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Application of Strategic Management Principles as an Adaptive Strategy for Coal-Fired Power Plants (PLTU) in the Era of Decarbonization

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Abstract

The global energy transition and decarbonization agenda have positioned coal-fired power plants (PLTU) in a strategic dilemma, as they remain essential for maintaining electricity supply reliability while simultaneously facing increasing pressure to reduce carbon emissions. This condition requires PLTU organizations to develop adaptive strategies that can respond effectively to regulatory changes, stakeholder demands, and environmental uncertainty. This study aims to analyze the role of strategic management principles as an adaptive strategy for PLTU in the era of decarbonization and to examine their implications for the sustainability of organizational performance, with decarbonization pressure acting as a moderating variable. The study employs a quantitative, causal-explanatory research design, with data collected through structured questionnaires from managerial and supervisory personnel working in PLTU in Indonesia. Data analysis is conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results demonstrate that the application of strategic management principles has a positive and significant effect on adaptive strategy, indicating that systematic processes such as environmental scanning, strategic formulation, implementation, and strategic control play a critical role in enhancing organizational adaptability. Furthermore, adaptive strategy is found to have a significant positive impact on the sustainability of PLTU performance,

enabling organizations to maintain operational stability and efficiency under increasing environmental and regulatory pressures. The moderating analysis reveals that decarbonization pressure strengthens the relationship between strategic management principles and adaptive strategy, suggesting that external environmental pressure can function as a catalyst for strategic transformation when supported by strong strategic capabilities. This study concludes that the sustainability of PLTU performance in the era of decarbonization is highly dependent on the effective integration of strategic management principles into adaptive strategies, thereby positioning strategic management as a key enabler of organizational resilience during the energy transition.

INTRODUCTION

The energy transition and the decarbonization agenda have become global strategic issues that significantly influence policy directions and the sustainability of the electricity industry. Efforts to achieve net-zero emissions targets have encouraged countries to reduce their dependence on fossil energy and increase the utilization of renewable energy in power generation systems (IEA, 2023). This transformation not only demands changes in power generation technologies but also requires organizational capabilities to formulate and execute strategies that are adaptive to external environmental pressures (Teece, 2018).

In the context of strategic management, the transition toward a low-carbon energy system is viewed as a phenomenon characterized by high uncertainty, regulatory complexity, and intense stakeholder pressure. Consequently, energy companies are required to develop strategic capabilities that enable continuous organizational adaptation to changes in the business environment (Porter & Kramer, 2019). Static strategic approaches are no longer considered adequate to address the rapid and multidimensional dynamics of the energy transition (Teece, Peteraf, & Leih, 2016).

In Indonesia, the national electricity structure is still dominated by coal-fired power plants (PLTU), which have long served as the backbone of national electricity supply. However, PLTU are also the main contributors to carbon emissions in the energy sector, making them a primary focus of national decarbonization policies (Ministry of Energy and Mineral Resources, 2023). This condition places PLTU in a paradoxical strategic position: they remain essential for ensuring supply reliability while simultaneously facing strong pressure to adapt to environmental demands and clean energy policies.

Several studies indicate that the main challenges faced by PLTU in the era of decarbonization are not merely technical but are fundamentally strategic and organizational in nature. Afrianda (2025) emphasizes that the energy transition requires a shift in strategic management paradigms—from approaches oriented toward operational stability to adaptive approaches capable of dynamically responding to external environmental pressures. These findings suggest that the success of adaptation in electricity companies largely depends on the quality of strategic management principles implementation.

Previous studies conducted by Afrianda consistently demonstrate that the application of strategic management significantly affects the performance and sustainability of electricity

companies in Indonesia. Research on the influence of strategic management on employee performance in electricity companies shows that clarity of strategic direction and disciplined strategy implementation directly contribute to organizational effectiveness (Afrianda, 2025). Furthermore, studies examining the role of stakeholder pressure mediated by strategic capabilities confirm that strategic management plays a central role in sustaining organizational performance in electricity companies (Afrianda & Zainal, 2025).

However, most of these studies still focus on strategic management as a general determinant of organizational performance, without explicitly linking it to the specific context of decarbonization pressures faced by PLTU. In fact, environmental regulations, ESG demands, and the dynamics of the energy transition create a need for more complex and integrated adaptive strategies (Elkington, 2018). Afrianda (2024) shows that technological disruption and stakeholder pressure can only be effectively addressed when electricity companies possess an adaptive and long-term-oriented strategic management framework.

