Economics and Business Quarterly Reviews

Natalia, C. (2025). Risk Assessment and Mitigation of LNG Export – Permit Delays using ISO 31000:2018 and Decision-Analysis: A Case Study of PT Sulawesi. *Economics and Business Quarterly Reviews*, 8(4), 135-143.

ISSN 2775-9237

DOI: 10.31014/aior.1992.08.04.697

The online version of this article can be found at:
https://www.asianinstituteofresearch.org/

Published by:
The Asian Institute of Research

The Asian Institute of Research *Economics and Business Quarterly Reviews* is a peer-reviewed International Journal. The journal covers scholarly articles in the fields of Economics and Business, which include, but are not limited to, Business Economics (Micro and Macro), Finance, Management, Marketing, Business Law, Entrepreneurship, behavioral and Health Economics, Government Taxation and Regulations, Financial Markets, International Economics, Investment, and Economic Development. As the journal is Open Access, it ensures high visibility and the increase of citations for all research articles published. The *Economics and Business Quarterly Reviews* aims to facilitate scholarly work on recent theoretical and practical aspects of Economics and Business.

ASIAN INSTITUTE OF RESEARCH
Connecting Scholars Worldwide

The Asian Institute of Research
Economics and Business Quarterly Reviews
Vol.8, No.4, 2025: 135-143
ISSN 2775-9237

DOI: 10.31014/aior.1992.08.04.697

Risk Assessment and Mitigation of LNG Export – Permit Delays using ISO 31000:2018 and Decision-Analysis: A Case Study of PT Sulawesi

Christina Natalia[1]

[1] School of Business and Management, Institut Teknologi Bandung

Correspondence: Christina Natalia, School of Business and Management, Institut Teknologi Bandung.
Email: c26natalia@gmail.com

Abstract
Liquefied Natural Gas (LNG) export activities in Indonesia operate within a capital-intensive and highly regulated environment, where regulatory uncertainty can translate rapidly into operational disruption and significant financial loss. Following the enactment of Government Regulation No. 61 of 2024, LNG exporters are required to prioritize domestic gas allocation before export approval, introducing timing uncertainty in the issuance of export permits. In 2025, this regulatory transition resulted in recurring LNG export-permit delays for PT Sulawesi, a single-train LNG producer with limited operational flexibility. This study assesses and mitigates the risk of LNG export-permit delays at PT Sulawesi using the ISO 31000:2018 risk management framework, complemented by systems thinking and decision-analysis tools. A qualitative case-study approach is employed, supported by quantitative estimation of financial impacts. Data were obtained from internal company reports, semi-structured interviews with senior management, and official regulatory and policy documents issued by ESDM, SKK Migas, and the Ministry of Trade. Risk mapping, gap analysis, and scenario-based quantitative modelling are applied to estimate revenue at risk and evaluate the effectiveness of existing and proposed controls. The findings show that export-permit delays represent a structural regulatory timing risk rather than a purely administrative issue. The inherent risk score is assessed as high to critical (20), with potential profit downside of approximately USD 40 million at a minimum under a high-exposure scenario. Following mitigation measures and proposed governance enhancements, the residual risk score is reduced to 12. This study contributes empirically by demonstrating the practical application of ISO 31000:2018 combined with decision analysis in managing regulatory risk in LNG operations and provides actionable insights for LNG producers operating under similar regulatory constraints.

Keywords: LNG export permits; regulatory risk; ISO 31000:2018; decision analysis; Enterprise Risk Management; Indonesia

1. Introduction

1.1 Background and Research Context

Liquefied Natural Gas (LNG) projects operate within complex technical, commercial, and regulatory environments, where delays in regulatory approvals can directly translate into material financial losses and

systemic risks across the energy value chain. In capital-intensive and highly regulated industries such as LNG, Enterprise Risk Management (ERM) has increasingly evolved from a compliance-oriented function into a strategic decision-support tool. Empirical evidence suggests that organizations with mature and integrated ERM practices tend to achieve better operational performance and higher firm value, particularly in regulated sectors (Arena et al., 2011; McShane et al., 2011).

