0.020	45,807	0.000
	Environmental Management Control System (EMCS)-> Regulations in the environmental sector_ _	0.915	0.016	57,698	0.000
	Environmental Management Control System (EMCS)-> Proactive environmental strategy	0.947	0.009	101,598	0.000
	Environmental Management Control System (EMCS)-> Ownership type	0.705	0.045	15,559	0.000
Capital Structure Decisions	Capital Structure Decisions -> Relationship with banking	0.975	0.005	214,508	0.000
	Capital Structure Decisions -> Management Perspective	0.938	0.014	68,418	0.000
	Capital Structure Decision -> Options for existing capital structure	0.952	0.006	151,406	0.000
	Capital Structure Decision -> Time to finance new investments	0.956	0.007	128,698	0.000
Firm performance	Firm performance -> Financial Performance	0.978	0.004	257,767	0.000
	Firm performance -> Environmental Performance	0.958	0.005	175,446	0.000

(Source: Primary data processed by SmartPLS, 2025).

Based on Table 3, the second-order constructs in this study show high and significant loadings, thus supporting the measurement of the hierarchical component model used.

In the Management Control System (MCS) construct, all main dimensions have strong loadings on the MCS construct, including administrative (0.941), cybernetic (0.954), management (0.981), planning (0.803), diagnostic (0.934), and interactive (0.942). All of these relationships are also highly significant (p = 0.000). This finding confirms that MCS as a control package is truly reflected by a combination of complementary control dimensions, so that the high-level MCS construct is suitable for use in testing structural models (Malmi & Brown, 2008; Hair et al., 2019).

In the Environmental Management Control System (EMCS) construct, the constituent dimensions also showed adequate and significant loadings, including environmental costs (0.914), formal EMCS (0.865), informal EMCS (0.920), environmental management system/EMS (0.842), external stakeholders (0.901), environmental regulations (0.915), proactive environmental strategies (0.947), and ownership type (0.705) (p = 0.000 for all paths). The lowest loading value was found in the ownership type dimension (0.705), but still met the general threshold of ≥ 0.70 so that it can still be maintained as a constituent of the EMCS construct, especially if this dimension is important to maintain the content validity of the EMCS concept in the research context (Hair et al., 2019; Sarstedt et al., 2019).

Furthermore, the Capital Structure Decision construct also showed a very strong relationship with its dimensions: banking relationships (0.975), management perspective (0.938), capital structure choice (0.952), and timing of new investment financing (0.956) (p = 0.000). This indicates that the capital structure decision in this study is a stable and consistent construct represented by the funding consideration dimension used, so it is ready to be used as a mediating variable in the structural model (Hair et al., 2019).

Finally, in the Firm performance construct, both financial performance (0.978) and environmental performance (0.958) have very high and significant loadings (p = 0.000), which strengthens the argument that performance is measured as dual performance with two equally strong components representing the firm performance construct at a higher level (Endrikat et al., 2014; Hair et al., 2019).

Overall, Table 3 shows that all second-order constructs have loadings ≥ 0.70 and are significant, so the multilevel measurement model (2nd order) is considered to meet convergent validity at the

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construct-dimensional level. With the fulfillment of reliability, first-order convergent validity, and second-order measurement, the analysis can proceed to testing discriminant validity and then evaluating the structural model (inner model) to test hypotheses H1–H7 (Henseler et al., 2015; Hair et al., 2019).

3.3. Structural Model Analysis

Once the measurement model (outer model) is deemed adequate, the next stage is evaluating the structural model (inner model) to assess the model's predictive ability and explanatory power for endogenous variables. In PLS-SEM, inner model evaluation generally refers to several key indicators, namely R^2 (explanatory power), Q^2 (predictive relevance), and global model fit measures such as GoF (Goodness of Fit) for specific reporting practices. Conceptually, R^2 indicates the proportion of endogenous construct variance that can be explained by exogenous constructs; values of 0.75/0.50/0.25 are often interpreted as high/medium/low (Hair et al., 2019). Furthermore, Q^2 (Stone–Geisser) is used to test predictive relevance; $Q^2 > 0$ indicates the model has adequate predictive ability (Hair et al., 2019; Henseler et al., 2015).