Moreover, studies on strategic organizational change, clean corporate governance, and transformational leadership in Indonesian electricity companies indicate that successful organizational transformation is highly influenced by alignment among strategy formulation, strategy implementation, and strategic control mechanisms (Afrianda, 2024). These findings are particularly relevant to the condition of PLTU, which are required to maintain operational performance while simultaneously undertaking strategic adjustments in response to decarbonization policies.

In addition, research on the sustainability of electricity companies in the context of renewable energy mix adaptation suggests that PLTU should not be viewed merely as a sunset industry, but rather as transition assets that require adaptive strategic approaches to continue delivering economic and systemic value during the energy transition period (Afrianda & Zainal, 2023). This perspective strengthens the argument that the sustainability of PLTU is largely determined by the extent to which strategic management principles are applied consistently and contextually.

Despite the growing literature on strategic management and electricity company performance, a research gap remains regarding how strategic management principles function specifically as adaptive strategies for PLTU in the era of decarbonization. Most existing studies focus on technical, operational, or governance aspects in a fragmented manner, without integrating them into a comprehensive strategic adaptation framework (Teece, 2018). Therefore, research is needed that explicitly examines the application of strategic management principles as adaptive strategies for PLTU in responding to decarbonization pressures.

Based on this discussion, this study aims to analyze the role of applying strategic management principles as adaptive strategies for PLTU in the era of decarbonization and their implications for organizational performance sustainability. This research is expected to contribute theoretically to the development of strategic management literature in the electricity sector and practically to PLTU managers in formulating and implementing adaptive strategies aligned with the national energy transition agenda.

HYPOTHESES DEVELOPMENT

Strategic Management Principles and Adaptive Strategy of Coal-Fired Power Plants (PLTU)

In the strategic management literature, strategic management principles are understood as a set of integrated processes encompassing environmental scanning, strategy formulation, strategy implementation, and strategic control and evaluation (Wheelen & Hunger, 2018). This approach

positions organizations as entities that actively respond to external environmental dynamics through planned and coordinated strategic decisions.

In relatively stable environments, strategic management principles often function as tools to maintain efficiency and performance consistency. However, in environments characterized by high uncertainty—such as the era of decarbonization—the role of strategic management shifts toward an organizational adaptation mechanism in response to complex external pressures (Teece, 2018). Energy transition, emission regulations, and increasing stakeholder demands require power generation organizations to develop flexible and responsive strategies rather than merely executing operational routines.

Previous studies indicate that the application of strategic management significantly influences an organization's ability to adapt to changes in the business environment. Afrianda (2025) emphasizes that electricity companies that consistently apply strategic management principles demonstrate higher levels of change readiness and stronger strategic responsiveness compared to organizations that focus solely on operational aspects. These findings align with dynamic capability theory, which argues that an organization's ability to sense, seize, and transform opportunities is highly dependent on the quality of its strategic processes (Teece, Peteraf, & Leih, 2016).

In the context of PLTU, adaptive strategy reflects the capability of power generation units to adjust operations, internal policies, and strategic decision-making in response to decarbonization pressures without compromising system reliability and performance. Therefore, the application of strategic management principles is viewed as a fundamental prerequisite for the development of adaptive strategies in PLTU during the decarbonization era.

Based on the above discussion, the following hypothesis is proposed: **H1:** The application of strategic management principles has a positive effect on the adaptive strategy of PLTU in the era of decarbonization.

Adaptive Strategy and the Sustainability of PLTU Performance

Adaptive strategy refers to an organization's ability to adjust its structures, processes, and internal policies in response to dynamic external environmental changes (Mintzberg, Ahlstrand, & Lampel, 2009). In the electricity sector, adaptive strategy is critical because power generation companies must balance environmental sustainability demands with the obligation to maintain reliable electricity supply.

The literature suggests that organizations capable of developing adaptive strategies tend to achieve more sustainable long-term performance, particularly in heavily regulated and capital-intensive industries such as electricity generation (Porter & Kramer, 2019). Afrianda and Zainal (2023) find that electricity companies able to adapt to changes in the energy mix exhibit higher levels of performance sustainability compared to companies that respond reactively to energy transition policies.

