Type of Contribution:

Editorial
Research Paper
Review Paper
Case Study

ENERGY: JURNAL ILMIAH ILMU-ILMU TEKNIK
Vol. 16, No. 2 (2026) pp 445-458
DOI: 10.51747/energy.v16i2.p445-458

E-ISSN: 2962-2565

This article contributes to:

SUSTAINABLE DEVELOPMENT GOALS

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Supply Chain Risk Analysis and Mitigation Using the House of Risk Method: A Case Study of an LPG Manufacturing Company

Balqis Rahmi Salsabil[1*], **Adithya Sudiarno**[1], **Rizki Revianto Putera**[1]

[1] Department of Industrial and Systems Engineering, Sepuluh Nopember Institute of Technology, ITS Keputih Campus, Surabaya 60111, **Indonesia.**

* balqisalsabil@gmail.com

Abstract

Supply chain disruptions in LPG manufacturing can significantly affect procurement, production, and distribution, requiring a proactive risk management approach. This study aims to identify supply chain risks, prioritize their root causes, and develop preventive mitigation strategies by integrating the Supply Chain Operations Reference (SCOR) model and the House of Risk (HOR) method. A quantitative case study was conducted using interviews, focus group discussions, and expert judgment involving five managers from procurement, operations, terminal, marine, and sales functions. The SCOR model identified 22 Risk Events and 41 Risk Agents across six supply chain processes. HOR Phase 1 prioritized seven Risk Agents, accounting for 55.59% of the total Aggregate Risk Potential, with procurement- and logistics-related risks emerging as the most critical. HOR Phase 2 proposed 13 preventive actions, including supplier performance evaluation, unloading schedule optimization, preventive maintenance, cross-functional coordination, and real-time shipment monitoring. The integration of SCOR and HOR provides a systematic framework for prioritizing critical Risk Agents and developing proactive mitigation strategies, thereby improving supply chain resilience and operational reliability in LPG manufacturing.

Keywords: Supply Chain Risk Management, House of Risk, SCOR, LPG Manufacturing, Risk Mitigation, Aggregate Risk Potential.

Article Info

Submitted: 2026-06-24
Revised: 2026-08-01
Accepted: 2026-08-07
Published: 2026-08-08

Publisher

Universitas Panca Marga

1. Introduction

Supply chain disruptions have become a critical challenge affecting organizational performance in increasingly uncertain business environments. Global economic fluctuations, regulatory changes, geopolitical tensions, supplier instability, transportation constraints, and extreme weather events have increased supply chain uncertainty, leading to material shortages, production interruptions, delivery delays, inventory imbalances, and reduced customer satisfaction. Consequently, Supply Chain Risk Management (SCRM) has evolved into a strategic capability for enhancing business continuity and organizational resilience [3], [9], [10].

The downstream oil and gas industry, particularly Liquefied Petroleum Gas (LPG) manufacturing, is highly exposed to these disruptions due to its complex and interconnected supply chain involving suppliers, transportation providers, storage facilities, production units, distributors, and customers. Because disruptions occurring at one stage can propagate throughout the entire supply chain, maintaining reliable procurement, production, and distribution processes is essential for ensuring operational continuity and national energy security [4], [6].

Unlike demand-driven manufacturing systems, LPG manufacturing generally operates under a supply-driven strategy based on long-term procurement contracts. This operating model requires companies to balance procurement, inventory, production, and distribution while maintaining sufficient inventory levels and uninterrupted product availability. Consequently, disruptions in procurement, logistics, or operational coordination can rapidly reduce supply chain performance, increase operational costs, and negatively affect customer service. These characteristics highlight the need for a proactive and systematic supply chain risk management approach capable of identifying and mitigating the root causes of supply chain disruptions.

Supply chain disruptions have become a critical challenge affecting organizational performance in increasingly uncertain business environments. Global economic fluctuations, regulatory changes, geopolitical tensions, supplier instability, transportation constraints, and extreme weather events have increased supply chain uncertainty, leading to material shortages, production interruptions, delivery delays, inventory imbalances, and reduced customer satisfaction. Consequently, Supply Chain Risk Management (SCRM) has evolved into a strategic capability for improving business continuity and organizational resilience [3], [9], [10], [15].

