



DEVELOPING A COMPREHENSIVE RISK MANAGEMENT MODEL FOR INTEGRATED ELECTRICITY PROVIDERS: INSIGHTS FROM ISO 22301-BASED FINANCIAL IMPACT ANALYSIS

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Abstrak

Studi ini mengeksplorasi strategi ketahanan keuangan bagi penyedia layanan listrik terintegrasi dalam menghadapi gejala global, termasuk tekanan regulasi dan transisi energi, ancaman siber, volatilitas nilai tukar, dan gangguan dalam rantai pasokan energi primer. Analisis ini mengintegrasikan Indeks Kematangan Risiko (Risk Maturity Index/RMI) dan Analisis Dampak Bisnis (Business Impact Analysis/BIA) berdasarkan standar ISO 22301—yang umumnya diterapkan pada aspek operasional, tetapi dalam studi ini diperluas ke dimensi keuangan. Penelitian ini menggunakan pendekatan campuran: metode deskriptif kuantitatif dan penyelidikan kualitatif melalui studi kasus, wawancara, observasi, analisis dokumen, pengujian stres, pemetaan panas risiko, dan pengujian sensitivitas skenario. Temuan menunjukkan bahwa perusahaan masih berada pada tingkat kematangan risiko yang rendah (RMI 2.4 – fase pengembangan) dan menghadapi risiko strategis yang signifikan dalam hal likuiditas, penetapan tarif, keandalan infrastruktur, dan keamanan siber. Penerapan BIA keuangan memberikan gambaran risiko yang lebih jelas, mengidentifikasi pemicu krisis, dan merumuskan strategi pemulihan yang meningkatkan kemampuan keberlanjutan bisnis. Studi ini merekomendasikan penguatan manajemen aset, peningkatan kapasitas sumber daya manusia, dan eksplorasi instrumen keuangan untuk mitigasi risiko. Secara keseluruhan, temuan ini berkontribusi pada pengembangan model manajemen risiko komprehensif yang sangat relevan untuk perusahaan layanan publik strategis.

Kata Kunci: Indeks Kematangan Risiko (RMI), Analisis Dampak Bisnis (BIA), Sistem Manajemen Kelangsungan Bisnis ISO 22301 (BCMS)

Abstract

This study explores financial resilience strategies for integrated electricity service providers in navigating global turbulence, including regulatory pressures and energy transition, cyber threats, exchange rate volatility, and disruptions in primary energy supply chains. The analysis integrates the Risk Maturity Index (RMI) and Business Impact Analysis (BIA) based on ISO 22301 standards—commonly applied to operational aspects, but in this study extended to financial dimensions. The research employs a mixed approach: quantitative descriptive methods and qualitative inquiry through case studies, interviews, observations, document analysis, stress testing, risk heat mapping, and scenario sensitivity testing. The findings indicate that the company remains at a low level of risk maturity (RMI 2.4 – developing phase) and faces significant strategic risks in liquidity, tariff setting, infrastructure reliability, and cybersecurity. Applying financial BIA provides a clearer risk landscape, identifies crisis triggers, and formulates recovery strategies that enhance business continuity capabilities. The study recommends strengthening asset management, improving human resource capacity, and exploring financial instruments for risk mitigation. Overall, these findings contribute to the development of a comprehensive risk management model that is particularly relevant for strategic public service enterprises.

Keywords: Risk Maturity Index (RMI), Business Impact Analysis (BIA), ISO 22301 Business Continuity Management System (BCMS)

INTRODUCTION

The era of globalization and digitalization is characterized by increasing uncertainty and turbulence across industries. For the electricity sector—an essential driver of economic and social development—global economic volatility, energy price fluctuations, technological disruption, and complex geopolitical risks have intensified financial and operational pressures. Under these conditions, financial resilience and sustainable operations become indispensable strategic priorities for electricity providers.

In Indonesia, PT PLN (Persero) Batam, the largest electricity provider, plays a vital role in safeguarding national energy security. With services spanning almost the entire archipelago, PLN functions not only as a business corporation but also as a strategic entity directly tied to public welfare. In recent years, however, the company has faced significant financial pressures. The financial reports from 2019 to 2023 reveal persistent challenges, including a high debt burden, volatility in primary energy prices (coal and gas), and substantial financing needs for clean energy projects and grid infrastructure. Despite initiatives in digital transformation, operational efficiency, and debt restructuring, the risk of financial distress remains, underscoring the need for a systematic and measurable approach to strengthen corporate resilience. These financial strains have reduced the company's capacity to mobilize investment for meeting future electricity demand. Key performance indicators (KPI) falling below 95% signal organizational underperformance; a Risk Maturity Index score of 2.4 indicates a developing stage; and Asset Management Level of 15% reflects an insufficient state ("innocent" level). Such systemic financial vulnerabilities directly affect technical

reliability and corporate reputation, as evidenced by declining Customer Satisfaction Index scores. This paradox is striking given the integrated scope of operations and the vast resources managed by the utility, which holds significant potential to evolve into a corporate-scale enterprise. However, it remains classified as an individual business scale, falling short of the Systemic A criteria outlined in PER-2/KBUMN/2023.

Business Continuity Management System (BCMS) provides a structured framework to ensure organizational resilience during crises. At its core lies Business Impact Analysis (BIA), a systematic process for identifying critical operations, assessing potential disruptions, and designing effective recovery strategies. Through BIA, companies can prioritize essential activities and financial risks, enabling risk management strategies to focus on what is truly vital for long-term sustainability. (Steen, R., Haug, O. J., & Patriarca 2024); Integrating Business Impact Analysis with risk assessment and asset prioritization: A 2024 study demonstrates a decision-making model that combines BIA with multi-criteria techniques (e.g., BWM–TOPSIS) to identify asset criticality and acceptable recovery times. This approach is particularly relevant for electric utilities managing large, interdependent asset portfolios. (Aghabegloo et al. 2023).

To ensure that Business Impact Analysis (BIA) is applied consistently and aligned with international best practices, ISO 22301:2019 serves as a globally recognized standard. It provides a structured framework for organizations to establish effective business continuity management systems by integrating risk identification, impact assessment, and recovery planning into a holistic approach. Beyond enhancing crisis preparedness, the implementation of ISO 22301 strengthens

organizational resilience, fosters stakeholder trust, improves operational efficiency, and reinforces sound governance (International Organization for Standardization 2019b).