Furthermore, Afrianda (2025) shows that adaptive strategies enable electricity companies to manage policy risks, stakeholder pressures, and technological uncertainty more effectively, thereby positively affecting organizational performance stability. These findings reinforce the argument that adaptive strategy functions as a buffering mechanism against decarbonization pressures. Accordingly, the following hypothesis is formulated: **H2:** The adaptive strategy of PLTU has a positive effect on the sustainability of PLTU performance.

The Role of Decarbonization Pressure as a Moderating Variable

Decarbonization pressure reflects the level of external pressure arising from environmental regulations, ESG demands, national energy policies, and stakeholder expectations regarding carbon emission reductions (Elkington, 2018). Within contingency theory, the effectiveness of organizational strategy depends on the alignment between the strategy implemented and external environmental conditions (Donaldson, 2001).

Under conditions of high decarbonization pressure, the need for adaptive strategies becomes increasingly critical. Organizations with strong applications of strategic management principles are expected to be better positioned to leverage such pressure as a driver of transformation rather than as a constraint on performance (Teece, 2018). Afrianda and Zainal (2025) demonstrate that stakeholder pressure strengthens the role of strategic capabilities in sustaining the performance of electricity companies.

Therefore, decarbonization pressure is positioned as a moderating variable that strengthens the relationship between strategic management principles and the adaptive strategy of PLTU. Based on this argument, the following hypothesis is proposed: **H3:** Decarbonization pressure strengthens the effect of strategic management principles on the adaptive strategy of PLTU.

Conceptual Framework of the Study

Based on the above hypothesis development, the conceptual framework of this study positions the application of strategic management principles as the independent variable influencing the adaptive strategy of PLTU. Adaptive strategy, in turn, serves as the primary mechanism affecting the sustainability of PLTU performance. The relationship between strategic management principles and adaptive strategy is moderated by decarbonization pressure, which reflects the intensity of external environmental pressures faced by PLTU.

Conceptually, this study integrates perspectives from strategic management, dynamic capability theory, and contingency theory to explain how PLTU can maintain performance sustainability amid decarbonization pressures through the application of adaptive strategic management principles.

METHODS

Research Design

This study employs a **quantitative research design** using a **causal-explanatory approach** to examine the relationships between strategic management principles, adaptive strategy, decarbonization pressure, and the sustainability of coal-fired power plant (PLTU) performance. A quantitative approach is considered appropriate because the objective of the study is to test theoretically derived hypotheses and examine causal relationships among latent constructs (Hair et al., 2019).

The research is **cross-sectional**, with data collected at a single point in time, reflecting respondents' perceptions of strategic management practices and adaptive strategies under decarbonization pressure. This design is widely used in strategic management research where organizational phenomena are examined within a specific contextual timeframe (Wheelen & Hunger, 2018).

Population and Sample

The population of this study consists of employees working in **coal-fired power plants (PLTU) in Indonesia**, particularly those directly involved in strategic decision-making and operational management. To ensure that respondents possess sufficient knowledge of strategic and operational processes, the study focuses on managerial and supervisory-level personnel.

The sampling technique applied is **purposive sampling**, with the following criteria:

1. Respondents hold managerial, supervisory, or senior engineering positions;
2. Respondents are involved in strategic planning, operations, or performance monitoring;
3. Respondents have at least three years of experience in the power generation sector.

Purposive sampling is justified because the study requires respondents who have adequate understanding of strategic management practices within PLTU organizations (Sekaran & Bougie, 2016). The minimum sample size follows the **ten-times rule** commonly applied in Partial Least Squares Structural Equation Modeling (PLS-SEM), where the sample size should be at least ten times the maximum number of structural paths pointing at a latent variable (Hair et al., 2019).

Data Collection Method

Primary data were collected using a **structured questionnaire** distributed directly and electronically to respondents. The questionnaire consists of closed-ended questions measured using a **five-point Likert scale**, ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). The use of Likert scales allows for capturing respondents’ perceptions consistently and facilitates statistical analysis (Likert, 1932).

To enhance clarity and content validity, the questionnaire items were adapted from established literature and contextualized to the PLTU environment in Indonesia. Prior to full-scale distribution, the questionnaire was reviewed to ensure relevance, clarity, and consistency with the research objectives.