The downstream oil and gas industry, particularly Liquefied Petroleum Gas (LPG) manufacturing, is highly exposed to these disruptions due to its complex and interconnected supply chain involving suppliers, transportation providers, storage facilities, production units, distributors, and customers. Because disruptions occurring at one stage can propagate throughout the entire supply chain, maintaining reliable procurement, production, and distribution processes is essential for ensuring operational continuity and national energy security [4], [6].

Unlike demand-driven manufacturing systems, LPG manufacturing generally operates under a supply-driven strategy based on long-term procurement contracts. This operating model requires companies to balance procurement, inventory, production, and distribution while maintaining sufficient inventory levels and uninterrupted product availability. Consequently, disruptions in procurement, logistics, or operational coordination can rapidly reduce supply chain performance, increase operational costs, and negatively affect customer service. These characteristics highlight the need for a proactive and systematic supply chain risk management approach capable of identifying and mitigating the root causes of supply chain disruptions.

2. Methods

2.1 Preliminary Study

A preliminary study was conducted before the House of Risk analysis to obtain an overview of the company's supply chain conditions and identify potential sources of risk. Data were collected through interviews with experts from the Production Planning and Inventory Control (PPIC), Terminal, and Marketing departments. The preliminary investigation identified major operational risks throughout the procurement, storage, filling, distribution, and customer service processes (**Table 1**), as well as the company's internal and external supply chain risks (**Table 2**). These findings served as the basis for the subsequent SCOR-based supply chain mapping and House of Risk analysis. To illustrate the complexity of supply chain risks faced by LPG manufacturing companies, the major operational risks identified during the preliminary study are summarized in **Table 1**.

Table 1 demonstrates that supply chain risks are distributed across every operational stage rather than originating from a single business activity. The interconnected nature of these risks indicates that disruptions occurring during procurement may propagate to production and distribution, eventually affecting customer satisfaction. Therefore, managing supply chain risks requires a systematic and proactive approach capable of identifying the root causes of operational disruptions before they escalate into more significant organizational problems. A preliminary investigation conducted through interviews with the Production Planning and Inventory Control (PPIC), Terminal, and Marketing departments further revealed that the company experiences both external and internal operational risks, as presented in Table 2.

Table 1. Major Supply Chain Risks in LPG Manufacturing

Supply Chain Activity	Potential Risks	Operational Impact
Procurement	Import regulation changes, supplier uncertainty	Material shortages and procurement delays
Storage	LPG leakage, inventory imbalance	Safety incidents and increased inventory costs
Filling Process	Equipment failure, filling bottlenecks	Reduced production capacity
Distribution	Transportation disruption, adverse weather	Delivery delays
Customer Service	Delivery delays and product complaints	Reduced customer satisfaction

Source: Preliminary study and interviews with PPIC, Terminal, and Marketing Department.

2.2 Research Design

This study employed a quantitative case study approach to analyze and mitigate supply chain risks in an LPG manufacturing company operating in the downstream oil and gas sector. The research focused on identifying supply chain Risk Events, determining the dominant Risk Agents, and formulating preventive mitigation strategies using the House of Risk (HOR) methodology. The Supply Chain Operations Reference (SCOR) model was adopted to systematically map supply chain activities into six processes: Plan, Source, Make, Deliver, Return, and Enable.

Table 2. Preliminary Supply Chain Risk Mapping

External Risks	Internal Risks
Import regulation changes	Overstocking or understocking
LPG price fluctuations	LPG leakage
Supplier delivery uncertainty	Filling process delays
Weather-related transportation disruption	Customer complaints
Transportation capacity limitation	Manual inventory management

Source: Preliminary study.

Primary data were collected through structured interviews, Focus Group Discussions (FGDs), and expert judgment involving five experts representing Procurement and PPIC, Terminal and Technical Support, Marine Operations, Operational Management, and Sales and Marketing. All respondents had more than ten years of professional experience and were directly involved in supply chain planning and operational decision-making. The study adopted a cross-sectional design in which all data were collected during a single observation period.

2.3 Research Procedure

The research consisted of four sequential stages:

1. Preliminary study and supply chain mapping using the SCOR model to identify operational activities and potential risk points.
2. Risk identification, in which Risk Events (RE) and Risk Agents (RA) were determined through interviews, FGDs, and expert judgment.
3. Risk assessment using House of Risk Phase 1 to calculate Aggregate Risk Potential (ARP) and prioritize Risk Agents.
4. Risk mitigation planning using House of Risk Phase 2 to determine preventive actions based on the Effectiveness-to-Difficulty (ETD) ratio.

