14th ISCA 2024

Analysis And Risk Mitigation Of The Kapulaga Supply Chain Using The House Of Risk (HOR) Method (A Case Study on Kapulaga SMEs in Baseh Village, Kedungbanteng Subdistrict)

Faqih Fadillah [1*], Retno Widuri[2], Joni Prayogi[3]

[1*]University of Jenderal Soedirman, faqih.fadillah@mhs.unsoed.ac.id, Indonesia
[2] University of Jenderal Soedirman, retno.widuri@unsoed.ac.id, Indonesia
[3] University of Jenderal Soedirman, joni.prayogi@unsoed.ac.id, Indonesia
*corresponding author

ABSTRACT

The Kapulaga SME in Baseh Village, Kedungbanteng District, Banyumas Regency, faces challenges in supply chain risk management, such as maintaining product quality, addressing product returns, and dealing with price fluctuations from major companies. This study aims to identify supply chain risks and develop effective mitigation strategies. The methodology employed includes the Supply Chain Operations Reference (SCOR) framework to map and identify risks in supply chain activities such as planning, sourcing, making, delivering, and returning. Additionally, the House of Risk (HOR) method is used to measure and analyze the Aggregate Risk Potential (ARP) values of identified risks and prioritize the most appropriate mitigation measures. Based on the results of HOR Phase 1, 25 risk events and 24 risk agents were identified. The ARP calculation identified three risk agents with the highest ARP values: weather factors, limited production equipment capacity, and a lack of suppliers. Subsequently, HOR Phase 2 was conducted to design mitigation actions, resulting in nine proposed actions. From these, priority mitigation actions were selected, including securing funding sources to invest in new equipment, adding or upgrading production equipment with higher capacity, utilizing modern drying equipment (drying ovens), and scheduling production based on seasonal conditions to optimize weather utilization.

Keywords: Risk Management, HOR, SCOR.

---

1. Introduction

Indonesia is known as an agrarian country, with the agricultural sector playing a vital role in the economy through its contribution to the Gross Domestic Product (GDP), food security, and provision of raw materials for industries (Zuhdi et al., 2020). One of the flagship commodities is cardamom, referred to as the "king of spices" due to its high demand in both local and global markets (Anggrasari et al., 2021). Central Java Province, particularly Banyumas Regency, is a significant contributor to national cardamom production (Putri, 2023).

The Cardamom MSME in Baseh Village, Kedungbanteng District, acts as a bridge between local farmers and markets, including large companies such as PT Industri Jamu dan

Farmasi Sido Muncul Tbk. However, this MSME faces challenges, such as product returns due to non-compliance with quality standards, including the presence of foreign particles in the cardamom (Pratiwi et al., 2023). In addition, price fluctuations from purchasing companies and high operational costs pose further challenges that affect the sustainability of the business and its supply chain.

To address these issues, this study aims to identify the main risks in the cardamom MSME supply chain, calculate the most significant risk values, and design risk mitigation priorities. The Supply Chain Operation Reference (SCOR) method is employed to identify risks in planning, procurement, production, delivery, and return activities. Risk assessment is conducted using the House of Risk (HOR) method, which combines Failure Mode and Effect Analysis (FMEA) and House of Quality (HOQ) to determine mitigation priorities based on Aggregate Risk Potential (ARP) (Pujawan & Geraldin, 2009b).

This research is expected to provide strategic solutions for the Cardamom MSME to manage supply chain risks, improve operational efficiency, and support business sustainability amidst increasing market competition.

2. Literature Review

2.1 Supply Chain Management (SCM)

Supply Chain Management (SCM) involves coordinating activities across multiple functions, including procurement, production, inventory, and distribution to consumers (Purwaningsih et al., 2021). SCM integrates upstream, internal, and downstream supply chains, aiming to improve long-term performance (Tuban, 2004). Key stakeholders include suppliers, distributors, retailers, and consumers (Indrajit & Djokopranoto, 2003).