The relevance of ISO 22301 is increasingly evident from various recent studies. Dell’Atti et al. 2024 emphasized that the implementation of ISO 22301 has proven to be able to strengthen organizational resilience, not only in maintaining operational sustainability, but also in protecting financial stability in the midst of a crisis. Similar findings were also revealed by Durak Uşar 2024) and Khan et al. 2024, which indicates that ISO-certified companies tend to have better financial performance compared to non-ISO companies. The certification improves the quality of governance, risk management efficiency, and investor confidence, which directly contributes to long-term profitability and financial resilience.

In the face of escalating geopolitical, climate, and cyber risks, adopting ISO 22301:2019 with a focus on Business Impact Analysis (BIA) offers PLN a strategic framework for resilience. BIA enables the company to identify critical processes, set recovery tolerances, and quantify operational and financial impacts, forming the basis for adaptive recovery planning. Beyond financial protection, this approach reflects PLN’s social responsibility to ensure reliable electricity supply, while evidence from Spain (2008–2023) highlights that resilient organizations are better positioned to withstand systemic crises. The main factor of resilience is the ability to adapt, learn, and integrate business continuity strategies (Jose Sevilla et al. 2024). Several studies have examined the implementation of Business Continuity Management Systems (BCMS). Based on ISO 22301, BCMS provides an international framework to safeguard organizational operations during major disruptions. In the context of

electricity companies exposed to global turbulence—such as energy crises, economic instability, natural disasters, and cyberattacks—BCMS ensures not only technical continuity but also financial resilience. Integrating BCMS with risk management strategies and Business Impact Analysis (BIA) enables organizations to identify critical functions, assess financial impacts, and design recovery strategies aligned with business objectives. This underscores the importance of conducting gap assessments against ISO 22301 and securing top management commitment to readiness. (Setiawan, I., Waluyo, R., & Pambudi 2019); The integration of BCMS into an integrated management system (IMS) strengthens organizational efficiency, risk management, and resilience (Perović, M., & Todorović 2024). Offers a technical framework for integrating Risk Analysis and BIA to support ISO 22301, Help visualize financial impact (Strelicz and Bognár 2020). Other research by (Giannakis, M., & Papadopoulos 2016) shows that the success of BCMS is heavily influenced by organizational culture and leadership. Most existing studies emphasize operational resilience within normative or case-specific contexts. This article proposes a novel model integrating risk quantification with ISO 22301 through financial stress-testing to address regulatory pressures and global dynamics. The approach strengthens risk maturity, ensures product and service quality, and supports business continuity. By aligning BCMS with Enterprise Risk Management and Business Impact Analysis, electricity companies can better identify financial risks, evaluate operational-economic impacts, and design recovery strategies. Thus, BCMS functions not only as compliance but as a strategic instrument for long-term financial and operational resilience.

This study underscores the academic and practical urgency of adopting ISO 22301-based Business Impact Analysis (BIA) as a strategy for financial resilience in integrated electricity companies. Academically, it enriches the literature on the nexus between business continuity management and financial resilience in the energy sector. Practically, it provides strategic recommendations for PLN and other utilities to strengthen risk management systems that are more robust, adaptive, and capable of sustaining stakeholder trust amid global turbulence. The urgency of such strategies is reflected in systemic performance indicators over the past three years, where recurrent loss events have emerged. These include electricity tariffs set below the basic cost of supply, surging primary energy prices unaccompanied by tariff adjustments, and the depreciation of the Indonesian rupiah against the U.S. dollar affecting gas imports as a key energy source.

LITERATURE REVIEWS

According to ISO 31000, risk management is a coordinated set of activities and methods designed to guide and control risks that may affect the achievement of organizational objectives (International Organization for Standardization 2015). According to (Blokdijs 2008), The task of risk management is to manage risk by preventing companies from failure, reducing excessive expenditure from the results of the impact or risk that occurs Other sources (Blokdijs, G., Engle, C., & Brewster 2008).

Risk Assessment through the Risk Maturity Index (RMI). Risk identification in integrated electricity service providers is conducted using the Risk Maturity Index (RMI) framework. Referring to Regulation PER-2/MBU/03/2023 on State-Owned Enterprise Governance and Significant Corporate Activities, the assessment focuses

on detecting potential failures across the entire value chain—from production processes to service delivery—ensuring operational continuity and safeguarding customer trust (Kementerian BUMN RI 2023). The purpose of the Risk Maturity Index (RMI) assessment is to identify three key aspects: the root causes of failure, the potential impacts arising from such failures, and the criticality level of these impacts.

Business Impact Analysis (BIA) is a systematic process used to identify and evaluate critical business functions whose disruption would significantly affect an organization's operations and sustainability (Ramesh 2002), Prioritizing actions and recognizing resource interdependencies as a foundation for effective decision-making (International Organization for Standardization 2019a). Business impact assessment using the measurement of the Risk Quantification method (Deputy for Finance and Risk Management 2023). Business impact assessment of crises resulting in disruption or suspension of processes in delivering products and services to customers encompasses three key dimensions: operational (products/services), financial (internal), and reputational (external). These constitute the primary classifications of business impact evaluation.

Table 1: Classification of business impact assessments on product and service aspects

Impact level	Description	Value
Insignificant	Results in a momentary blackout for <15 minutes at a time	1
Minor	Results in a 15-minute blackout – 1 hour at a time	2
Medium	Results in blackout for 1 – 3 hours at a time	3
Signifikan	Resulting in blackouts for 3 hours – 1 day at a time	4
A small five-year-old	Resulting in blackouts for more than 1 day and/or resulting in rotating blackouts in the time frame (blackout system)	5

Table 2: Classification of business impact assessments on financial/internal business process aspects.