ISO 31000:2018 provides an internationally recognized framework for risk management that emphasizes integration with organizational processes, structured and systematic risk assessment, and continual improvement. Prior academic studies in Indonesia, including postgraduate research at Institut Teknologi Bandung, demonstrate the relevance of ISO 31000 in addressing regulatory, operational, and governance risks in energy and infrastructure projects, particularly under conditions of regulatory transition and multi-stakeholder oversight.

In Indonesia, LNG export activities are governed by a layered regulatory framework that prioritizes domestic gas allocation over exports. Government Regulation No. 61 of 2024 mandates the fulfilment of national commodity balances before export approvals are granted. This regulation is operationalized through coordination among the Ministry of Energy and Mineral Resources (ESDM), SKK Migas, the Ministry of Trade, and other government institutions. During the transition period in 2025, increased scrutiny of domestic LNG availability and evolving coordination mechanisms introduced significant uncertainty in export-permit issuance.

For LNG producers such as PT Sulawesi, export-permit delays represent more than an administrative inconvenience. Delays directly affect cargo scheduling, revenue realization, compliance with long-term Sales and Purchase Agreements (SPAs), and production efficiency. As a single-train LNG facility with limited redundancy, PT Sulawesi is particularly exposed to prolonged permit delays and domestic diversion requirements. Prior studies of Indonesian LNG projects, including Tangguh LNG and Bontang LNG, identify regulatory coordination and permit timing as among the most critical non-technical risks affecting project performance.

This study responds to the need for a structured and decision-oriented approach to managing regulatory timing risk in LNG operations. By applying ISO 31000:2018 in combination with systems thinking and decision analysis, the research integrates qualitative risk identification with quantitative estimation of financial exposure. The study positions ERM as an operational and strategic tool to support managerial decision-making under regulatory uncertainty.

1.2 Research Problem and Objectives

In 2025, PT Sulawesi experienced recurring delays in LNG export permits, driven by domestic gas prioritization, regulatory coordination challenges, and transitional implementation of new regulations. These delays posed material risks to commercial performance, operational stability, and contractual compliance. Despite the existence of an ERM framework, export-permit delays were not previously managed as a distinct strategic risk with quantified financial exposure and formal decision-support mechanisms.

Accordingly, this study addresses the following research questions:

1. What controls should PT Sulawesi implement to reduce risks arising from LNG export-permit delays?
2. How effective are PT Sulawesi's current controls in managing export-permit delay risk?
3. What is the potential financial impact on PT Sulawesi and upstream operations if export-permit delays materialize in 2025?

The objectives of this research are to identify and assess export-permit delay risks using ISO 31000:2018, evaluate the adequacy of existing controls, develop a simple quantitative model to estimate revenue at risk, and propose practical mitigation strategies supported by decision analysis.

1.3 Contribution of the Study

This study contributes to both academic literature and managerial practice in three ways. First, it provides an empirical application of ISO 31000:2018 combined with decision analysis in the context of LNG export-permit governance, a topic that remains underexplored in existing ERM literature. Second, it integrates system-level analysis with firm-level risk management, highlighting how national energy policy and regulatory coordination shape corporate risk exposure. Third, it offers actionable governance and decision-support tools, including a decision-tree framework, that can be adapted by LNG producers operating under similar regulatory constraints.

2. Literature Review and Conceptual Framework

2.1 Enterprise Risk Management in Regulated Industries

Enterprise Risk Management has evolved as a holistic approach to identifying, assessing, and managing risks across organizational boundaries. Arena et al. (2011) emphasize that ERM delivers value when it is embedded in decision-making processes rather than treated as a reporting exercise. McShane et al. (2011) further demonstrate a positive association between ERM maturity and firm value, particularly in capital-intensive and regulated industries.

In the energy sector, regulatory risk is consistently identified as a dominant non-technical risk. Studies of LNG and upstream oil and gas projects highlight that permit delays, policy changes, and regulatory coordination failures can generate financial impacts comparable to technical disruptions. Indonesian academic studies applying ISO 31000 confirm its suitability for managing such risks, particularly where regulatory uncertainty and multi-agency governance prevail.

2.2 Regulatory Risk and LNG Export Governance

LNG export governance typically involves multiple government agencies, long planning horizons, and coordination between domestic energy security objectives and international commercial commitments. International best practices observed in Australia, Qatar, and the United States emphasize early regulator engagement, centralized risk ownership, transparent documentation, and digital permit tracking.