2.2 Supply Chain Risk

Supply chain risks refer to uncertainties that arise from events within the supply chain or external factors, potentially leading to financial losses and business disruptions (Natalia et al., 2021). These risks can be classified into pure and speculative risks, impacting multiple actors in the supply chain and affecting operational continuity (Magdalena & Vannie, 2019).

2.3 Supply Chain Risk Management

Supply chain risk management involves identifying, assessing, and mitigating risks to ensure smooth operations and prevent disruptions. It requires strategic coordination across stakeholders to reduce risks at each stage, enhancing long-term business continuity (Purwaningsih et al., 2021). Effective risk management balances risks and opportunities.

2.4 Supply Chain Operations Reference (SCOR)

The Supply Chain Operations Reference (SCOR) model, developed by the Supply Chain Council (SCC), is a framework used to measure and improve supply chain performance (Zaroni, 2015). SCOR consists of three process levels: top level (Plan, Source, Make, Deliver, Return), configuration level (categorizing processes), and process element level (detailed process analysis). It includes key activities such as planning, procurement, production, delivery, and returns, with an emphasis on aligning strategies and improving efficiency through best practices (Ulfah, 2022). The model helps optimize supply chain operations and facilitates collaboration among supply chain partners (Nadhira et al., 2019).

2.5 Failure Mode and Effect Analysis (FMEA)

Failure Mode and Effect Analysis (FMEA) is a method used to identify, define, and reduce the likelihood of failures, issues, and errors in a system. It helps assess system reliability by identifying potential failures and analyzing their impacts. FMEA evaluates failure severity, occurrence, and detection, with ratings from 1 to 10 to determine risk levels. Severity classifies failure impacts, occurrence measures the frequency of risks, and detection identifies potential risk detection. The result of FMEA is quantified using the Risk Priority Number (RPN) (Julianto et al., 2024).

2.6 House of Risk (HOR)

House of Risk (HOR) is a model that integrates Failure Mode and Effect Analysis (FMEA) with House of Quality (HOQ) to mitigate supply chain risks (Pujawan & Geraldin, 2009). HOR consists of two phases:

3.6.1 HOR Phase 1

HOR Phase 1 involves identifying supply chain processes, assessing potential risks, measuring severity, determining risk sources and probabilities, and calculating Aggregate Risk Potential (ARP) to prioritize mitigation (Saputro, 2022).

Table 1. HOR Phase 1

To be treated risk agent (A_j)	*Preventive action* (PA_k)					*Aggregate risk potentials* (ARPj)
	PA_1	PA_2	PA_3	PA_4	PA_5	
A_1	E_{11}	E_{12}	E_{13}			ARP_1
A_2	E_{21}	E_{22}				ARP_2
A_3	E_{31}					ARP_3
A_4						ARP_4
A_5						ARP_5
Total efectiveness of action k	TE_1	TE_2	TE_3	TE_4	TE_5	
Degree of difficulty performing action k	D_1	D_2	D_3	D_4	D_5	
Effectiveness to difficulty ratio	ETD_1	ETD_2	ETD_3	ETD_4	ETD_5	
Rank of priority	R_1	R_2	R_3	R_4	R_5	

Source: Pujawan & Geraldin (2009)

3.6.2 HOR Phase 2

HOR Phase 2 focuses on selecting effective preventive actions based on ARP, evaluating the relationship between actions and risk sources, calculating total effectiveness (TE), assessing implementation difficulty, and prioritizing actions (Saputro, 2022). This approach helps reduce risk occurrence and improve supply chain reliability.

Table 2. HOR Phase 2

To be treated risk agent (A_j)	*Preventive action* (PA_k)					*Aggregate risk potentials* (ARPj)
	PA_1	PA_2	PA_3	PA_4	PA_5	
A_1	E_{11}	E_{12}	E_{13}			ARP_1
A_2	E_{21}	E_{22}				ARP_2
A_3	E_{31}					ARP_3
A_4						ARP_4
A_5						ARP_5
Total efectiveness of action k	TE_1	TE_2	TE_3	TE_4	TE_5	
Degree of difficulty performing action k	D_1	D_2	D_3	D_4	D_5	
Effectiveness to difficulty ratio	ETD_1	ETD_2	ETD_3	ETD_4	ETD_5	
Rank of priority	R_1	R_2	R_3	R_4	R_5	

Sumber: Pujawan & Geraldin (2009)

3. Research Methodology

This study adopts a mixed-method approach, combining both qualitative and quantitative methods. According to Creswell and Plano Clark (2018), a mixed-method approach integrates both qualitative and quantitative data collection and analysis in one study or related studies. The aim is to leverage the strengths of both methods to provide a comprehensive understanding of the research phenomenon.