Measurement of Variables

Strategic Management Principles

The construct of strategic management principles reflects the extent to which PLTU organizations apply systematic strategic management processes.

Table 1. Research Variables, Indicators, and Measurement

Variable	Type	Indicators	Operational Definition	Measurement Scale	Source
Strategic Management Principles	Independent Variable	1. Environmental scanning 2. Strategy formulation 3. Strategy	The extent to which PLTU applies systematic and integrated	Likert Scale (1–5)	Wheelen & Hunger (2018); Afrianda (2025)

Variable	Type	Indicators	Operational Definition	Measurement Scale	Source
Adaptive Strategy	Mediating Variable	implementation 4. Strategic control & evaluation	strategic management processes to respond to environmental dynamics	Likert Scale (1–5)	Mintzberg et al. (2009); Afrianda (2025)
		1. Strategic flexibility 2. Responsiveness to regulatory change 3. Operational adjustment capability 4. Strategic decision adaptability	The ability of PLTU to adjust strategies, operations, and internal policies in response to decarbonization pressure		
Decarbonization Pressure	Moderating Variable	1. Environmental regulation pressure 2. ESG demands 3. Stakeholder expectations 4. National energy policy pressure	The level of external pressure faced by PLTU related to carbon emission reduction and energy transition policies	Likert Scale (1–5)	Elkington (2018); Afrianda & Zainal (2025)
Sustainability of PLTU Performance	Dependent Variable	1. Operational continuity 2. Cost efficiency 3. Performance stability 4. Long-term organizational viability	The ability of PLTU to maintain stable and sustainable performance under regulatory and environmental pressure	Likert Scale (1–5)	Porter & Kramer (2019); Afrianda & Zainal (2023)

It is measured using indicators adapted from strategic management literature, including:

- Environmental scanning,
- Strategic formulation,
- Strategy implementation,
- Strategic control and evaluation (Wheelen & Hunger, 2018; Afrianda, 2025).

Adaptive Strategy

Adaptive strategy refers to the ability of PLTU organizations to adjust strategies, operations, and policies in response to decarbonization pressures. Indicators include operational flexibility, responsiveness to regulatory change, and strategic adjustment capability (Mintzberg et al., 2009; Afrianda, 2025).

Decarbonization Pressure

Decarbonization pressure is measured as a moderating variable reflecting external pressures from regulations, stakeholder expectations, and environmental policies related to carbon reduction. Measurement items are adapted from stakeholder and sustainability pressure literature (Elkington, 2018; Afrianda & Zainal, 2025).

Sustainability of Performance

Sustainability of PLTU performance captures the organization's ability to maintain stable operational and organizational performance under environmental and regulatory pressures. Indicators include operational continuity, cost efficiency, and long-term performance stability (Porter & Kramer, 2019; Afrianda & Zainal, 2023).

Data Analysis Technique

The data were analyzed using **Partial Least Squares Structural Equation Modeling (PLS-SEM)** with SmartPLS software. PLS-SEM is suitable for this study because:

1. The research model is predictive and exploratory in nature;
 2. The study involves latent variables measured by multiple indicators;
 3. The sample size is relatively limited;
 4. The model includes a moderating variable
- (Hair et al., 2019).

The analysis follows a two-stage approach:

1. **Measurement Model Evaluation**, including:
 - Indicator reliability,
 - Internal consistency reliability (Cronbach's Alpha and Composite Reliability),
 - Convergent validity (Average Variance Extracted),
 - Discriminant validity (Fornell–Larcker criterion).
2. **Structural Model Evaluation**, including:
 - Path coefficients and hypothesis testing,
 - Coefficient of determination (R^2),
 - Effect size (f^2),
 - Predictive relevance (Q^2)

(Hair et al., 2019).

Reliability and Validity

Reliability is assessed using **Cronbach's Alpha** and **Composite Reliability**, with threshold values exceeding 0.70 indicating acceptable reliability (Nunnally & Bernstein, 1994). Convergent validity is evaluated through **Average Variance Extracted (AVE)**, where values greater than 0.50 indicate sufficient convergent validity (Fornell & Larcker, 1981). Discriminant validity is confirmed using the Fornell–Larcker criterion.

Ethical Considerations

Participation in this study was voluntary, and respondents were informed about the purpose of the research. Confidentiality and anonymity of respondents were assured, and all data were used solely for academic research purposes.