In Indonesia, the prioritization of domestic gas allocation introduces a structural timing risk for exporters. While large, multi-train LNG projects such as Tangguh and Bontang benefit from scale, operational buffers, and institutional continuity, smaller single-train projects face heightened exposure to permit delays. This asymmetry underscores the importance of firm-level governance and decision-support mechanisms tailored to regulatory constraints.

2.3 Conceptual Framework

This study integrates three analytical lenses: ISO 31000:2018 risk management, systems thinking, and decision-analysis theory. ISO 31000 provides the structural framework for risk identification, analysis, evaluation, and treatment. Systems thinking, operationalized through causal-loop diagrams, is used to contextualize export-permit delays within a broader governance ecosystem involving regulators, upstream suppliers, domestic demand, and government revenue. Decision-analysis theory, implemented through a decision-tree model, supports sequential and repeatable managerial decision-making under uncertainty.

Together, these lenses form a conceptual framework that treats LNG export-permit delays as a systemic and strategic risk, requiring proactive governance, quantitative foresight, and integrated coordination across organizational and institutional boundaries.

3. Research Methodology

3.1 Research Design

This study adopts a qualitative-dominant case study design complemented by semi-quantitative risk and financial analysis. The case study approach is appropriate given the institutional complexity of LNG export governance in Indonesia and the need to examine regulatory risk within its real-world context. The research is framed within ISO 31000:2018 to ensure systematic identification, analysis, evaluation, and treatment of export-permit delay risk, while decision-analysis theory is applied to structure managerial responses under uncertainty.

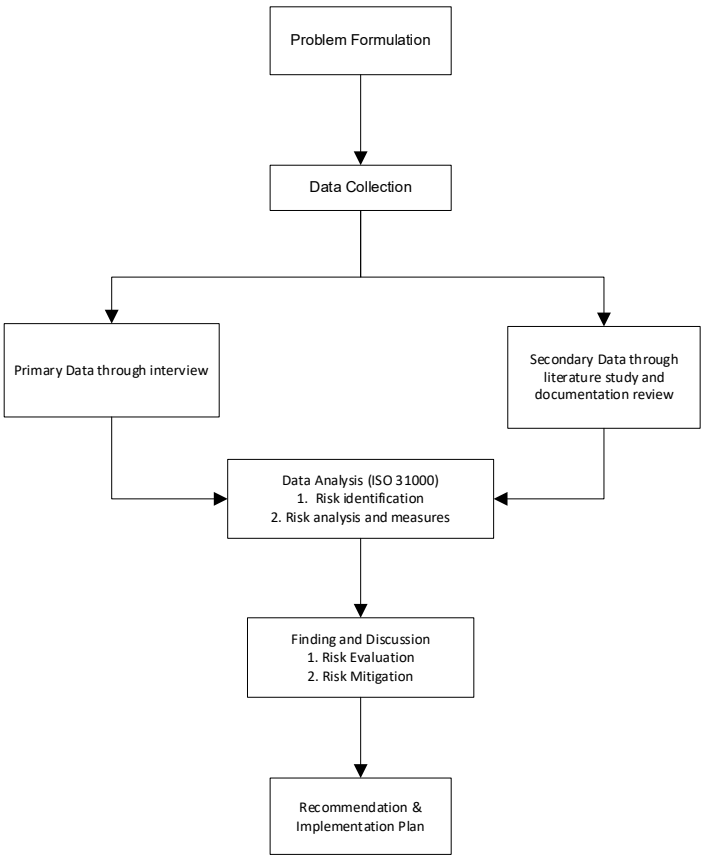

Figure 1: Conceptual Framework Analysing Business Risks

3.2 Data Sources and Triangulation

Data were collected through methodological triangulation to enhance analytical credibility. Primary qualitative data were obtained through semi-structured interviews with PT Sulawesi's high-level management, focusing on permit delays, operational impacts, and decision-making practices. Secondary data included internal company reports, LNG export permit documentation, and operational records for 2025. Regulatory data were sourced from government regulations, ministerial decrees, SKK Migas reports, and official meeting minutes or correspondence where available. Academic literature and industry publications were used to contextualize findings and support benchmarking.

