



Risk Maturity and Cash Depletion: A Dynamic Quadrant Analysis of Energy Firms

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Abstract

Energy firms face acute pressure to preserve financial resources while maintaining robust risk governance, yet they frequently experience severe cash depletion. This study examines how risk governance maturity relates to cash depletion among six IDX-listed energy companies from 2021 to 2024. Drawing on the Levers of Control framework, the Risk Maturity Index (RMI) is conceptualized as a boundary system, and a high Net Burn Rate (NBR) is framed as sustained net cash depletion. Utilizing Mean Comparison Analysis and a Dynamic Quadrant Matrix, observations were classified relative to the mean RMI (3.94) into four quadrants: High Resilience, Vulnerable, High Burn, and Passive Efficiency. The findings reveal that while formal risk maturity is relatively high (mean RMI of 3.94), a significant portion of observations experience high cash depletion, concentrated across the Vulnerable (41.67%) and High Burn quadrants. This demonstrates that formal risk compliance does not automatically guarantee cash resilience. For managers, these results highlight the urgency of integrating risk maturity with active capital allocation strategies. For regulators, it emphasizes the need to evaluate risk governance beyond mere administrative compliance to ensure true financial sustainability.

Keywords: *Risk Maturity Index, Net Burn Rate, boundary systems, managerial financial burnout, Listed energy firms, Dynamic Quadrant Matrix*

INTRODUCTION

Listed energy firms are vital economic drivers and foreign exchange earners, yet they face severe liquidity volatility following the pandemic and during ongoing energy transitions [Huo et al., \(2025\)](#). In this capital-intensive industry, cash availability is fundamental to corporate survival. However, many energy companies continue to experience severe cash depletion, operating with high Net Burn Rates (NBR) despite maintaining formally mature risk governance structures.

Previous Enterprise Risk Management (ERM) literature has extensively explored the design of risk frameworks, yet findings regarding their impact on tangible firm performance remain inconclusive [Ittner \(2019\)](#); [Görtz et al., \(2022\)](#). While the RMI has been formalized through the [Ministry of State-Owned Enterprises \(2023\)](#) guidelines and examined within the Indonesian energy sector [Effendi \(2025\)](#); [Widjaja \(2026\)](#), these studies rarely link risk maturity to direct financial outcomes like corporate cash holdings. Romeike (2021) suggests this disconnect occurs because risk governance often acts as a mere paper-based boundary system that fails to constrain actual risk-taking behavior in capital allocation. Furthermore, current literature [Januardi et al., \(2026\)](#); [Tavakoli et al., \(2024\)](#) has not adequately addressed how formal risk compliance interacts with cash depletion at the firm level.

To address this gap, this study draws on the Levers of Control framework [Simons \(1995\)](#) to conceptualize RMI as a boundary system, while framing high NBR as a manifestation of sustained net cash depletion, adapting from the Conservation of Resources Theory [Hobfoll \(1989\)](#). Specifically, this study aims to examine the relationship between risk governance maturity and cash resilience among IDX-listed energy companies. By applying a Dynamic Quadrant Matrix (DQM), the

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analysis maps companies into four strategic quadrants: High Resilience, Vulnerable, High Burn, and Passive Efficiency. Ultimately, this research contributes to the ERM and control systems literature by providing empirical evidence on how formal risk design translates into actual financial sustainability, extending the understanding of boundary systems in practice.

LITERATURE REVIEW

Levers of Control and Boundary Systems

Corporate control systems function not merely as compliance mechanisms but as strategic instruments directing organizational behavior toward stated objectives [Merchant & Van der Stede, \(2017\)](#); [Fraser & Simkins \(2010\)](#). [Simons' \(1995\)](#) identifies four control levers — belief systems, boundary systems, diagnostic control systems, and interactive control systems — among which boundary systems are most relevant to risk control. They operate through negative guidance, establishing explicit constraints and risk-exposure thresholds that organizations must not exceed. In capital-intensive, high-risk industries such as energy, the effectiveness of boundary systems is directly tested by market uncertainty and potential operational losses [Effendi \(2025\)](#).