Impact level	Description	Value
Insignificant	The company's business process activities are not disrupted	1
Minor	Resulting in the company's business process activities being disrupted in a limited way in 1 unit and not affecting services	2
Medium	Resulting in the company's business process activities being disrupted in a limited way in 1 unit and affecting services	3
Signifikan	Resulting in limited disruption of the company's business process activities in several units	4
A small five-year-old	Resulting in limited business process activities of the company being disrupted in a wide range	5

Table 3: Classification of business impact assessments on reputational/external business process aspects

Impact level	Description	Value
Insignificant	Penyelesaian Tuntutan dilakukan melalui musyawarah	1
Minor	Penyelesaian Tuntutan dilakukan melalui musyawarah, dengan peran mediator	2
Medium	Penyelesaian Tuntutan dilakukan melalui alternatif penyelesaian sengketa	3
Signifikan	Penyelesaian Tuntutan dilakukan melalui proses peradilan, mulai dari Pengadilan Negeri, Banding Pengadilan Tinggi, Kasasi Mahkamah Agung RI	4
A small five-year-old	Penyelesaian Tuntutan dilakukan melalui proses peninjauan Kembali Mahkamah Agung RI.	5

ISO 22301:2019 offers a structured framework to safeguard business continuity against unforeseen disruptions. In this study, it underpins the conceptual thinking and workflow design, guiding the organization's approach with clarity and resilience.

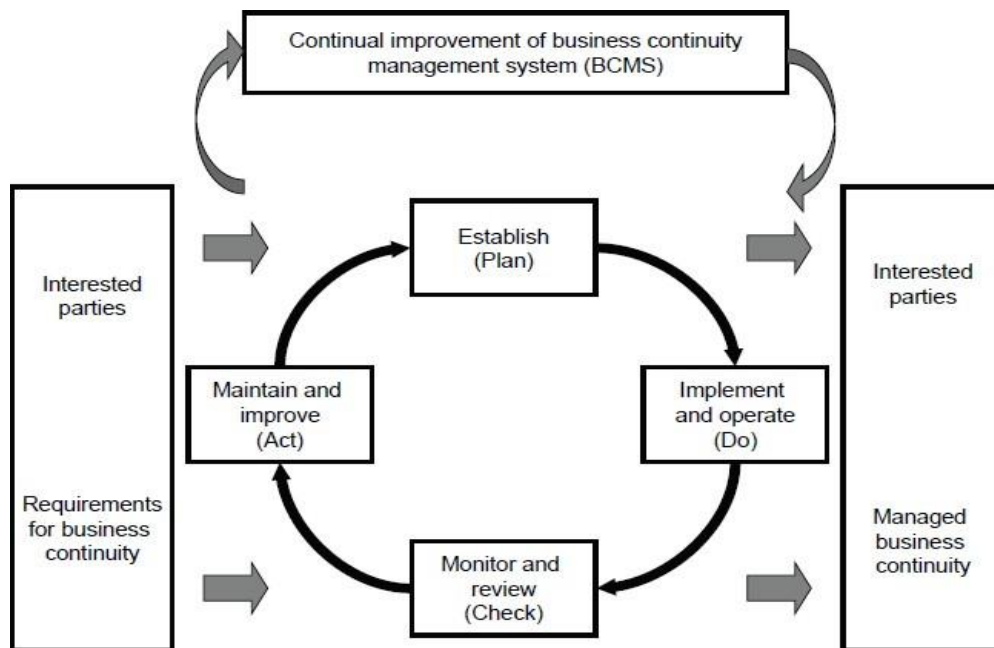


Figure 1. ISO 22301:2019 framework

METHODS

This study combined qualitative and quantitative approaches to explore business continuity management. Qualitative insights were drawn from case studies and content analysis of interviews, documents, and observations. Quantitatively, the Risk Maturity Index (RMI), stress testing, and sensitivity analysis captured the company's resilience against global turbulence, such as energy price surges, currency swings, and cyber threats. Risk heat maps illustrated exposure levels, while the Altman Z-Score highlighted potential financial distress, linking risk assessment directly to organizational sustainability.

Data Analysis Techniques (a). Qualitative Analysis: Case study analysis to examine business continuity management practices.; Content analysis from interviews, documents, and observations. (b). Quantitative Analysis: Risk Maturity Index (RMI): to measure the level of maturity of

risk management; Stress Testing & Sensitivity Analysis: to simulate global turbulence scenarios (rising primary energy prices, exchange rate fluctuations, cyber attacks). Risk Heat Map: to visualize the level of risk based on probability and impact; Altman Z-Score: to test the potential financial distress of companies.

RESULTS AND DISCUSSION

In the preparation of *the Business Impact Analysis* (ISO 22301 Clause 8.2.2) of this financial aspect, considering that the provision of integrated electricity services has the potential to be multi-crisis (complex), for the effectiveness of the impactful strategy, the following workflow is determined:

1. Examine the company's empirical data, vision and mission, as well as stakeholder needs and expectations. Assess the alignment between the company's vision and mission and stakeholder requirements in achieving

performance objectives by reviewing the past three years of empirical data, presented through visualized business

processes within the integrated electricity company ecosystem:



Figure 2. Business Processes in an Integrated Electrical Organization Ecosystem

The electricity business ecosystem consists of six core pillars: (1) Generation as the energy source, (2) Transmission for long-distance delivery, (3) Distribution to ensure electricity reaches end users, (4) Customer Services encompassing sales, billing, and service protection, (5) Supporting Functions including finance, HR, IT, audit, and risk management, and (6) Beyond/Development, which focuses on business diversification such as fiber optics, data centers, and joint ventures. This value chain is integrated, meaning the success of electricity supply relies on seamless coordination across all stages. Efficient generation, reliable transmission, equitable distribution, and responsive customer service drive satisfaction, while robust support functions maintain operational health and regulatory compliance. Simultaneously, business development ensures future competitiveness.

a. Risk Maturity Index (RMI) Achievement. The Risk Maturity Index (RMI), developed based on the Technical Guidelines of RMI SK-8 KBUMN, serves as a benchmark for organizational risk management capabilities. The overall RMI score of 2.4 positions the organization in the Developing Phase, below the threshold for the Good Practice Phase (>3). Areas requiring improvement include: (a). Dimensional Aspects: Risk Model, Data, and Technology, scoring 2 (Initial Phase). (b). Performance Aspects: Health Level scoring 28, Risk Composite scoring 5, with a score adjustment of -1. This assessment highlights specific focus areas for enhancing both structural and operational risk management capabilities.