3.3 Analytical Framework and Tools

The analysis integrates four complementary tools. First, ISO 31000:2018 provides the overarching risk-management process. Second, root-cause analysis using a Fishbone diagram identifies structural and organizational drivers of permit delays. Third, systems thinking and causal-loop diagrams capture feedback dynamics between domestic gas demand, regulatory intervention, and operational evidence. Fourth, a decision-

tree model structures alternative responses to diversion requests and permit uncertainty, representing the study's principal analytical contribution.

3.4 Risk Scoring and Quantitative Assessment

Risk likelihood and impact were assessed using PT Sulawesi's internal risk matrix, aligned with ISO 31000 principles. Financial exposure was estimated through scenario analysis comparing baseline export realization with diversion scenarios of <10, 10, and 20 LNG cargoes. While data limitations constrain full probabilistic modelling, the approach provides a conservative and decision-relevant estimate of downside exposure.

4. Results and Discussion

4.1 Inherent Risk Assessment and Gap Analysis

The results confirm that LNG export-permit delays constitute a high to critical inherent risk for PT Sulawesi. Prior to mitigation, the risk scored 20 (impact 5; likelihood 4), reflecting exposure exceeding USD 80 million and a high probability of occurrence. Gap analysis reveals misalignment with ISO 31000 best practice, particularly in fragmented risk ownership, reactive controls, and absence of scenario-based planning.

4.2 Residual Risk after Mitigation

Following mitigation measures implemented in 2025, including intensified regulator engagement and fulfilment of domestic LNG obligations, the residual risk score declined to 12 (impact 4; likelihood 3). This reduction demonstrates improved control effectiveness but confirms that material exposure persists due to systemic factors beyond the company's direct control.

4.3 Quantitative Impact and Sensitivity

Scenario analysis indicates that diversion of up to 10 cargoes can be absorbed with limited financial impact under current compensation mechanisms. However, diversion of 20 cargoes, approximately half of annual production, generates an estimated profit downside of USD 40 million at a minimum. Sensitivity analysis suggests that exposure increases materially if contractual penalties or replacement cargo purchases are required, underscoring the importance of commercial flexibility.

4.4 Managerial Validation through Interviews

Interview findings corroborate analytical results, highlighting domestic supply constraints and unclear regulatory authority as root causes. Management confirmed that decision-making remains largely ad hoc and reactive, reinforcing the need for structured governance and decision-support tools.

4.5 Benchmarking against Tangguh and Bontang LNG

Comparative analysis shows that mature LNG projects treat permitting as a strategic governance issue rather than an administrative task. Tangguh's formal escalation structures and Bontang's institutional continuity contrast with PT Sulawesi's fragmented approach, explaining differential exposure and informing targeted recommendations.

4.6 External Risk Context: PESTEL Analysis

A PESTEL analysis was conducted to establish the external context of LNG export-permit risk, as required under the ISO 31000 context-establishment stage. Politically and legally, the enactment of Government Regulation No. 61 of 2024 formalized domestic gas prioritization, directly constraining export approvals. Institutional overlap among ESDM, SKK Migas, and the Ministry of Trade increased coordination risk during the regulatory transition period.

From an economic perspective, LNG export delays expose PT Sulawesi to deferred revenue, loss of price arbitrage opportunities, and additional logistics costs. Social and environmental dimensions arise from government pressure to secure domestic energy supply and maintain price stability, reinforcing political intervention in export decisions. Technological factors include limitations in digital licensing platforms (SNANK and INSW), which were reported to experience synchronization delays and data validation issues. Collectively, the PESTEL analysis confirms that export-permit delays are driven primarily by structural and policy-related forces rather than firm-level administrative weakness.

4.7 Root-Cause Identification: Fishbone Analysis

Building on the external context, a Fishbone (Ishikawa) diagram was applied to identify root causes of export-permit delays. The analysis categorized causes into regulatory, organizational, process, information, and technical dimensions. Regulatory causes include evolving domestic allocation thresholds and discretionary approval authority. Organizational causes relate to fragmented ownership of permit risk across commercial, regulatory, and operations teams. Process-related issues include sequential approvals and limited escalation mechanisms. Information gaps arise from late-stage requests for revised domestic allocation data, while technical causes relate to digital system outages and inconsistent data standards.