RMI as a Proxy for Boundary Systems

Risk maturity assessment operationalizes this function by reflecting how deeply risk management principles are embedded in a firm's strategy and operations, as codified in the [COSO \(2017\)](#) framework and, in Indonesia, the Ministry of State-Owned Enterprises' technical guideline (SOEs) [Kementerian BUMN, \(2023\)](#). Empirical findings on what a high maturity score actually captures are mixed. [Romeike \(2021\)](#), [Firmansyah et al. \(2026\)](#), [Tavakoli et al. \(2016\)](#), a high aggregate maturity score coexisted with weak performance on specific risk dimensions, since the aggregate masked internal variation. Together, these studies suggest RMI captures the formal existence of boundary systems but says little about whether they are enforced — a gap this study addresses by pairing RMI with a cash-based outcome. [Luna Bianca and Bayangkara \(2021\)](#), [Simanjuntak et al. \(2025\)](#) and [Yunus and Mannan \(2026\)](#) review risk management practices at PLN without testing the RMI–cash link directly — the specific gap this study fills for the energy sector.

NBR and COR Theory

This study also draws on COR Theory, which holds that actors strive to obtain, retain, and protect resources, and that stress arises when resources are lost faster than they can be replenished [Hobfoll \(1989\)](#). [Anjelina et al. \(2023\)](#) show that cash planning and control function as a resource-protection mechanism in this sense. NBR is a condition in which a firm records sustained net cash depletion across consecutive periods, observable through the NBR and intended as a descriptive label for a pattern rather than a psychological diagnosis [Lailani et al., \(2005\)](#), [Hendryadi \(2017\)](#), a low RMI signals a boundary system that has not established clear limits on risk-taking.

RESEARCH METHODOLOGY

Research Design and Data

This study employs a quantitative, descriptive-diagnostic design to map the relationship between risk governance maturity and cash depletion among listed energy firms. Secondary data were collected from official corporate annual reports, sustainability reports, and risk governance disclosures spanning the 2021–2024 observation window. The temporal scope was selected to capture post-pandemic liquidity volatility, commodity price fluctuations, and capital-intensive energy transition pressures within the sector.

Population and Sample

The population comprises energy-sector companies listed on the Indonesia Stock Exchange (IDX). Purposive sampling was applied based on three specific criteria: (1) the firm formally discloses a RMI score or equivalent risk governance maturity metric in its annual or sustainability reports; (2) RMI and financial data are available consistently across the 2021–2024 period; and (3) sufficient beginning- and end-of-year cash and cash equivalent data are accessible to compute the NBR.

To address data comparability between SOEs and private issuers, normalization was applied. SOE issuers (PTBA and PGAS) formally derive RMI from the Ministry of SOE Regulation (PER-2/MBU/03/2023), utilizing a 0–5 scale. For private issuers (ADRO, ADMR, ABMM, and AADI), RMI data were extracted from audited risk governance disclosures and GCG reports structured around the COSO (2017) framework, ensuring alignment to the standardized 0–5 scale. For spinoffs like AADI, pre-listing data were traced through corporate prospectuses and consolidated annual reports. Ultimately, six companies met all criteria, yielding 24 balanced firm-year observations suitable for descriptive-diagnostic mapping, thereby minimizing scaling discrepancies between ownership types.

Variable Definition and Measurement

RMI

Measures the institutional depth and formal embedding of a firm's risk management practices, evaluated on a scale from 0 (non-existent/ad-hoc) to 5 (optimized).

NBR

Measures the rate at which a company depletes or accumulates net cash reserves. To ensure cross-firm comparability given varying company scales, NBR is expressed as a scaled ratio relative to opening cash balances. All financial figures are reported in billions of Indonesian Rupiah (IDR). Crucially, NBR reflects *total* net cash movements—encompassing operating, investing, and financing cash flows (such as debt issuances, capital expenditures, or asset divestments)—rather than strictly operational burn. A positive NBR value indicates net cash depletion (cash burn), interpreted as sustained resource strain, whereas a negative value signifies net cash accumulation.