Table 4: Risk Maturity Index Score

Parameters	Dimension	Description	Dimension Score	Skor
1-3	1	Risk culture and capabilities	4,3	
4-19	2	Organization and Risk Governance	3,9	
20-33	3	Risk and Compliance Framework	3,6	
34-40	4	Process and Risk Control	3,1	
41-42	5	Risk Models, Data, and Technologies	2	
1-42	Dimensional Aspect Score			3,4

No.	Aspects	Aspect Value	Conversion Value	Weight	Conversion Value x Weight	Score
1.	Final Rank Health Level	BB	56	50%	28	
2.	Risk Composite Rating	5	10	50%	5	
1-2	Performance Aspect Score					33
Score Adjustment						-1
Score RMI						2.4

b. Financial Performance. The company's financial health was assessed using the Altman Z-Score, which integrates liquidity, profitability, productivity, and equity to highlight critical financial thresholds. The firm falls into Health Category B (score: 4.36), while its bankruptcy risk lies in the Grey Area, indicating a high risk of financial distress (score: 1.11).

Z- Score range

< 1.1
1.1 < x < 2.6
> 2.6

1. Coefficient of the first ratio

6.56

Working Capital

187,684

Total Assets

21,833,136

Working Capital / Total Asset

0.01

Coefficient * (WC/TA)

0.06

2. Coefficient of the second ratio

3.26

Retained Earnings

6,475,447

Total Assets

21,833,136

Retained Earnings / Total Asset

0.30

Coefficient * (RE/TA)

0.97

3. Coefficient of the third ratio

6.72

EBIT

(5,428,978)

Total Assets

21,833,136

EBIT / Total Asset

(0.25)

Coefficient * (EBIT/TA)

(1.67)

4. Coefficient of the fourth ratio

1.05

Book value of equity

11,560,799

Book value of debt

6,945,563

Book Value of Equity / Book Value of Debt

1.66

Coefficient * (BV of Equity/BV of Debt)

1.75

Z-Score

1.11

1.10

Bankruptcy Status

Grey Area

Bankrupt

Z-Score + 3.25

4.36

Synthetic Rating Prediction

B

Risk Capacity Simulations (in billion IDR)

7,759,367

Figure 3. Altman Zscore Bankruptcy Score

c. Risk profile

Risk Assessment of the company's Strategic Objectives obtained 13 business risks with 8 strategic risks (red), namely:

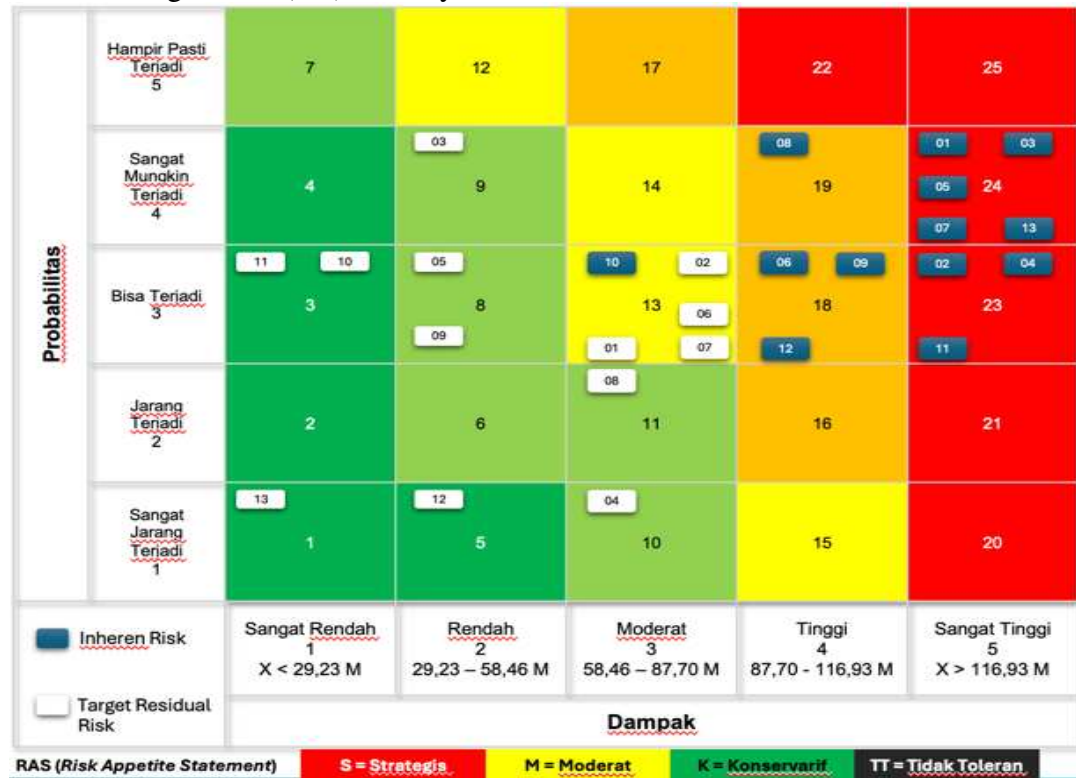


Figure 4. Risk Heatmap

Risks with a high or intolerant category (red) occupy the most critical position on the company's risk map. Based on the identification results, there are two main risk groups. First, the risk with the code (01, 03, 05, 24) which is categorized as very high because it has a "very likely – almost certain" probability of occurring, with a potential financial impact exceeding Rp 116.93 billion. Second, risks with codes (02, 04, 07, 13, 23, 25) which are also included in the large category and are clearly still outside the tolerance limit as set out in the company's Risk Appetite Statement. Must be mitigated immediately with additional controls, *contingency plans*, or risk transfers (e.g. insurance/hedging). Strategic risks in the orange category (06, 08, 09, 16, 18, 19, 22) are significant threats that have the potential to disrupt the company's performance and sustainability if not controlled. Strategic risks in the orange category have great potential to disrupt the company's performance, requiring the close supervision of senior management. Mitigation is focused on prevention through strong governance and adaptive contingency plans to protect business sustainability and stakeholder trust. The moderate risks marked in the yellow category (12, 14, 15, 17, 13) indicate that although the threat level is still relatively acceptable, it still has the potential to develop into more serious if not managed appropriately. Therefore, a balanced management approach through periodic reviews is needed to ensure that risks remain under control, as well as the implementation of effective mitigation strategies so that they do not increase into strategic risks that can disrupt the sustainability of the

organization. This approach reflects a proactive and thoughtful attitude in maintaining stability while encouraging a culture of vigilance in the work environment.