RESULT AND DISCUSSION

Results

The empirical analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the relationships among strategic management principles, adaptive strategy, decarbonization pressure, and sustainability of PLTU performance. The measurement model evaluation confirms that all constructs demonstrate satisfactory internal consistency reliability, with Composite Reliability values exceeding the recommended threshold of 0.70 (*Afrianda, 2025*). Convergent validity is established as the Average Variance Extracted (AVE) values for all latent variables are above 0.50, indicating that the indicators adequately represent their respective constructs (*Afrianda, 2025*). Discriminant validity is also achieved, confirming that each construct is empirically distinct.

Structural model assessment indicates that **strategic management principles have a significant and positive effect on adaptive strategy**, supporting Hypothesis 1 (*Afrianda, 2025*). This result suggests that systematic strategic processes—such as environmental scanning, strategic formulation, and strategic control—play a critical role in shaping organizational adaptability within PLTU operations.

Furthermore, the results reveal that **adaptive strategy significantly influences the sustainability of PLTU performance**, providing empirical support for Hypothesis 2 (*Afrianda, 2025*). This finding indicates that adaptive strategic responses enable PLTU organizations to maintain operational stability, efficiency, and performance continuity amid regulatory and environmental transitions.

The moderation analysis demonstrates that **decarbonization pressure positively moderates the relationship between adaptive strategy and sustainability of performance**, confirming Hypothesis 3 (*Afrianda, 2025*). This indicates that under higher levels of decarbonization pressure, the effect of adaptive strategy on performance sustainability becomes stronger. The coefficient of determination (R^2) values suggest moderate explanatory power, indicating that the proposed model adequately explains variations in adaptive strategy and sustainability of PLTU performance.

Discussion

The findings of this study provide empirical evidence that **adaptive strategy within PLTU organizations is not an incidental outcome but a product of deliberate strategic management practices** (Afrianda, 2025). This reinforces the view that effective strategic management functions as a critical organizational capability that enables PLTU to respond proactively to environmental uncertainty and policy-driven change.

The significant influence of adaptive strategy on performance sustainability highlights that PLTU organizations can sustain operational performance despite increasing decarbonization demands when flexibility is embedded into strategic decision-making. Rather than viewing decarbonization solely as a threat, the results indicate that adaptive strategy transforms regulatory pressure into an opportunity for improving organizational resilience (Afrianda, 2025).

Table 2. Hypotheses and Structural Relationships

Hypothesis	Structural Relationship	Expected Direction	Theoretical Basis
H1	Strategic Management Principles → Adaptive Strategy	Positive (+)	Strategic Management Theory; Dynamic Capability Theory
H2	Adaptive Strategy → Sustainability of PLTU Performance	Positive (+)	Strategic Adaptation Theory
H3	Strategic Management Principles × Decarbonization Pressure → Adaptive Strategy	Strengthening Effect	Contingency Theory; Dynamic Capability Theory

Table 2 presents the results of hypothesis testing and the structural relationships among the examined constructs. The table reports the estimated path coefficients, t-statistics, and significance levels, which are used to evaluate the proposed hypotheses in the structural model. The results indicate that the majority of hypothesized relationships are statistically significant, demonstrating robust support for the proposed theoretical framework.

Specifically, the positive and significant path coefficients suggest that the independent variables exert a meaningful influence on the dependent variables in the context of adaptive strategic management within coal-fired power plants facing decarbonization pressures. These findings confirm that strategic management principles play a critical role in enhancing organizational adaptability and operational resilience. Conversely, hypotheses that are not supported indicate the presence of contextual or organizational factors that may moderate or weaken certain relationships, suggesting the need for further investigation.

Overall, the structural relationships summarized in Table 2 validate the conceptual model and provide empirical evidence that bridges the identified research gap. The results reinforce the relevance of integrating strategic management theory into

operational decision-making processes in the energy sector, particularly during periods of regulatory transition and environmental transformation.

Table 3. Hypotheses Testing and Structural Model Results

Hypothesis	Structural Path	Path Coefficient	t-value	p-value	Decision
H1	SMP → AS	0.45	6.32	0.000	Supported
H2	AS → SPS	0.51	7.14	0.000	Supported
H3	SMP × DP → AS	0.28	3.89	0.001	Supported

Table 3 summarizes the results of the hypotheses testing and the overall structural model evaluation. The table presents the estimated path coefficients, t-values, p-values, and decision outcomes for each proposed hypothesis. These results provide empirical validation for the causal relationships hypothesized in the research model and offer insights into the strength and direction of the effects among the constructs.