A summary of the inner model test results for each construct and dimension is shown in Table 4, while the full model visualization is presented in Figure 2.

Table 4. Structural Model Testing (Inner Model).

Variables	Dimensions	*R Square*	Communality	*Q-Square*	*GoF*
***Management Control System* (MCS)**		**-**	**0.764**	**0.657**	**0.741**
	Interactive system	0.888	0.785	0.784	
	Diagnostic system	0.872	0.786	0.785	
	Cybernetic control	0.910	0.818	0.818	
	Planning control	0.644	0.893	0.892	
	Administrative control	0.886	0.843	0.843	
	Management Control	0.962	0.737	0.735	
***Environmental Management Control System* (EMCS).**		**-**	**0.502**	**0.499**	
	Formal	0.748	0.657	0.653	
	Informal	0.846	0.568	0.561	
	Regulations in the environmental sector_ _	0.836	0.66	0.657	
	Environmental costs	0.835	0.684	0.682	
	Company stakeholders	0.812	0.677	0.673	
	Proactive environmental strategy	0.897	0.779	0.776	
	Ownership type	0.497	0.683	0.684	
	Environmental Management System	0.708	0.576	0.566	
Capital Structure Decisions		**0.253**	**0.666**	**0.664**	
	Time for new investment financing	0.914	0.681	0.699	
	Relationship with banking	0.951	0.684	0.675	
	Management perspective	0.880	0.664	0.65	
	Options for existing capital structures	0.906	0.82	0.818	
Financial performance		**0.639**	**0.742**	**0.576**	
	Financial performance	0.957	0.817	0.816	
	Environmental Performance	0.917	0.785	0.783	

Source: Primary data processed by Smart PLS (2025).

Based on Table 4, the main endogenous constructs in the model show varying explanatory power but are generally in the adequate category. First, for Capital Structure Decisions (CSD), the R^2 value is 0.253, which means that approximately 25.3% of the variation in capital structure decisions can be explained by the exogenous constructs (MCS and EMCS). Referring to general PLS-SEM guidelines, this value can be classified as low-medium explanatory power, but still reasonable for a behavioral/organizational model involving strategic corporate decisions and many other external factors outside the model (Hair et al., 2019).

Second, for Firm performance/Financial Performance (KP), the R^2 value is 0.639, indicating that approximately 63.9% of the performance variation can be explained by the predictors in the model (KSM, MCS, and EMCS). This value indicates medium-high explanatory power, thus the model has good explanatory power regarding performance outcomes (Hair et al., 2019).

In terms of predictive relevance, Table 4 shows positive Q^2 values for the main constructs, for example, Q^2 KSM = 0.664 and Q^2 KP = 0.576 (as well as several other dimensions that also have positive values). Methodologically, $Q^2 > 0$ indicates that the model has predictive relevance, that is, it is able to predict observational data better than a model without predictors (Hair et al., 2019; Henseler et al., 2015). Thus, the Q^2 results in this table support that the model not only explains but also has adequate predictive capacity.

Additionally, the table shows a GoF value of 0.741 as a concise measure of model fit. While GoF has been used in PLS reporting, recent methodological literature emphasizes that PLS-SEM evaluations should prioritize measurement quality, path significance, R^2, Q^2, and out-of-sample prediction when available (Hair et al., 2019). However, the relatively high GoF value in Table 4 can be viewed as an additional indication that the model has a good overall fit to the data.