The Low Risk – Conservative (Green) category reflects conditions where the potential impact and probability of risk are relatively small so that they are still within acceptable limits. In this context, risk does not cause significant disruption to the sustainability of business processes, so no major strategic intervention is required. The right approach is to carry out routine monitoring mechanisms consistently so that any potential escalation can be detected early. Thus, organizations can continue to operate as business as usual while ensuring vigilance and readiness in the event of a change in the risk environment.

d. Asset Management Maturity Level

Based on the results of the evaluation of the six main elements in the asset management framework, the organization shows an average maturity level of 15%. This figure indicates that the overall asset management process is still at the *initial level*, where the approach applied is generally reactive, not well documented, and not systematically integrated.

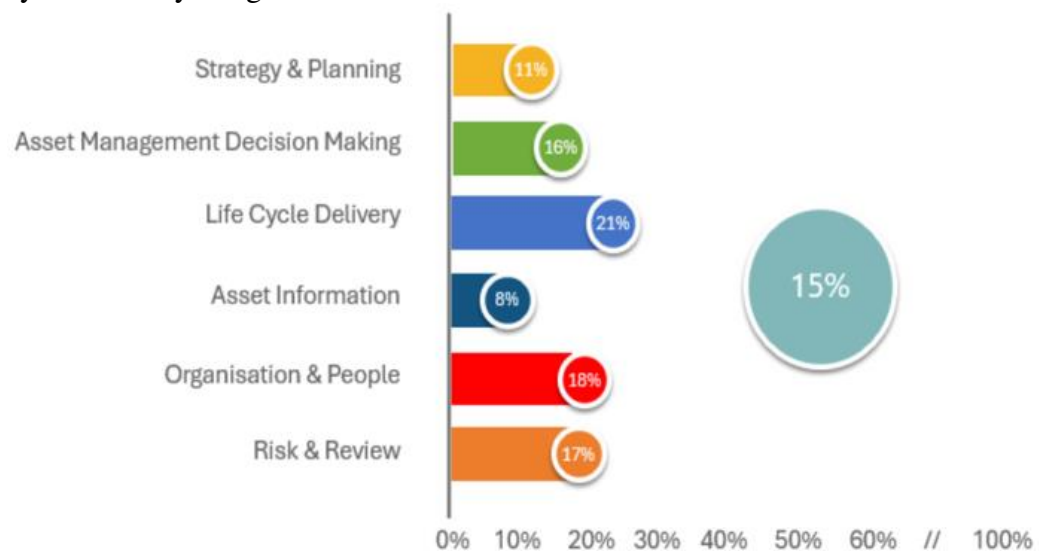


Figure 5. Asset Maturity Level

- Strategy & Planning (11%): The maturity level is still low. Asset planning has not been fully integrated with long-term business strategies., Implications: Risk of asset management directions that are not in line with organizational goals. therefore it is necessary: Preparation of asset management policies and strategic plans based on asset data.
- Asset Management Decision Making (16%): The process of making decisions related to assets is starting to exist, but it is still limited to operational aspects. The implications that occur are potentially sub-optimal decisions because they are not based on long-term risk, cost, and benefit analysis. Therefore, it is necessary to have a risk-based decision-making framework and business case analysis.
- Life Cycle Delivery (21%) – Highest. The most advanced aspect compared to the others. There is already a practice in managing the asset lifecycle (procurement, operation, maintenance, and disposition). The implication is that efficiency has begun

to be seen, although it is not yet consistent. Therefore, it is necessary to optimize asset life cycle cost analysis so that the asset value is maximized.

- d. The low availability of asset information (8%) indicates the weak quality of data, which has not been fully digitized and is often inaccurate. This condition has an impact on difficulties in strategic and operational decision-making due to the limited availability of reliable information. Therefore, the development of an integrated asset information system, such as the Asset Management System or Computerized Maintenance Management System (CMMS), is needed to improve accuracy, consistency, and ease of access to data, thereby supporting more effective and sustainable asset management.
 - e. Organisation & People (18%): Human resource capabilities in organisations can be categorized at a moderate level, but still face the fundamental challenge of not having a strong asset management culture in place. This condition causes employee competence to be uneven, so it has the potential to cause errors in maintenance and asset management. To reduce these risks, strategic interventions are needed in the form of structured training programs, asset management certification as a standard of professionalism, and the implementation of change management in order to create collective awareness and a consistent work culture in asset management.
 - f. Risk & Review has only reached 17%, meaning that the risk evaluation and performance review functions are already in place but not yet in place. This makes asset risk not optimally monitored. To improve this condition, companies need to strengthen risk registers, regularly conduct asset audits, and build a continuous evaluation cycle so that risks can be controlled more effectively.
2. Risk Assessment, identifying business process risks that have the potential for crisis, available resources, and bonds or obligations that must be fulfilled related to products/services in the form of SLAs (service level agreements).

Table 5. Critical Business Function

Business Proces Level 0	Business Proces Level 1	Business Proces Level 2	Directorat	Division	Hasil Kritikalitas Kuisisioner	Pertimbangan Manajemen	Result (Keputusan Akhir)
Core Business	Operation	Pembangkitan & Penyaluran	Operation Director	Operation Division	Critical	Critical	Critical
Supporting	Finance	Penjualan	Finance Director	Finance Division	Non Critical	Critical	Critical
Core Business	Services	Distribusi & Pelayanan Pelanggan	Bussines & Commercial Director	Bussines Division	Critical	Critical	Critical
Supporting	Corporate Secretary	Hubungan Masyarakat & stakeholder	Human Capital Director	Corporate Secretary Division	Non Critical	Critical	Critical

Some activities are categorized as critical because they have the potential to cause serious obstacles or even complete termination of business activities if not managed properly.