The overall research procedure is illustrated in Figure 1

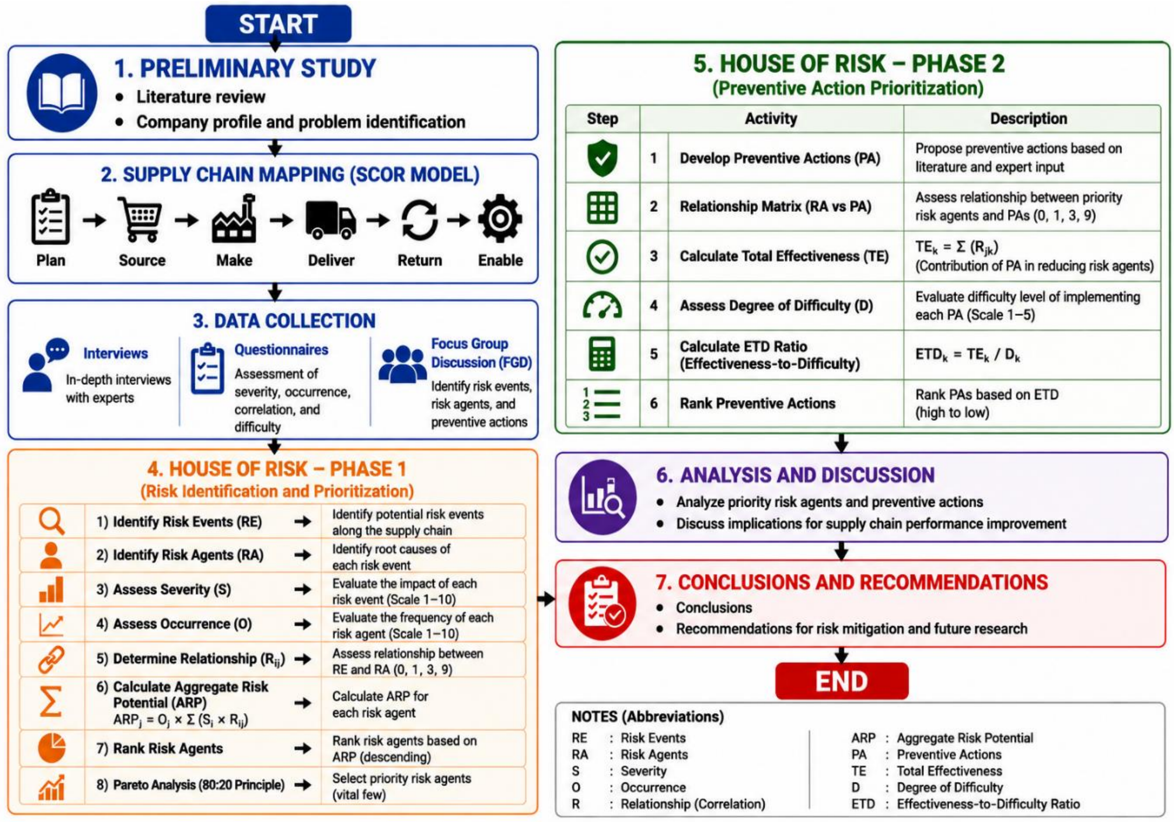

Figure 1. Supply Chain Risk Analysis Research Framework

2.4 House of Risk Phase 1

The House of Risk Phase 1 was employed to prioritize Risk Agents responsible for supply chain disruptions.

The procedure consists of:

1. Assessing the Severity (Si) of each Risk Event using a ten-point scale.
2. Assessing the Occurrence (Oj) of each Risk Agent.
3. Evaluating the relationship between Risk Events and Risk Agents using correlation values of 0, 1, 3, and 9.

4. Calculating the Aggregate Risk Potential (ARP) for each Risk Agent using:

$$ARPj = Oj \sum_{i} (Si \; x \; Rij) \tag{1}$$

where:

ARPj = Aggregate Risk Potential of Risk Agent jjj

Oj = Occurrence of Risk Agent jjj

Si = Severity of Risk Event iii

RijR = Relationship between Risk Event iii and Risk Agent jjj

Risk Agents were then ranked according to their ARP values. A Pareto analysis (80:20 principle) was conducted to determine priority Risk Agents requiring mitigation.