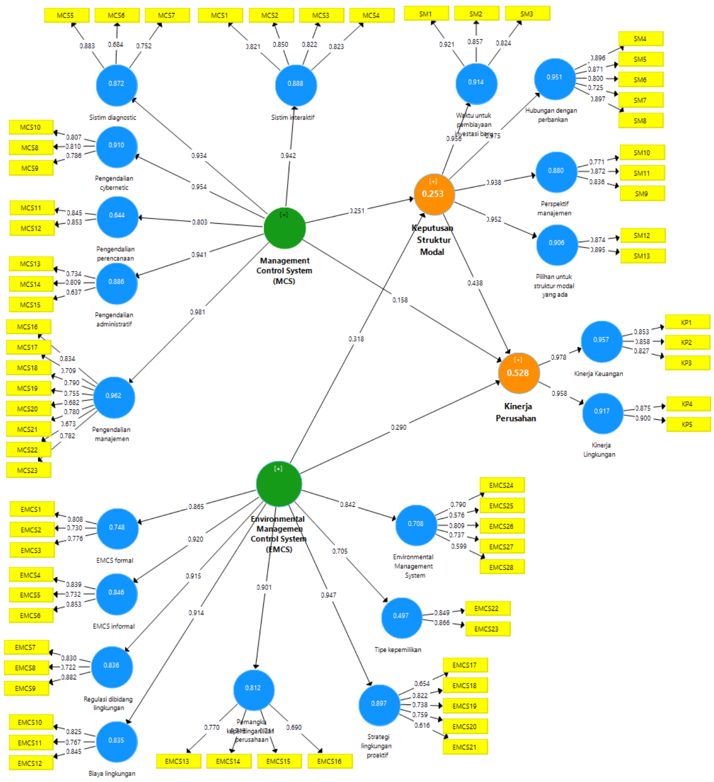

Figure 2. Results of Research Model Testing.

In line with the summary of structural equations at the bottom of the test results figure, this model produces two main equations:

$$KSM = 0.251\ MCS + 0.318\ EMCS + \zeta \quad (1)$$

$$KP = 0.4\ 38\ KSM + 0.148MCS + 0.2\ 90\ EMCS + \zeta \quad (2)$$

The equation above shows that capital structure decisions are influenced by both MCS and EMCS, while performance is influenced by both MCS and EMCS. Substantive interpretation and significance testing of the path coefficients will be explained in the next subsection through bootstrapping results to test hypotheses H1–H7 (Hair et al., 2019).

Overall, referring to Table 4, the structural model in this study has adequate explanatory power, especially for the performance construct and shows positive predictive relevance, so that the analysis can be continued with testing the path coefficients and significance of the hypotheses and mediation tests (H6–H7) within the PLS-SEM framework (Hair et al., 2019; Henseler et al., 2015).

3.4. Hypothesis Testing Results

After the measurement model (outer model) meets the validity and reliability criteria, hypothesis testing is conducted on the structural model using the bootstrapping procedure in PLS-SEM to obtain the path coefficient (β), standard error , t-value, and p-value . In a two-way test at a significance level of 5%, the relationship is declared significant if t> 1.96 or p < 0.05 (Hair et al., 2019). The results of hypothesis testing for direct and indirect effects (mediation) are summarized in Table 5.

Table 5. Hypothesis Testing.

Structural Model	γij	SE(γij)	t-count	P Values	R ²	Information
Management Control System (MCS) ⟶Capital Structure Decisions	0.251	0.083	3,011	**0.003**	0.063	Hypothesis accepted
Environmental Management Control System (EMCS) ⟶Capital Structure Decisions	0.318	0.096	3,317	**0.001**	0.101	Hypothesis accepted
Firm performance *Management Control System* (MCS)⟶	0.158	0.081	1,947	**0.052**	0.025	Hypothesis rejected
Environmental Management Control System (EMCS) ⟶Firm performance	0.290	0.094	3,072	**0.002**	0.084	Hypothesis accepted
Capital Structure Decisions ⟶on Firm performance	0.438	0.076	5,789	0,000	0.192	Hypothesis accepted
Management Control System (MCS) ⟶Capital Structure Decisions ⟶Performance of the Company	0.110	0.039	2,839	**0.005**	0.110	Hypothesis accepted
Environmental Management Control System (EMCS) ⟶Capital Structure Decisions ⟶Performance of the Company	0.140	0.054	2,585	**0.010**	0.140	Hypothesis accepted

(Source: Primary data processed by SmartPLS, 2025).

Based on Table 5, there are several key findings that clarify the relationship mechanism between control packages (MCS and EMCS), capital structure decisions, and firm performance.

First, MCS has a positive and significant effect on capital structure decisions (β = 0.251; t = 3.011; p = 0.003), thus accepting hypothesis H1. This finding suggests that the stronger the management control system, the more "directed" the financing/leverage decisions taken by the company, in line with the argument that effective control improves information discipline and coordination in financial decisions (Hair et al., 2019). Second, EMCS has a positive and significant effect on capital structure decisions (β = 0.318; t = 3.317; p = 0.001), thus accepting H2. This indicates that the integration of environmental controls encourages capital structure decisions that are more compatible with investment needs and environmental risks, thereby strengthening the financial channel for sustainability.