Data Analysis Techniques

The NBR itself is calculated as the simple difference between the opening and closing cash balances of year t , expressed as:

$$NBR_t = (\text{Opening Cash}_t - \text{Closing Cash}_t) / \text{Opening Cash}_t$$

The analytical procedure integrates Mean-Centering Analysis (MCA), Mean Comparison Analysis, and a DQM.

1. Mean-Centering Analysis: Positions each firm-year observation relative to the sample grand means of RMI ($\bar{X}_{\text{RMI}} = 3.94$) and NBR ratio ($\bar{X}_{\text{NBR}} = -10.08\%$). The grand mean is utilized as an objective threshold to avoid arbitrary classification bias.
2. Mean Comparison Analysis: Groups observations into two tiers based on the RMI grand mean ($\text{RMI} \geq \text{sample mean}$ vs. $\text{RMI} < \text{sample mean}$) to evaluate comparative differences in mean NBR behavior.
3. DQM: Maps observations across four strategic categories to track temporal trajectories:
 - a. High Resilience: Above-average RMI pairs with below-average NBR, indicating low cash burn.

- b. Vulnerable: RMI above the sample mean, but NBR above the sample mean (high cash depletion).
- c. High Burn: RMI below the sample mean and NBR above the sample mean.
- d. Passive Efficiency: RMI below the sample mean and NBR below the sample mean.

FINDING AND DISCUSSION

This section presents DQM results from 24 firm-year observations of six IDX-listed energy companies from Annual Reports 2021–2025. Using MCA and the DQM, the analysis RMI relates to operating cash stability.

Table 1. Descriptive Statistics of the Risk Maturity Index and Net Burn Rate

Variabel	N	Mean	Min	Max	Std. Dev.
RMI	24	3.94	3.00	4.40	0.43
NBR Ratio (%)	24	-10.08%	-182.80%	99.13%	66.16%

Descriptive Analysis of the Research Variables

Table 1 shows the RMI averaging 3.94 on a five-point scale, with a low standard deviation of 0.43. This indicates that the sampled energy companies implemented risk governance at a mature level. However, data distribution reveals scores ranging from 3.00 to 4.40. Firms with the minimum score demonstrate substantial room for improvement in operational safeguards; as Romeike (2021) noted, such gaps can expose companies to unforeseen vulnerabilities, highlighting varied risk-control implementations across the sector.

Furthermore, the NBR variable—now expressed as a scale-adjusted ratio to ensure comparability—has a mean value of -10.08%, with a minimum value of -182.80% and a maximum value of 99.13%. The relatively high standard deviation of 66.16% reflects substantial fluctuations in liquidity conditions among energy-sector companies during the 2021–2024 period. The negative mean NBR ratio (-10.08%) indicates that, in aggregate, corporations in this sector experienced a net cash accumulation (surplus) equivalent to roughly 10% of their opening cash balances, driven by post-pandemic commodity windfalls. However, the extreme maximum burn rate of 99.13% also highlights that certain firm-years suffered severe and rapid cash depletion. This condition aligns with the resource stress parameters outlined by Hobfoll (1989) and Lailani et al. (2005), illustrating the intense liquidity pressures faced during capital-intensive transitions.

Comparative Analysis of Mean NBR by RMI Level

To examine the initial pattern of the relationship between RMI and NBR, observations were classified into two groups based on their position relative to the sample mean (grand mean RMI = 3.94).

Table 2. Comparison of Mean NBR by RMI Group

Group	N	Mean NBR Ratio (%)	Interpretation
RMI ≥ Sample Mean	16	-8.15%	Relatively better cash preservation

Group	N	Mean NBR Ratio (%)	Interpretation
RMI < Sample Mean	8	-13.94%	Higher cash depletion

Higher RMI companies exhibited lower mean NBR, supporting that mature risk governance mitigates cash depletion.