2.5 House of Risk Phase 2

Priority Risk Agents identified in Phase 1 were used as inputs for House of Risk Phase 2. Several preventive actions were proposed through literature review and expert discussions. The relationship between each preventive action and Risk Agent was evaluated using the same correlation scale (0, 1, 3, and 9).

The Total Effectiveness (TE) of each preventive action was calculated based on its contribution to reducing priority Risk Agents. Subsequently, experts assessed the Degree of Difficulty (D) for implementing each preventive action using a qualitative scale considering implementation complexity within the company. Finally, the Effectiveness-to-Difficulty (ETD) ratio was calculated to determine implementation priority.

$$ETDk = TEk \,/\, DEk \tag{2}$$

where:

TEk = Total Effectiveness of preventive action kkk

Dk = Degree of Difficulty

ETDk = Effectiveness-to-Difficulty ratio

Preventive actions with higher ETD values were prioritized because they provide greater mitigation effectiveness with relatively lower implementation difficulty. The final stage involved interpreting the results obtained from the House of Risk analysis. The analysis focused on identifying dominant Risk Agents, evaluating priority preventive actions, and discussing their implications for improving supply chain resilience in the LPG manufacturing company. The proposed mitigation strategies were expected to support proactive risk management by minimizing operational disruptions, improving inventory management, enhancing distribution performance, and strengthening overall supply chain performance.

The final stage involved interpreting the results obtained from the House of Risk analysis. The analysis focused on identifying dominant Risk Agents, evaluating priority preventive actions, and discussing their implications for improving supply chain resilience in the LPG manufacturing company. The proposed mitigation strategies were expected to support proactive risk management by minimizing operational disruptions, improving inventory management, enhancing distribution performance, and strengthening overall supply chain performance.

2.6 Data Analysis

The final stage involved interpreting the results of the SCOR and HOR analyses. The identified priority Risk Agents and preventive actions were analyzed to evaluate their implications for improving procurement reliability, inventory management, transportation performance, and overall supply chain resilience. Furthermore, the findings were compared with previous studies to demonstrate the contribution of the proposed SCOR–HOR integration to proactive supply chain risk management in the downstream LPG manufacturing industry.

3.Results and Discussion

3.1 Supply Chain Mapping Based on the SCOR Model

Tabel 3 hows that potential risks are distributed throughout all SCOR processes, indicating that disruptions may originate from both upstream and downstream activities. The Source and Deliver processes involve the largest number of external stakeholders, including suppliers, marine transportation providers, logistics companies, and distributors. Consequently, these processes are more vulnerable to supplier unreliability, transportation constraints, and weather-related disruptions than the remaining SCOR processes. This finding is consistent with Christopher (2016), who emphasized that procurement and logistics are the most vulnerable stages in supply chains because they depend heavily on external partners [2]. Similar observations were also reported by Enyinda et al. (2011), who found that procurement and transportation activities are the primary sources of disruption in petroleum supply chains [3].

Furthermore, the SCOR mapping demonstrates that the LPG supply chain operates as a highly interconnected system. Unlike conventional manufacturing industries where production can continue using safety stock, LPG manufacturing depends on continuous material flow because of storage limitations, safety requirements, and uninterrupted market demand. Consequently, procurement or transportation disruptions rapidly propagate to production and distribution activities, reducing inventory availability and customer service performance. This finding supports the SCOR framework proposed by APICS (2022), which states that disruptions in upstream processes can cascade through subsequent supply chain activities if operational integration is inadequate [11].

Table 3. Supply Chain Mapping Based on the SCOR Model

SCOR Process	Main Activity	Potential Risk
Plan	Production planning and inventory planning	Forecast errors, inventory imbalance
Source	LPG procurement and supplier management	Supplier delay, material shortage, transportation disruption
Make	LPG filling process	Equipment failure, filling delay
Deliver	Product distribution to customers	Delivery delay, vehicle availability, weather disruption
Return	Empty cylinder return	Cylinder damage, return delay
Enable	Information system, documentation, coordination	Communication failure, inaccurate inventory data