The Fishbone analysis demonstrates that permit delays emerge from the interaction of multiple reinforcing causes, confirming that the risk cannot be mitigated through document completeness controls alone. This finding aligns with ISO 31000 guidance that complex risks require systemic treatment rather than isolated controls.

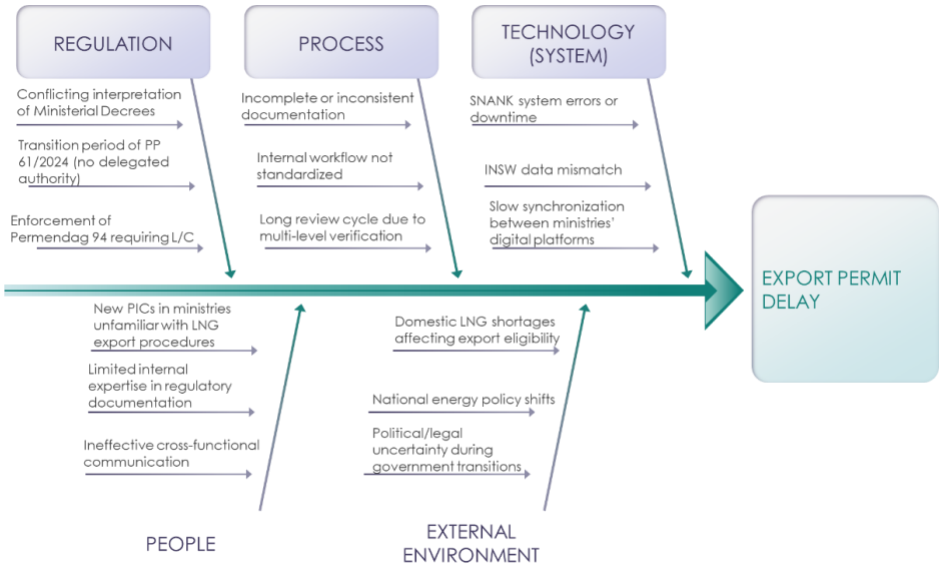

Figure 2: Risk Cause Analysis using Fishbone Diagram

4.8 Dynamic Risk Interaction: Causal Loop Diagram (CLD)

To capture dynamic interactions over time, a Causal Loop Diagram was developed to map feedback relationships between domestic gas demand, regulatory intervention, LNG production, and export outcomes. The CLD identifies a reinforcing loop in which increased domestic demand triggers stricter regulatory oversight, leading to export delays, cargo diversion, and reduced export revenue. Reduced export revenue, in turn, constrains investment flexibility and heightens sensitivity to subsequent regulatory intervention.

A balancing loop is also observed, whereby compliance with domestic allocation reduces immediate regulatory pressure but increases operational and commercial strain on single-train LNG facilities such as PT Sulawesi. The CLD highlights that export-permit delay risk is endogenous to the broader energy governance system and will

persist unless addressed through proactive coordination and anticipatory planning. This systems-based insight explains why reactive permit submission strategies yield limited long-term risk reduction.