Changes in Quadrant Positions

Each firm-year observation was plotted in the DQM using grand-mean RMI 3.94 and NBR Ratio -10.08%.

Figure 3. DQM of RMI and NBR

High Burn	Vulnerable
Variable: ABMM: 2022, 2023 PGAS: 2023 PTBA: 2023, 2024	Variable: AADI: 2023, 2024 ADMR: 2021, 2024 PGAS: 2022 ABMM: 2024 ADRO: 2021, 2023, 2024 PTBA: 2021
Passive Efficiency	High Resilience
Variable: ABMM: 2021 PGAS: 2024 PTBA: 2022	Variable: AADI: 2021, 2022 ADRO: 2022 ADMR: 2022, 2023 PGAS: 2021

Dynamic trajectories reveal distinct volatility across firms. Unlike unscaled measurements, the adjusted matrix shows that AADI, ADMR, and ADRO did not remain persistently Vulnerable. Instead, they briefly achieved High Resilience (2021–2022) before deteriorating into the Vulnerable quadrant by 2023–2024. This indicates that while maintaining high, stable RMI scores, their formal boundary systems failed to sustain long-term cash resilience against subsequent external pressures. Furthermore, ABMM exhibited substantial RMI improvement, peaking at 4.40 in 2024, yet its quadrant position improved only with a time lag and never reached High Resilience. Conversely, PTBA demonstrated the clearest deterioration, with declining RMI scores accompanied by a sustained movement into the High Burn quadrant. Overall, transitions into High Resilience occurred for several firms but were short-lived, failing to persist throughout the observation window. This underscores the highly contextual and dynamic effectiveness of boundary systems in practice.

Table 4. Quadrant Distribution

Company	Quadrant	Definition	Number of Observations	Percentage
AADI: 2021, 2022 ADMR: 2022, 2023 ADRO: 2022 PGAS: 2021	High Resilience	$RMI \geq \text{mean}, NBR < \text{rata-rata}$	6	25%
AADI: 2023, 2024 ABMM: 2024 ADRO: 2021, 2023, 2024 ADMR: 2021, 2024 PGAS: 2022 PTBA: 2021	Vulnerable	$RMI \geq \text{mean}, NBR \geq \text{rata-rata}$	10	41.67%
ABMM: 2022, 2023 PGAS: 2023 PTBA: 2023, 2024	High Burn	$RMI < \text{mean}, NBR \geq \text{rata-rata}$	5	20.83%
ABMM: 2021 PGAS: 2024 PTBA: 2022	Passive Efficiency	$RMI < \text{mean}, NBR < \text{rata-rata}$	3	12.50%

Table 5. Firm-Year Quadrant Mapping

Code	Year	RMI	NBR Ratio (%)	Quadrant
AADI	2021	4.25	-36.63%	High Resilience
	2022	4.25	-86.64%	
	2023	4.25	25.02%	Vulnerable
	2024	4.25	40.08%	
ABMM	2021	3.50	-117.21%	Passive Efficiency
	2022	3.30	6.60%	High Burn
	2023	3.70	14.89%	
	2024	4.40	9.68%	Vulnerable
ADMR	2021	4.25	99.13%	High Resilience
	2022	4.25	-182.80%	

Code	Year	RMI	NBR Ratio (%)	Quadrant
ADRO	2023	4.25	-14.67%	Vulnerable
	2024	4.25	-4.46%	
	2021	4.25	94.39%	High Resilience
	2022	4.25	-124.57%	
	2023	4.25	18.59%	Vulnerable
	2024	4.25	57.54%	
PGAS	2021	3.97	-27.50%	High Resilience
	2022	4.18	3.70%	Vulnerable
	2023	3.40	14.02%	High Burn
	2024	3.60	-11.12%	Passive Efficiency
PTBA	2021	3.98	-1.23%	Vulnerable
	2022	3.67	-59.99%	Passive Efficiency
	2023	3.00	41.13%	High Burn
	2024	3.00	0.15%	

Table 4 shows PGAS occupying all quadrants, moving sequentially to Passive Efficiency, indicating extreme cash-resilience volatility.