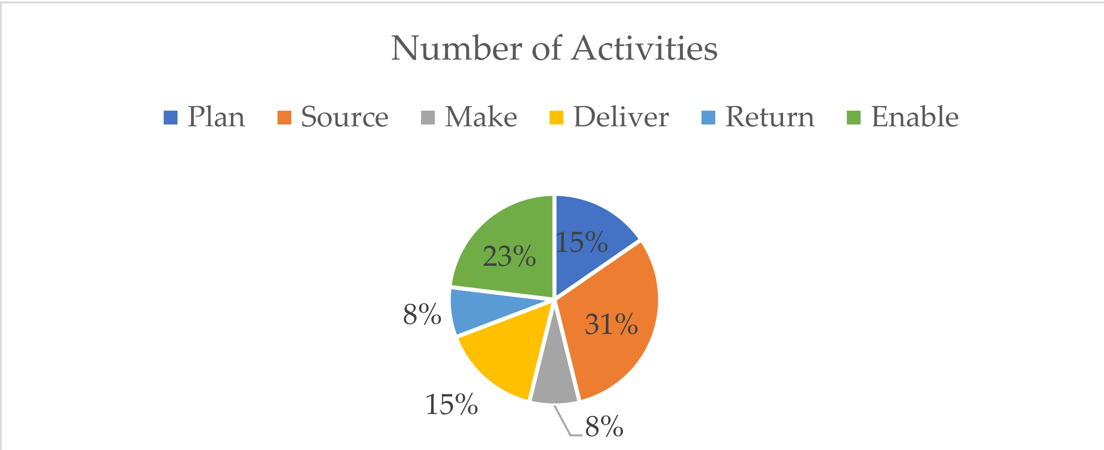

Figure 2. Summary of SCOR Activity Distribution in The Form of a Bar Chart.

3.2 Identification of Supply Chain Risk Events and Risk Agents

Table 4 indicates that the Deliver process contains the highest number of Risk Events, whereas the Source process contains the greatest number of Risk Agents. This result reflects the operational characteristics of LPG supply chains, where procurement activities involve multiple uncertainty sources, including supplier capacity, shipping schedules, import regulations, and transportation reliability, while distribution activities experience the greatest operational exposure because they directly interact with customers.

The identified Risk Agents include external factors, such as supplier shutdowns, vessel schedule changes, adverse weather conditions, and transportation disruptions, together with internal factors including poor coordination, equipment failures, and inventory management errors. These findings demonstrate that supply chain disruptions are rarely caused by a single factor but rather by interactions among multiple interconnected operational processes. Similar conclusions were reported by Pujawan and Mahendrawathi (2017), who explained that manufacturing supply chain risks generally arise from interactions among procurement, logistics, inventory, and operational coordination rather than from isolated operational failures [9]. Moreover, the coexistence of multiple Risk Agents influencing a single Risk Event supports the proactive philosophy of the House of Risk methodology, in which mitigation efforts focus on eliminating the causes of disruptions before operational failures occur [8].

Table 4. Summary of Identified Risk Events and Risk Agents

SCOR Process	Risk Events	Risk Agents
Plan	3	8
Source	5	13
Make	3	8
Deliver	6	7
Return	2	2
Enable	3	3
Total	**22**	**41**