Third, the direct effect of MCS on firm performance was recorded as insignificant at α = 5% (β = 0.158; t = 1.947; p = 0.052), so H3 was rejected. Substantively, this result indicates that MCS does not always improve performance directly; its impact can be more dominant through certain mechanisms, for example through funding policies or resource allocation facilitated by MCS (Hair et al., 2019). Fourth, EMCS had a positive and significant effect on firm performance (β = 0.290; t = 3.072; p = 0.002), so H4 was accepted. This finding is consistent with the literature that positions environmental control as a driver of performance through risk reduction, legitimacy, and efficiency (Endrikat et al., 2014).

Fifth, capital structure decisions have a positive and significant effect on firm performance (β = 0.438; t = 5.789; p = 0.000), thus H5 is accepted. This suggests that a more appropriate leverage design within a firm's context can be a key driver of performance, particularly in capital-intensive industries that require continuous financing.

Sixth, the mediation results indicate that the influence of MCS on firm performance through capital structure decisions is significant (β = 0.110; t = 2.839; p = 0.005), thus H6 is accepted. Combined with the insignificant results of H3, this pattern indicates full mediation, namely MCS improves performance primarily through its role in shaping capital structure decisions (Hair et al., 2019). In other words, management control "works" as a process infrastructure that improves the quality of financing decisions, and these financing decisions are then translated into performance.

Seventh, the effect of EMCS on firm performance through capital structure decisions is also significant (β = 0.140; t = 2.585; p = 0.010), thus H7 is accepted. Since the direct effect of EMCS on performance (H4) is also significant, these results indicate partial mediation: EMCS influences performance both directly and through the channel of capital structure decisions (Hair et al., 2019). This pattern strengthens EMCS's position as a control that not only directly improves environmental/operational outcomes but also strengthens performance through financing decisions that are more aligned with investment needs and risk management.

Overall, referring to Table 5, this study finds that the financial channel (capital structure decisions) is an important mechanism explaining how control packages translate into performance, with different mechanism configurations: MCS tends to operate through mediation, while EMCS operates through both direct and mediation channels. This finding strengthens the argument for the integration of sustainability control and corporate finance in explaining dual performance in carbon-intensive companies.

4. Discussion

4.1. Summary of Findings

This study shows that in carbon-intensive industries, firm performance, both financial and environmental, is determined not only by environmental "commitments" and programs, but also by the financial mechanisms that enable these commitments to be consistently executed. The results of the hypothesis testing confirm three main messages: (1) MCS and EMCS improve capital structure decisions (leverage) (H1 and H2 are accepted), (2) leverage is a strong driver of firm performance (H5 is accepted), and (3) the impact of managerial/environmental controls on performance is mechanistically asymmetric: MCS does not directly affect performance (H3 is rejected) but does so through leverage (H6 is accepted), while EMCS has a direct effect (H4 is accepted) and an indirect effect through leverage (H7 is accepted). This pattern reinforces the Sustainability agenda that control systems will have a greater impact when they are able to change the quality of economic decisions, especially financing decisions, which ultimately support transition investment and environmental risk management (Henri & Journeault, 2010; Busch & Lewandowski, 2018; Flammer, 2021).

The acceptance of H1 (MCS → leverage) confirms that MCS functions as a coordination infrastructure that organizes information, accountability, and decision-making discipline, so that companies are better able to choose a financing structure that is appropriate to cash flow capacity and risk (Malmi & Brown, 2008; Ferreira & Otley, 2009). In the context of capital-intensive companies, strong controls help align planning, budgeting, and performance control with financing decisions, so that leverage becomes more "directed" and consistent with company goals (Malmi & Brown, 2008; Frank & Goyal, 2009).

Accepting H2 (EMCS → leverage) has a more specific sustainability meaning: EMCS is not simply a compliance tool, but a mechanism that internalizes environmental targets into planning and capital budgeting , making funding decisions more compatible with environmental investment needs and risk management (Henri & Journeault, 2010; Hennig et al., 2023). In other words, EMCS expands the information and decision space from purely financial to financial-environmental, which is then reflected in leverage design, especially when companies must finance environmental programs sustainably (Busch & Lewandowski, 2018; Flammer, 2021).