- a. Identification through the questionnaire, from the results of the questionnaire, there are activities that are assessed as Critical and some are Non-Critical. However, even

- though there are activities that were initially assessed as Non-Critical by the respondents, management considerations still designate them as Critical because they consider strategic impacts, SLAs, and the linkages between business processes.
- b. Management considerations, management classifies all activities on the table as Critical, including those originally considered Non-Critical. This indicates significant consequences for service, SLA compliance, and operational continuity if these activities are disrupted.
 - c. Implications for Service and SLA (Service Level Agreement). Critical activities are directly related to an organization's obligations to meet SLAs to customers and business partners. Failure of any of the critical activities will cause: (1). Service interruption (delay, error, or downtime). (2). Financial risk due to SLA penalties or compensation to customers. (3). Reputational loss due to declining customer trust. (4). Legal and compliance risks in the event of a breach of the service contract.
 - d. Resources and Liabilities, to maintain the continuity of critical activities, the company must ensure the availability of key resources in the form of: (1). Human resources are trained and competent in the management of core processes. (2). Reliable IT infrastructure & information systems, with backup & redundancy. (3). Contingency procedures and recovery plans that are in line with Business Continuity Management (BCM) and ISO 22301 standards.
3. Assign interested parties: *interest party*, *dependent*, *independent* of the company's business process.

Tabel 6. List of Interested Parties

Stakeholder Names	Internal	Eksternal	Function/Process Relationship		Interested Parties	Descriptions
			Dependency	Dependent		
Government/Regulator		√	√		√	Political functions (rulemakers); and Administrative functions (regulatory implementers)
PT PLN (Persero)	√		√	√	√	(a) the main shareholder for strategic corporate decision-making; (b). Partner in the achievement of strategic objectives
Employee	√		√	√	√	Business Process Implementer and Owner Risk
(a). Customers, (b). Community (in Batam), (c). PLN (outside Batam), (d). Sub Holding (Icon+, Indonesia Power, PLN EPI).		√	√	√	√	External customers/service users where PT PLN must provide excellent service
Labor union	√		√	√	√	Unions are representatives of employees. In accordance with the

Stakeholder Names	Internal	Eksternal	Function/Process Relationship		Interested Parties	Descriptions
			Dependency	Dependent		
						collective labor agreement, synergize with management in achieving the company's strategic goals.
Partners/ Suppliers		√	√	√	√	As a partner of the service/product provider in supporting related business process activities in the contract within a certain time that is mutually necessary and beneficial.
Mass media		√				Communication Media in corporate branding.

4. Setting a *Trigger Level* is a trigger level or trigger threshold in the form of a certain value or condition that when reached or exceeded will trigger a certain action or response.

Trigger Level is a threshold set on a company's financial indicators. When the value of an indicator reaches or exceeds this limit, this will be an early warning signal for management to immediately take corrective action or implement a recovery plan.

In the data below, each indicator has three trigger levels: (a). Safe Level (Normal) → conditions are still healthy, low risk, no need for major intervention. (b). The Alert Level (Moderate) → begins to show deviations from the target, management needs to monitor closely and prepare mitigation measures. (c). Crisis Level (Critical) → indicator has passed the threshold, significant risk, must take immediate action or activate the Recovery Plan.

- Capital (Debt to Equity Ratio). Current value: 2.14 (still in the safe zone). However, if it rises to 2.57 (enter alert). If it reaches 3.00 crisis zones, it means that the capital structure is too heavy and endangers financial sustainability.
- Liquidity (ICRC & CR): ICRC is currently 3.75 (safe); If it drops to 2.88 (alert); If it falls to 2.00 (crisis (indicates that the ability to pay short-term obligations has decreased drastically); The same for CR (Current Ratio): below 0.74 means a liquidity crisis.
- Profitability (ROE, ROA, EBITDA, EBITDA Margin): The current ROE is 0.08 (8%), still safe; If it drops to 0.07 (alert); If it falls to 0.05 (the crisis → indicates that the ability to generate profits for shareholders is very low). The same pattern applies to ROA, EBITDA, and EBITDA Margin.
- Asset Quality (Non-Performing Asset / NPA). Currently 0.05 (still safe); If it rises to 0.12 (alert); If it reaches 0.19 (crisis → indicates a lot of problematic/unproductive assets).