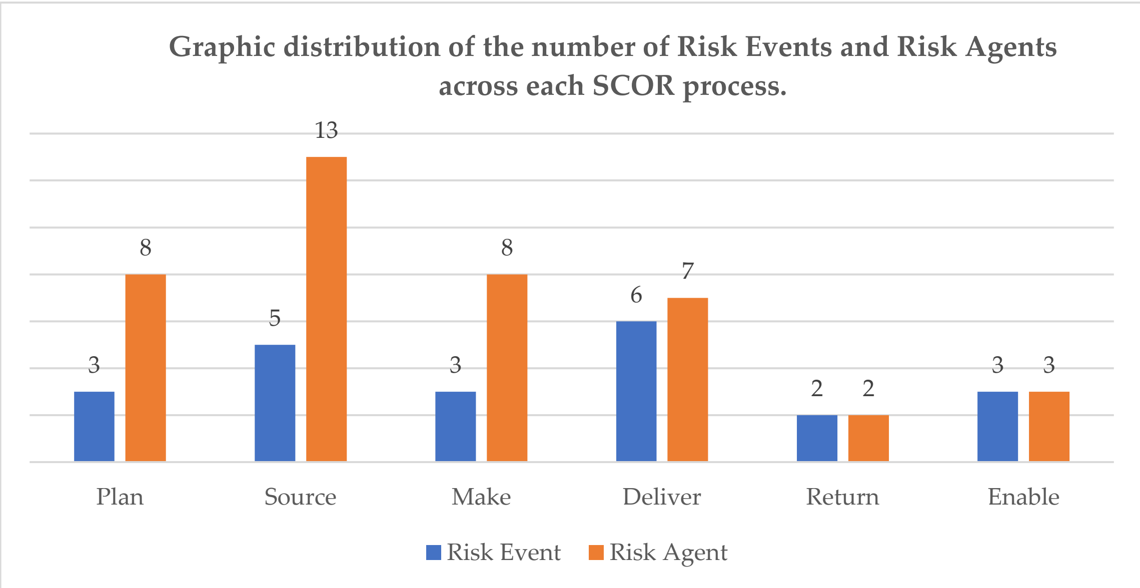

Figure 3. Distribution of the number of Risk Events and Risk Agents Across Each SCOR Process

3.3 Risk Assessment Using House of Risk Phase 1

Table 5 demonstrates that procurement- and logistics-related Risk Agents dominate the highest Aggregate Risk Potential (ARP) values. This finding indicates that supply chain performance in LPG manufacturing depends primarily on maintaining uninterrupted material flow rather than solely improving production efficiency.

For example, inefficient LPG unloading directly delays product availability for filling operations, whereas supplier shortages and vessel schedule changes interrupt procurement before production activities begin. Likewise, distribution vehicle breakdowns and route disruptions immediately affect customer deliveries because LPG products are distributed continuously to regional markets. These results are consistent with Fazli et al. (2015), who reported that procurement reliability, marine transportation, and logistics coordination are the dominant contributors to operational disruptions in downstream oil and gas supply chains [4].

Table 5. Top Seven Risk Agents Based on ARP

Rank	Risk Agent	ARP
1	A19 – Inefficient LPG unloading process using isotank	315
2	A21 – Distribution vehicle breakdown	315
3	A9 – Supplier unable to fulfill LPG supply	270
4	A18 – Vessel schedule changes	270
5	A8 – Poor coordination between PPIC and Operations	265
6	A17 – Adverse weather conditions	225
7	A13 – Distribution route disruption	210

In addition, poor coordination between PPIC and Operations emerged as one of the priority Risk Agents. This result suggests that information sharing is equally important as physical logistics activities. Christopher (2016) argued that inadequate coordination among supply chain functions reduces operational visibility and increases the likelihood of inventory imbalance and delayed distribution decisions [2]. Therefore, both external uncertainties and internal coordination issues contribute to the high ARP values observed in this study.

3.4 Priority Risk Agents and Pareto Analysis

Figure 4 shows that the first seven Risk Agents contribute 55.59% of the total Aggregate Risk Potential. Rather than being evenly distributed, supply chain risks are concentrated within a relatively small number of procurement- and logistics-related causes. This finding supports the Pareto principle proposed by Juran (1998), which suggests that a limited number of dominant causes are responsible for the majority of operational problems [5].