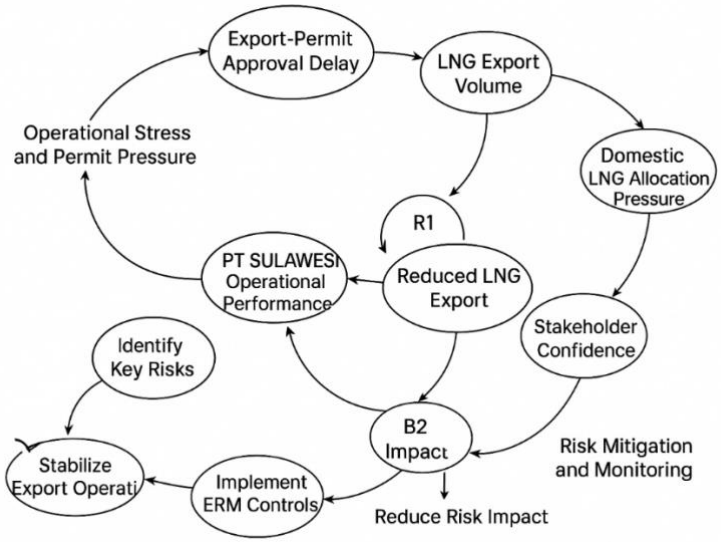

Figure 3: Causal Loop Diagram

4.9 Decision Tree Analysis and Managerial Decision-Making

To address these gaps, a decision tree was developed to structure managerial responses to export-permit uncertainty. The decision tree models sequential choices following a diversion request, including acceptance of domestic diversion, negotiation of export timing, or escalation for regulatory clarification. Each branch incorporates estimated financial outcomes and probability-weighted impacts.

Application of the decision tree demonstrates that early engagement and conditional diversion strategies dominate reactive compliance in expected-value terms. The model transforms permit management from an ad hoc process into a repeatable and auditable decision framework, consistent with ISO 31000's emphasis on integration with organizational decision-making.

Table 1: Outcome Summary

Outcome	**Business Result**	**Upstream Impact**	**GoI Revenue Implication**
Full buyer approval	Optimal	Stable production	Maintained export fiscal intake
Partial approval + appeal success	Manageable	Minor adjustments	Balanced revenue
Mandatory diversion (10 cargoes)	Commercially challenging	Production scheduling pressure	Reduced export revenue
Worst-case 20-cargo diversion	Material corporate exposure	Curtailment / stranded gas	Significant fiscal decline
Permit delay unresolved	Operational disruption	Backlog, inefficiency	Delayed revenue realization