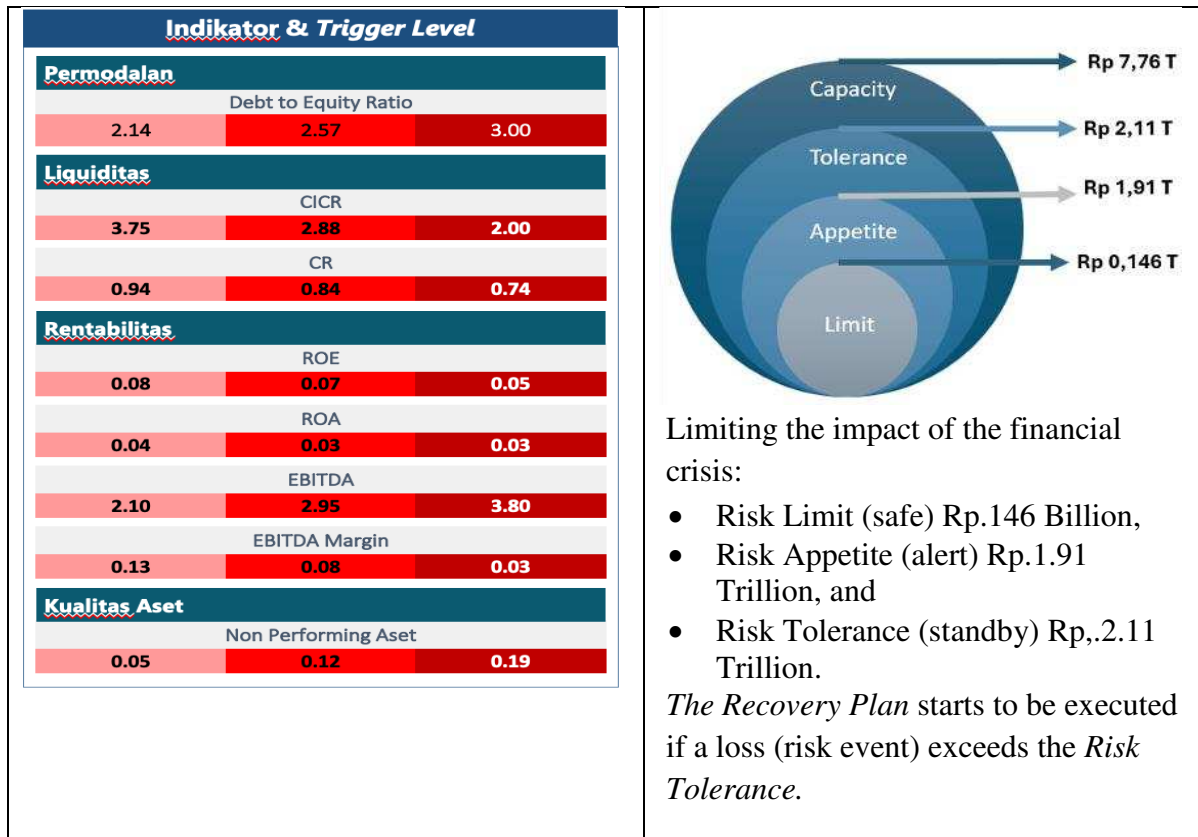


Figure 6. Financial Level Triggers

Relationship with Risk Limit – Appetite – Tolerance

- Risk Limit (IDR 146 Billion) means the maximum loss limit that is still considered safe.
- Risk Appetite (Rp 1.91 T) means a level of risk that can still be tolerated in a state of alertness.
- Risk Tolerance (Rp 2.11 T) means the alert limit; if the loss exceeds this figure, the Recovery Plan should be implemented immediately.

Thus, the Trigger Level on each indicator serves as an early signal before the actual loss exceeds the Risk Tolerance limit.

5. Mapping the components of the recovery matrix:

Table 7. RTO, RPO, MAO, MBCO Recovery Matrix

No	Critical Systems	Freq	RTO	MAO	MBCO	Priority
1	Blackout (widespread blackout) on grid	2x/year	2 hours	72 hours	System protection must remain running to prevent widespread blackouts	1
2	Cyber attacks	3x/year	2 hours	24 hours	AP2T & SCADA Customer Service App Keeps Running	2

No	Critical Systems	Freq	RTO	MAO	MBCO	Priority
3	MPP generator breakdown	2x/year	2 hours	72 hours	Memenuhi EAF 80% (energy available factor)	6
4	Supply chain (shortage gas/coal)	3/year	2 days	5 days	5 HOP fuel available (min coal if gas shortage)	5
5	Outbreaks/disasters/fires	1x/year	3 days	30 days	Telkom's internal service applications and systems continue to run	9
6	Riots/demonstrations/coups of National Vital Objects	2x/year	5 hours	12 hours	Operations run according to TMP (SLA)	8
7	Supply Chain (material)	4/year	5 days	14 hours	Ensuring that the emergency PBJ process continues to run	7
8	Compliance/Legal (Tariffs, lawsuits, licensing)	3x/year	1 month	6 month	Operations run according to TMP (SLA)	3
9	Liquidity (Receivables, HGBT, Exchange rate weakening)	5x/year	2 month	9 month	Cashflow maintained by operating costs for the next 6 months	4

- a. *Recovery Point Objective (RPO)*, and
- b. *Recovery Time Objective (RTO)* in the event of an identified crisis
- c. *MAO (Maximum Acceptance Outage)*
- d. *MBCO (Minimum Business Continuity Objective)*
6. Analyze the financial impact on the product/service (from the cause of the operational, financial, reputational crisis of the company).

Table 8. List of Critical Systems and Their Impacts

No	Critical Systems	Critical Functions	Financial	Reputation	Operation	Product	Risk (Qual/Quant)
1	Blackout (Widespread blackouts) on grid	UB KITRAN, BID OPS	V	V	V	V	Quantitative
2	Cyber attacks	UB INFRA,	V	V	V	V	Quantitative

No	Critical Systems	Critical Functions	Financial	Reputation	Operation	Product	Risk (Qual/Quantitative)
		UB DISYAN					
3	MPP generator breakdown	UB BES, BID OPS	V	V	-	-	Quantitative
4	Supply chain (shortage gas/coal)	BID OPS, BID REN	V	V	V	V	Quantitative
5	Outbreaks/disasters/fires	BID HCGA, BID OPS/K3L	V	V	V	-	Qualitative
6	Riots/demonstrations/coups of National Vital Objects	SETPER	V	V	V	-	Qualitative
7	Supply Chain (construction materials)	BID MANPRO, UB DISYAN	-	-	-	V	Qualitative
8	Compliance/Legal (Tariffs, lawsuits, licensing)	SETPER	V	V	V	V	Qualitative
9	Liquidity (Receivables, HGBT, Exchange rate weakening)	BID KEU, BID REN, UB BES	V	V	V	V	Quantitative

Based on the table, the analysis of the financial impact on the product/service can be reviewed from the relationship between the causes of the operational, financial, and reputational crises of the company.

- a. Blackouts on the grid cause substantial direct financial losses, including lost revenue and recovery costs. Service disruptions severely impact customers, eroding trust and highlighting the vulnerability of a company's reputation when core operations are compromised.
- b. Cyber Attacks. Cyberattacks carry financial implications through system recovery costs and potential data loss. Digital services, including customer applications and SCADA systems, may be disrupted, adversely affecting customer experience. Corporate reputation is also at risk, as the public often gauges credibility based on security standards.
- c. MPP Generator Breakdown. Engine breakdowns have an impact on repair costs and loss of energy production capacity. Customers can feel a decrease in supply reliability, which affects satisfaction and perception of service quality. The reputation as a reliable energy provider will be eroded if this problem is repeated.
- d. Supply Chain (Shortage Gas/Coal). The limited supply of primary energy poses an additional financial burden as it has to look for emergency alternatives at high prices.

- Electrical products/services have the potential to be disrupted in their continuity, which can worsen the company's image as a safe and stable energy provider.
- e. Outbreak/Disaster/Fire. Disaster crises have caused significant financial losses, both from asset damage and reduced operating capacity. Public services are temporarily halted, lowering user satisfaction. The company's reputation can be affected because the public sees the inability to manage the crisis in a responsive manner.
 - f. Civil unrest, demonstrations, or coups targeting critical national infrastructure increase security costs and operational recovery efforts. Service disruptions can halt essential public services, while the company's reputation may be perceived as fragile due to its inability to maintain stable operations amid socio-political turmoil.
 - g. Construction material supply delays escalate project costs and strain company budgets. These delays hinder energy infrastructure development and are perceived by the public as operational inefficiency, potentially undermining long-term corporate reputation.
 - h. Compliance/Legal (Rates, Litigation, Licensing). Legal risks impose financial burdens through fines or lawsuits. Public services may be disrupted due to regulatory uncertainties. From a reputational perspective, non-compliance can signal irresponsibility, undermining stakeholder trust.
 - i. Liquidity (Receivables, HGBT, Currency Depreciation). Liquidity crises reduce a company's ability to finance operations, threatening service continuity and long-term electricity supply quality. Public perception of financial instability can erode reputation and competitiveness.
7. Conducted stress testing as mandated by the Ministry of State-Owned Enterprises. Sensitivity analysis of combined unfavorable variable changes increases the breakeven production cost (BPP), thereby reducing margins. Tariffs fall below sustainable BPP if adjustments are not aligned with changes in primary energy prices.