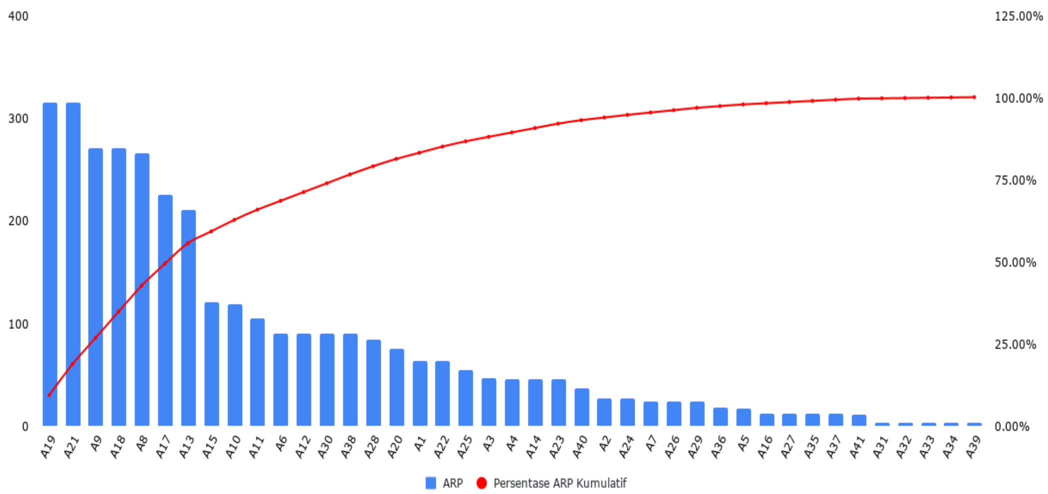

Figure 4. Pareto Diagram of Overall ARP by Risk Agent

Moreover, these Risk Agents are strongly interconnected. Supplier shortages and vessel schedule changes delay procurement activities, while inefficient unloading extends inventory replenishment time and ultimately delays product distribution. Distribution vehicle failures further amplify these disruptions by reducing delivery reliability. Similar relationships among procurement, transportation, and logistics risks have also been reported by Machfudiyanto et al. (2023), who identified procurement reliability and logistics performance as the principal determinants of supply chain resilience in Indonesia's downstream oil and gas industry [6].

3.5 Development of Preventive Actions Using House of Risk Phase 2

Table 5 indicates that the proposed preventive actions primarily focus on procurement reliability, logistics coordination, and transportation performance rather than production improvements. This prioritization reflects the dominant Risk Agents identified in HOR Phase 1, which are concentrated in upstream procurement and downstream logistics activities.

Table 5. Main Preventive Actions

Preventive Action	Target Risk Agent
Routine cross-functional coordination meetings	A8
Improve LPG unloading scheduling	A19
Real-time shipment monitoring system	A18, A21
Preventive maintenance of distribution vehicles	A21
Supplier performance evaluation	A9
Distribution contingency planning	A13, A17

For instance, optimizing LPG unloading schedules reduces delays in material availability, while preventive maintenance minimizes vehicle failures during distribution. Similarly, supplier performance evaluation and real-time shipment monitoring improve procurement visibility and enable earlier responses to supply disruptions. These preventive actions are consistent with previous House of Risk studies, which concluded that proactive mitigation targeting dominant Risk Agents is more effective than corrective actions implemented after operational failures occur [7], [12].

Overall, the integration of the SCOR model and the House of Risk methodology provides a systematic framework for identifying critical Risk Agents, prioritizing mitigation efforts, and strengthening supply chain resilience. This finding supports previous studies emphasizing that proactive supply chain risk management improves operational reliability by addressing the root causes of disruptions rather than merely responding to their consequences [8], [2].

3.6 Managerial Implications

The findings suggest that LPG manufacturing companies should prioritize procurement reliability, logistics performance, and cross-functional coordination to reduce supply chain disruptions. The proposed preventive actions, including supplier performance evaluation, optimized unloading schedules, preventive vehicle maintenance, and real-time shipment monitoring, support more proactive risk management. Furthermore, integrating the SCOR model with the House of Risk (HOR) enables managers to prioritize mitigation efforts based on Aggregate Risk Potential (ARP), thereby improving supply chain resilience and operational decision-making.

3.7 Comparison with Previous Studies

Previous studies have demonstrated the effectiveness of the House of Risk (HOR) method in prioritizing supply chain risks across various manufacturing industries. The HOR framework was first introduced as a proactive approach for identifying priority Risk Agents and developing mitigation strategies [8]. Subsequent studies successfully applied the method in bag manufacturing and automotive supply chains, confirming its effectiveness in supporting proactive risk management across different industrial contexts [7], [12]. However, these studies did not specifically address the operational characteristics of downstream LPG supply chains. In contrast, this study integrates the Supply Chain Operations Reference (SCOR) model with the House of Risk (HOR) approach to systematically identify 22 Risk Events, 41 Risk Agents, and 13 preventive actions tailored to LPG manufacturing. The findings reveal that procurement and logistics activities, particularly supplier reliability, unloading operations, marine transportation, and distribution, constitute the dominant sources of supply chain risk. Therefore, this study extends the application of the HOR methodology by integrating SCOR-based process mapping with proactive risk prioritization, providing a practical framework for improving supply chain resilience in the downstream LPG industry [8], [11].