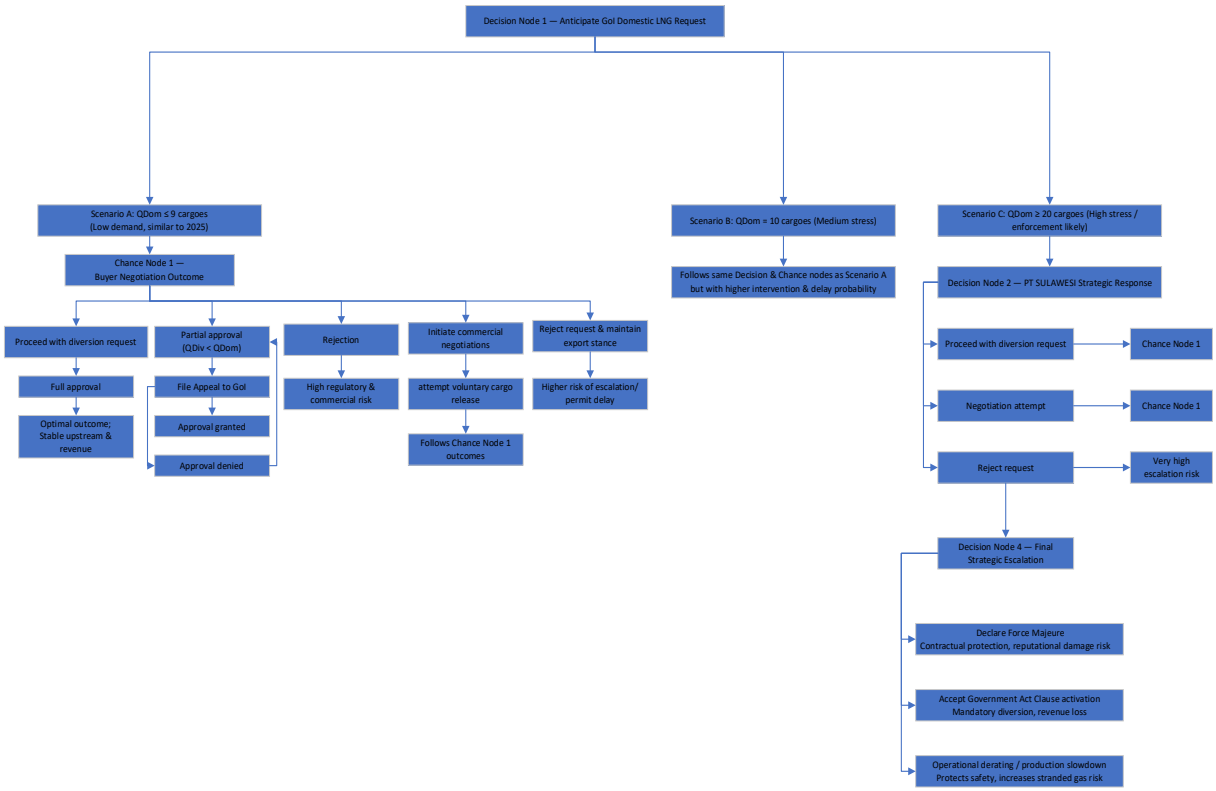

Figure 4: Decision Tree: Managing Export-Permit Delay & Cargo Diversions Scenarios

5. Conclusion

This study demonstrates that LNG export-permit delays at PT Sulawesi represent a systemic regulatory and commercial risk amplified by Indonesia's domestic-first energy policy framework. Current controls provide partial mitigation but remain insufficient under high-stress scenarios. Quantitative analysis estimates a potential downside of USD 40 million in 2025 if severe diversion materializes, confirming the materiality of the risk.

6. Recommendations

The study recommends institutionalizing the decision-tree framework, strengthening proactive government engagement, enhancing contractual flexibility, establishing a dedicated permit governance function, integrating scenario-based budgeting, and supporting regulatory process clarity. Collectively, these measures are projected to reduce permit-delay risk severity by approximately 40% and improve planning certainty.

Funding: Not applicable.

Conflict of Interest: The authors declare no conflict of interest.

Informed Consent Statement/Ethics Approval: Not applicable.

Declaration of Generative AI and AI-assisted Technologies: This study has not used any generative AI tools or technologies in the preparation of this manuscript.

References

Arena, M., Arnaboldi, M., & Azzone, G. (2011). Is enterprise risk management delivering? Evidence from the Italian public sector. *International Journal of Public Sector Management, 24*(7), 640–654. https://doi.org/10.1108/09513551111121366

Farouk Riza, M. (2019). *Analysis to reduce potential dead stock of maintenance, repair & operation (MRO) inventory in PT Badak NGL* (Master's thesis). Institut Teknologi Bandung.

Harits, A. (2025). *Analisis manajemen risiko dalam mencapai target Net Zero Emission 2060: Studi kasus di PT Pertamina Hulu Indonesia* (Master's thesis). Institut Teknologi Bandung.

Hasurungan, D. (2022). *Manajemen risiko pada transformasi bisnis perusahaan: Studi kasus PT Badak NGL* (Master's thesis). Institut Teknologi Bandung.

International Organization for Standardization. (2018). *ISO 31000:2018 risk management—Guidelines*. ISO.

McShane, M. K., Nair, A., & Rustambekov, E. (2011). Does enterprise risk management increase firm value? *Journal of Accounting, Auditing & Finance, 26*(4), 641–658. https://doi.org/10.1177/0148558X11409160

Nur Rahmi Syah Ramdani. (2019). *LNG value chain optimization to achieve sustainable electrification in Eastern Indonesia* (Master's thesis). Institut Teknologi Bandung.

Pemerintah Republik Indonesia. (2024). *Peraturan Pemerintah Republik Indonesia Nomor 61 Tahun 2024 tentang neraca komoditas*.

PricewaterhouseCoopers. (2025). *Oil and gas in Indonesia: Investment, taxation and regulatory guide*. PwC Indonesia.

PT Greencap Indonesia. (2016). *Tangguh LNG Trains 1 and 2 independent environmental and social compliance audit report*.

PT SULAWESI. (2025). *Company internal reports and LNG export permit documentation*.

Reuters. (2025, April 9). Indonesia to divert LNG cargoes to local buyers in April–May, adjust Singapore exports. *Reuters*.

SKK Migas. (2025). *Domestic LNG allocation and commodity balance review reports*.

Syahputri, H. Y. (2022). *Analisis manajemen risiko perusahaan pada Grup XYZ berdasarkan kerangka ISO 31000:2018* (Master's thesis). Institut Teknologi Bandung.

Tangguh Independent Advisory Panel. (2023, June). *Final report on operations and Tangguh expansion project*.