Discussion

RMI, Boundary Systems, and Cash Resilience

The mean RMI score of 3.94 indicates that the sampled energy companies formally adopted mature risk governance frameworks. However, the Dynamic Quadrant Matrix (DQM) presents a highly nuanced empirical pattern. While 25% of observations achieved the ideal High Resilience quadrant, the largest portion (41.67%) remained Vulnerable, exhibiting above-average RMI alongside high cash depletion. This suggests that formal risk maturity does not automatically translate into proportional cash preservation. Instead, it highlights a functional gap between the formal documentation of boundary systems and their actual operational enforcement during day-to-day capital allocation decisions.

Individual trajectories of PGAS, PTBA, and ABMM further illustrate this dynamic context. PGAS demonstrates that mature boundary systems can be severely challenged by persistent macroeconomic shocks, such as domestic regulatory pricing pressures. Conversely, PTBA presents a pattern where declining RMI aligns with movement toward the High Burn quadrant, suggesting that weakening risk-control capacity directly corresponds with increased vulnerability to cash depletion. Meanwhile, ABMM demonstrates substantial RMI improvement without an immediate

shift to High Resilience, indicating a potential time lag between risk governance enhancements and tangible financial impacts.

Crucially, aggregate comparison reveals a counterintuitive association: companies with RMI below the sample mean recorded higher average cash accumulation (-13.94%) than those above (-8.15%). This anomaly highlights a major limitation of relying solely on net cash changes. Because the Net Burn Rate (NBR) captures total cash movements, extreme cash accumulations in lower-RMI firms are frequently driven by aggressive financing activities or asset liquidations rather than operational efficiency, requiring cautious interpretation.

CONCLUSION AND FURTHER RESEARCH

This study set out to examine the extent to which the risk governance maturity of IDX-listed energy firms, measured by the RMI, corresponds to their cash resilience, measured by the scaled NBR ratio, and how that correspondence changes over the 2021–2024 period. This objective was addressed by mapping 24 firm-year observations from six energy issuers against the sample grand means of RMI and NBR using a DQM, and by tracking each firm's movement between quadrants across the four-year window.

The findings reveal that RMI is relatively high, averaging 3.94 on a five-point scale. However, this formal maturity does not translate uniformly into cash resilience. Specifically, 41.67% of observations are concentrated in the Vulnerable quadrant, where RMI stands above the sample mean but the NBR ratio remains high. Conversely, the ideal High Resilience position is achieved in only 25% of observations and is frequently non-sustained.

Firm-level trajectories demonstrate that structural improvements in RMI do not automatically produce immediate advancements in quadrant positions. Companies with high RMI scores can still experience persistent cash depletion when exposed to continuous external shocks and capital allocation demands.

Theoretically, these findings extend [Simons' \(1995\)](#) framework by highlighting a critical distinction between the formal design of a boundary system and its actual functional enforcement during capital allocation. The coexistence of high formal maturity and cash depletion indicates that risk governance often operates merely as a compliance document rather than an active operational constraint on cash-depleting behaviors—a nuance that aggregate scores fail to capture.

Practically, high RMI should not falsely assure managers or regulators of absolute liquidity resilience. Regulators should pair qualitative RMI disclosures with scaled liquidity indicators like the NBR ratio, to help stakeholders assess whether formal risk governance and actual financial sustainability align.

Finally, this study notes four limitations: a small sample size, self-reported RMI data, firm scale differences complicating NBR comparisons, and descriptive, non-causal design.

Future research should expand samples, standardize NBR, verify cash data, and decompose RMI mitigation drivers.

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