4. Conclusion

This study integrated the Supply Chain Operations Reference (SCOR) model and the House of Risk (HOR) method to identify and prioritize supply chain risks in an LPG manufacturing company. The analysis identified 22 Risk Events, 41 Risk Agents, and seven priority Risk Agents that accounted for 55.59% of the total Aggregate Risk Potential, indicating that procurement and logistics activities are the dominant sources of supply chain disruption.

The main contribution of this study is the integration of SCOR-based supply chain mapping with the House of Risk approach, enabling systematic identification of Risk Events, prioritization of dominant Risk Agents, and development of 13 preventive mitigation actions tailored to the operational characteristics of downstream LPG manufacturing. This integrated framework provides practical decision support for improving supply chain resilience through proactive risk management.

This study is limited to a single LPG manufacturing company and expert assessments from five respondents. Therefore, future research should validate the proposed framework in different companies or energy sectors and incorporate quantitative or digital approaches to enhance the robustness of supply chain risk assessment.

Authors' Declaration

Authors' contributions and responsibilities - The authors made substantial contributions to the conception and design of the study. The authors took responsibility for data analysis, interpretation, and discussion of results. The authors read and approved the final manuscript.

Funding - No funding information from the authors.

Availability of data and materials - All data is available from the authors.

Competing interests - The authors declare no competing interest.

Additional information - No additional information from the authors.

References

[1] J. J. Bartholdi III and S. T. Hackman, Warehouse & Distribution Science. Atlanta, GA, USA: The Supply Chain and Logistics Institute, Georgia Institute of Technology, 2019.

[2] M. Christopher, Logistics & Supply Chain Management, 5th ed. Harlow, U.K.: Pearson Education, 2016.

[3] C. I. Enyinda, J. Briggs, and M. Bachkar, "Managing risk in petroleum supply chain," International Journal of Business and Management, vol. 6, no. 11, pp. 222–233, 2011.

[4] M. N. Fazli, A. M. Abdul Rahman, and M. A. Yusof, "Supply chain risk management in the oil and gas industry: A review," International Journal of Supply Chain Management, vol. 4, no. 2, pp. 1–8, 2015.

[5] D. Juran, Juran's Quality Handbook, 6th ed. New York, NY, USA: McGraw-Hill, 1998.

[6] M. Machfudiyanto, A. Sudiarno, and R. R. Putera, "Supply chain risk management in Indonesia's downstream oil and gas industry," International Journal of Industrial Engineering and Management, vol. 14, no. 2, pp. 121–132, 2023.

[7] D. Nugraha, A. Rahman, and H. Setiawan, "Risk analysis and mitigation in supply chain with House of Risk (HOR) approach in bag manufacturing industry at XYZ Ltd.," Journal of Industrial Engineering and Management Systems, vol. 15, no. 2, pp. 145–158,

2022.
[8] F. P. Pujawan and L. H. Geraldin, "House of Risk: A model for proactive supply chain risk management," Business Process Management Journal, vol. 15, no. 6, pp. 953–967, 2009.
[9] I. N. Pujawan and E. R. Mahendrawathi, Supply Chain Management, 3rd ed. Yogyakarta, Indonesia: Andi Publisher, 2017.
[10] N. Puspaningtyas and N. Zuraya, "Supply chain resilience in manufacturing industries: A systematic literature review," IOP Conference Series: Materials Science and Engineering, vol. 1072, no. 1, 2021.
[11] APICS, Supply Chain Operations Reference (SCOR) Digital Standard Version 13.0. Chicago, IL, USA: Association for Supply Chain Management (ASCM), 2022.
[12] M. Islami and H. Firmanto, "House of Risk (HOR) approach to manage risk involving multi-stakeholders: The case of automotive industry cluster of multifunctional rural mechanized tool (MRMT)," Journal of Industrial Engineering and Management, vol. 16, no. 3, pp. 512–529, 2023.
[13] [A. Ahmad, M. N. Ismail, and N. H. Abdullah, "Supply chain risk assessment in petroleum industry: A case study," International Journal of Supply Chain Management, vol. 6, no. 3, pp. 110–118, 2017.
[14] K. Choonga, M. A. Rahman, and N. Othman, "Risk management practices in the oil and gas supply chain," Procedia CIRP, vol. 26, pp. 344–349, 2015.
[15] A. S. Paul, M. Chowdhury, and S. K. Paul, "Supply chain risk management and resilience: A systematic literature review and future research agenda," Computers & Industrial Engineering, vol. 182, Art. no. 109356, 2023.