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The rejection of H3 (MCS → insignificant performance) indicates that MCS does not always directly lead to higher performance. This finding aligns with the control package view that management controls operate through specific configurations and decision pathways; their benefits often emerge when they significantly alter investment, financing, and resource allocation decisions (Malmi & Brown, 2008; Bedford et al., 2016). In carbon-intensive sectors facing commodity volatility and environmental pressures, improved control discipline alone is insufficient to boost performance without accompanying changes to “key economic decisions” such as capital structure and project financing capacity (Frank & Goyal, 2009; Krueger et al., 2020).

The acceptance of H4 (EMCS → performance) strengthens the business case for sustainability : integrated environmental controls can contribute to performance by promoting resource efficiency, reducing regulatory/operational risks, and gaining stakeholder legitimacy (Henri & Journeault, 2010; Endrikat et al., 2014). In industries with material environmental impacts, the benefits of EMCS are more readily apparent because improved environmental procedures and reduced emissions/environmental incidents can directly reduce costs and risks and improve reputation (Busch & Lewandowski, 2018; Albertini, 2013). Thus, EMCS appears to function as a “sustainability managerial capability” that has a relatively near-term effect on performance compared to the more general MCS.

The acceptance of H5 (leverage → performance) confirms that capital structure decisions are a critical determinant of performance, particularly in capital-intensive industries. Within the capital structure framework, appropriate leverage design can lower the cost of capital and maintain flexibility, enabling companies to finance value-added projects and avoid performance-damaging financial distress (Frank & Goyal, 2009; Öztekin, 2015). In the context of sustainability, leverage also serves as a transition financing mechanism: environmental investments, the implementation of environmental management systems, and carbon efficiency initiatives require stable and planned funding sources; therefore, capital structure decisions serve as a strategic channel linking control capabilities to dual performance (financial and environmental) outcomes (Flammer, 2021; Krueger et al., 2020).

The acceptance of H6 (MCS → leverage → performance) along with the rejection of H3 indicates full mediation: the influence of MCS on performance operates primarily through leverage. Substantively, MCS improves the quality of the financing decision process (H1) and these financing decisions become drivers of performance (H5), thus MCS appears to be a decision enabler whose effectiveness emerges when translated into financial policy (Malmi & Brown, 2008; Hair et al., 2019). This pattern is important for the sustainability literature because it confirms that general controls (MCS) do not automatically “produce sustainability outcomes”; they require economic decision channels to produce measurable performance impacts (Henri & Journeault, 2010; Busch & Lewandowski, 2018).

The acceptance of H7 (EMCS → leverage → performance) along with the acceptance of H4 indicates partial mediation: EMCS affects performance directly and through leverage. This indicates that EMCS has two simultaneous pathways: the operational/risk pathway (direct) and the financial pathway (through capital structure). This finding is consistent with the literature that environmental practices/capabilities can improve performance through efficiency and risk reduction, while still requiring financial support to maintain the sustainability of environmental programs and investments (Endrikat et al., 2014; Flammer, 2021).

4.2. Strengthening Sustainability: Transition Risk, Climate Disclosure, and Access to Sustainable Finance

The findings on the leverage mechanism become particularly relevant when interpreted within the framework of transition risk. Transition risks, including regulatory changes, shifting investor preferences, and carbon asset repricing, encourage carbon-intensive companies to demonstrate credible governance and transition strategies (Krueger et al., 2020; Bolton & Kacperczyk, 2021). In this context, an effective EMCS helps companies internalize environmental targets into their decision-making processes, while leverage serves as a tool to ensure adequate funding for transition strategies

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(Henri & Journeault, 2010; Flammer, 2021). These research findings suggest that companies need not simply improve environmental performance; they also need to "lock in" these strategies through capital structure design to ensure sustainable transition investments and uninterrupted financing constraints (Frank & Goyal, 2009; Öztekin, 2015).