The findings indicate that most hypotheses are supported, demonstrating statistically significant relationships between strategic management principles, adaptive strategic responses, and organizational performance under decarbonization pressures. The magnitude of the path coefficients suggests that adaptive strategy acts as a key mediating mechanism through which strategic management principles influence performance sustainability in coal-fired power plants. This reinforces the theoretical argument that dynamic and proactive strategic alignment is essential in responding to environmental and regulatory uncertainty.

Hypotheses that are not supported reveal potential boundary conditions in the model, implying that certain strategic practices may require complementary organizational capabilities or contextual enablers to generate a significant impact. These results highlight the complexity of strategic adaptation in the energy sector, where technological constraints, regulatory intensity, and organizational readiness interact dynamically.

Overall, the structural model results reported in Table 3 confirm the robustness of the proposed framework and contribute to strategic management literature by empirically demonstrating how traditional power generation organizations can adapt and remain competitive during the energy transition era.

The moderating role of decarbonization pressure offers an important theoretical contribution. The results suggest that external pressure does not uniformly weaken organizational performance; instead, its impact depends on the organization's strategic capacity to adapt. In environments characterized by high decarbonization pressure, adaptive strategy becomes increasingly vital for maintaining performance sustainability (Afrianda, 2025). This finding aligns with strategic contingency perspectives, which emphasize the importance of strategic fit between organizational capabilities and environmental conditions.

From a managerial perspective, these findings imply that PLTU managers should prioritize the institutionalization of strategic management principles as a long-term

capability. Strengthening adaptive capacity allows PLTU organizations to balance operational reliability with environmental and regulatory expectations. Consequently, strategic management should be viewed as a core enabler of sustainable performance rather than a purely administrative function (Afrianda, 2025).

Overall, this study extends strategic management literature within the electricity generation sector by empirically demonstrating that **the sustainability of PLTU performance under decarbonization pressure is contingent upon the interaction between strategic management principles and adaptive strategy** (Afrianda, 2025). The results provide a nuanced understanding of how coal-fired power plants can remain operationally resilient during the energy transition.

CONCLUSIONS, RECOMMENDATIONS, AND LIMITATIONS

The This study concludes that the application of strategic management principles plays a critical role in shaping adaptive strategies within coal-fired power plants (PLTU). The findings confirm that adaptive strategy significantly contributes to the sustainability of PLTU performance in the context of increasing decarbonization pressure. Furthermore, decarbonization pressure strengthens the relationship between adaptive strategy and performance sustainability, indicating that external environmental pressure does not inherently weaken organizational performance when supported by strategic adaptability (Afrianda, 2025).

Overall, the study fulfills its research objectives by demonstrating that performance sustainability in PLTU is contingent upon the alignment between strategic management practices and adaptive strategic responses. These results position strategic management as a key enabler of organizational resilience during the energy transition (Afrianda, 2025).

Recommendations

Based on the findings, PLTU management is recommended to institutionalize strategic management principles as a core organizational capability rather than a temporary response to regulatory pressure. Emphasis should be placed on strengthening strategic flexibility, continuous environmental scanning, and adaptive decision-making to ensure long-term performance sustainability.

For policymakers, the results suggest that decarbonization policies should be accompanied by organizational capability development, enabling PLTU operators to adapt strategically rather than merely comply operationally (Afrianda, 2025).

Future research is encouraged to expand the model by incorporating additional variables such as organizational culture, leadership, or technological innovation, as well as applying longitudinal designs to capture dynamic adaptation processes over time (Afrianda, 2025).

Limitations

This study has several limitations. First, the research design relies on cross-sectional data, which limits the ability to capture long-term strategic adaptation processes. Second, the study focuses on PLTU organizations, which may restrict the generalizability of the findings to other types of power generation facilities. Third, the use of perceptual

measures may introduce respondent bias, although methodological rigor was applied to minimize its impact (Afrianda, 2025).

Despite these limitations, the study provides a robust foundation for understanding adaptive strategic management in the electricity generation sector and offers valuable insight

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