Tabel 9. Stress Testing Scenario

No	Skenario	Stress Assumptions	Percentage of Impact	Total Loss Event (IDR Billion)	Trigger Level (Rp Billion)	Recovery Plan
A	Baseline (Normal)	No stress	0%	-	-	Aman
1	Gas Prices Rise	Gas price increase of 37%	37%	767	767	Set up a price control strategy & renegotiate supply contracts
2	Fire	Fire incident, damage to 21% of assets	21%	461	1.116	Strategy: fire insurance & occupational safety mitigation
3	Depreciation Rate	Exchange rate depreciation 26%	26%	497	1.604	Strategy: <i>hedging</i> & diversification of income sources
4	Down < RUP	Revenue decreased	31%	512	2.116	Strategy: cost efficiency, long-

No	Skenario	Stress Assumptions	Percentage of Impact	Total Loss Event (IDR Billion)	Trigger Level (Rp Billion)	Recovery Plan
		compared to RUP by 31%				term contract renegotiation
5	Cyber Attack (SCADA)	Cyberattacks that impact 2%	2%	38	2.235	Strategy: strengthen cybersecurity systems, routine IT audits, disaster recovery plan
6	Multi-Stress (Combined Stress)	A combination of rising gas prices, rate depreciation, fires, cyber attacks, and a decrease in RUP	Total: 2.235 (akumulasi)	37% + 21% + 26% + 31% + 2%	2.235	Integration of all recovery plans, crisis management, emergency liquidity

Table 10. Matrik Stress Testing

Aspects/Elements Tested	General Explanation (Justification)	Improvement Recommendations (Corrective & Preventive Actions)	Person in Charge	Target Time
EIA & Risk Assessment	Financial parameters (such as EIAs) need to be used more accurately by comparing more realistic market data.	Review the assumptions on the basis of financial risk calculation in EIA and ERM.	Risk Management & Finance Division	3 months
Business Development Aspects	Unrealistic growth makes financial risk management need to be improved.	Develop scenarios of varying levels of complexity (mild, moderate, severe). Focus on more realistic long-term projections.	Finance & Supervision Division	6 months
Business Development	BMP Financial is sufficient,	Establish additional protocols for BMP	Business Planning &	3 months

Aspects/Elements Tested	General Explanation (Justification)	Improvement Recommendations (Corrective & Preventive Actions)	Person in Charge	Target Time
Plan	but the readiness of the contingency plan needs to be strengthened.	Financial scenarios in the event of instability. Recommendations of internal procedures for the redistribution of funds & crisis communication.	Finance Division	
Testing Program (Exercise Programme)	Financial stress testing is very limited, it needs to be done more often and with more varied scenarios.	Conduct a financial testing process at least once a year. Involving multi-divisional, simulations focus on financial dynamics.	Business Planning Division	Every Year
Resources	Reserve funds & capital buffer are still minimal, prone to shocks.	Increase liquid cash reserves. Build broader relationships with various financial institutions.	Finance Division	Sustainable
Communication	Internal communication is not optimal, external needs to be improved.	Develop a proactive financial risk communication plan for stakeholders (regulators, investors, operators, the public).	Communication, Management & Finance Division	3 months
Comparison & Training	Some teams need further training in decision-making under financial pressure.	Train the management team related to financial decision making, stress test simulation, and benchmarking best practices in similar industries.	HR & Business Planning Division	6 months

Discussion

nal economic outcomes.

CONCLUSION

Low Risk Maturity Level. The integrated electricity company under study remains at a Risk Maturity Index (RMI) of 2.4 (developing phase), indicating that its risk management system is suboptimal and has yet to reach best practice standards. **High Financial Vulnerability.** Financial analysis using the Altman Z-Score indicates that the company falls within the Grey Area, reflecting a high risk of financial distress. **Key drivers** include declining liquidity, selling prices below the cost of production, and volatility in primary energy prices. **Strategic and Operational Risks:** Among 13 identified business risks, eight are classified as high-level strategic risks (red), encompassing liquidity, tariff policies, infrastructure reliability, adequacy of primary energy, and cyber threats. **Weak Asset Management.** Asset Management Maturity Level has only reached 15%, which means that the asset management process is still in the early stages, reactive, and not yet integrated. The implementation of Business Impact Analysis (BIA) based on ISO 22301 provides a comprehensive risk map, identification of critical activities, financial trigger levels, and recovery strategies. This demonstrates that BIA serves as a vital instrument for enhancing financial resilience and ensuring the business continuity of electricity companies.

a. **Risk Management Enhancement:** (1) Elevate the Risk Maturity Index (RMI) toward the “good practice” phase (>3) by improving risk model, data, and technology dimensions. (2) Integrate Enterprise Risk Management (ERM) with BCMS and BIA to ensure preparedness for multi-dimensional crises.

Asset Management Optimization: Enhancing asset maturity through a

documented, integrated, and digitally driven management system. Implementing predictive maintenance and real-time monitoring technologies to mitigate operational disruption risks. **Financial Diversification and Instruments:** Investigating hedging strategies to mitigate risks from primary energy price volatility and foreign exchange fluctuations; Promoting revenue diversification through renewable energy development and digital service offerings. **Enhancing**

Human Resource Capacity: Providing intensive training on Business Continuity Management, ISO 22301, and financial risk analysis; Fostering an organizational culture that is adaptive and resilient to global changes. **Top Management & Stakeholder Engagement:** Position ISO 22301 implementation as a strategic corporate priority rather than mere administrative compliance. Enhance communication with regulators, investors, and the public to strengthen trust and corporate legitimacy.

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