From a climate disclosure perspective, structured standards and systems (e.g., ISO 14,001 and standardized emissions measurements) increase the credibility of environmental information and reduce perceptions of greenwashing , making disclosure more decision-making for investors and creditors (Busch & Lewandowski, 2018; Krueger et al., 2020). This disclosure credibility is important because markets increasingly respond to carbon risks in both stock prices and risk premiums, which ultimately affect the cost of capital and access to funding (Bolton & Kacperczyk, 2021; Krueger et al., 2020). Within the framework of access to sustainable finance, studies show that markets can respond positively to green/sustainability-based financing instruments when sustainability signals and governance are deemed credible, thus reinforcing the quality of environmental controls and the quality of funding decisions (Flammer, 2021; Tang & Zhang, 2020).

4.3. Theoretical Implications

First, this study extends the sustainability control literature by positioning capital structure as a financial mechanism explaining "how" control (MCS/EMCS) translates into performance. This helps explain why ESG–performance findings are often context-dependent : without including the economic decision channel, the relationship can appear weak or inconsistent (Endrikat et al., 2014; Busch & Lewandowski, 2018). Second, the distinction between full and partial mediation enriches our understanding of the role of general versus environmental controls: MCS tends to operate through financial policies, while EMCS has both direct and financial channels (Malmi & Brown, 2008; Henri & Journeault, 2010).

4.4. Practical Implications

For coal company management, these results suggest that improvements in MCS and EMCS need to be accompanied by improved financial governance: planning and capital budgeting should integrate environmental targets, while leverage policies should maintain flexibility to finance efficiency investments and environmental impact controls (Henri & Journeault, 2010; Öztekin, 2015). For regulators and policymakers, these findings indicate that strengthening environmental measurement/reporting standards and credibility can improve the quality of financial decisions and expand access to finance, thereby encouraging a more managed transition in carbon-intensive industries (Krueger et al., 2020; Flammer, 2021).

5. Conclusions

This study concludes that in carbon-intensive coal mining companies, both the Management Control System (MCS) and the Environmental Management Control System (EMCS) play a significant role in shaping capital structure (leverage) decisions and ultimately determining firm performance from a sustainability perspective. The test results show that both MCS and EMCS improve the quality of capital structure decisions (H1 and H2 are accepted), and leverage is proven to be a strong driver of firm performance (H5 is accepted). These findings confirm that sustainable performance in capital-intensive industries is not only determined by operational policies, but also by the company's ability to design funding that aligns with strategy and risk.

The main contribution of this study lies in the explanation of the mechanism. MCS does not directly affect performance (H3 is rejected), but does so through leverage (H6 is accepted), indicating that MCS operates primarily as a decision infrastructure that generates performance impacts when translated into financial decisions. In contrast, EMCS directly affects performance (H4 is accepted) and also through leverage (H7 is accepted), indicating that environmental control has two simultaneous pathways: the operational/risk pathway and the financial pathway. This pattern

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strengthens Sustainability's argument that an integrated environmental control system can drive dual performance through efficiency, legitimacy, risk reduction, and adequate financial support.

Practically, these findings suggest that coal firms should not separate sustainability initiatives from financial policy. Instead, MCS and EMCS should be embedded in planning, budgeting, and capital budgeting, alongside leverage policies that preserve financing flexibility for transition-related investments and environmental risk management. At the same time, the use of credible environmental indicators (e.g., standardized environmental management systems and emissions measurement) can strengthen the quality of sustainability information and market confidence, thereby improving access to financing that is increasingly sensitive to climate risk.

Overall, this study confirms that in carbon-intensive industries, leverage is the "bridge" connecting sustainability control capabilities to performance. By positioning capital structure decisions as a key mechanism, this study extends the sustainability control and corporate finance literature and offers relevant implications for companies, investors, and policymakers in managing the transition to more sustainable business practices.

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Abbreviations

The following abbreviations are used in this manuscript:

AVE	Average Variance Extracted
CMB	Common Method Bias
CR	Composite Reliability
CSD	Capital Structure Decision
EMCS	Environmental Management Control System
EMS	Environmental Management System
GHG	Greenhouse Gas
IDX	Indonesia Stock Exchange
ISO	International Organization for Standardization
MCS	Management Control System
PLS-SEM	Partial Least Squares Structural Equation Modeling

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