The data display model used is the House of Risk (HOR), developed by Pujawan. The qualitative approach is employed to identify and explore potential risks in the Cardamom MSME supply chain and determine mitigation strategies, while the quantitative approach is used to measure and analyze risks and mitigation strategies using the HOR method.

3.1 Research Object

The object of this study is the supply chain activities of the Cardamom MSME located in Baseh Village, Kedungbanteng District, Banyumas Regency, Central Java. The research focuses on analyzing the supply chain risks faced by the MSME, identifying potential risks and their sources, the impacts, and the risk mitigation strategies that can be applied.

3.2 Research Flow Design

3.2.1 Problem Identification

This stage involves determining the scope of issues in the system to be analyzed. The goal is to understand the challenges faced by the MSME. The researcher conducts direct field visits and interviews with the stakeholders to observe the business processes and problems encountered.

3.2.2 Problem Formulation

Based on the problem identification, the research formulates the core issues, including identifying risks in supply chain activities, determining the highest risk values, and formulating risk mitigation priorities.

3.2.3 Literature Review

A literature review is conducted to study theories and knowledge related to the research issues. References include books, journals, and previous studies related to Risk Management, Supply Chain Management, SCOR, HOR, and Supply Chain Risk Management (SCRM).

3.2.4 Research Objectives

The research objectives are established to set boundaries for data collection and analysis. This ensures the research remains focused on the essential aspects, leading to more relevant and targeted results.

3.2.5 Data Collection

Data needed for this research include supply chain activities, risks in supply chain processes, impact and frequency levels, and the risk agents. Primary data is collected through:

- Observation: Direct observation of supply chain activities from farmer collection to delivery.
- Interviews: Interviews with MSME owners to gain insights into supply chain activities and risks.

3.2.6 Data Processing

Risk management steps are performed, including:

- HOR Risk Assessment (Stage 1): This includes assessing severity, occurrence, and correlation between risk events and risk agents, using Aggregate Risk Potential (ARP) for risk ranking.
- Risk Agent Priority Evaluation: Risks are ranked based on ARP values using a Pareto diagram.
- Mitigation Strategy Assessment (HOR Stage 2): Mitigation strategies are evaluated based on ARP values, including strategies to reduce severity, occurrence, and the correlation between risk events and risk agents.

3.2.7 Results Analysis

In-depth analysis of the processed data is conducted to address the research questions and provide insights into the risk mitigation strategies to be implemented.

3.2.8 Conclusion and Recommendations

The final stage provides a summary of the findings and recommendations for improving the MSME supply chain, focusing on areas that require attention and efficiency improvements.

The methodology integrates both qualitative and quantitative approaches to assess the risks and propose mitigation strategies for the Cardamom MSME supply chain.

4. Results

4.1 House of Risk Stage 1

Based on the identification results, 24 risk agents were found, as listed in Table 3, which includes the coding according to Pujawan and Geraldin (2009).

Table 3. Risk Event

Process	*Risk Event*	Kode	*Severity*
Plan	Fluctuations in raw material prices	E1	3
	Errors in raw material planning calculations	E2	5
	Resource limitations (labor and equipment)	E3	4
	Uncertainty in harvest time of supplier farmers	E4	3
	Market demand fluctuations	E5	5
	Errors in delivery scheduling	E6	4
	Stock planning errors	E7	6
Source	Inconsistent commitment from suppliers	E8	7
	Suppliers failing to meet raw material quantity requirements	E9	7
	Dependence on specific suppliers	E10	7
	Mismatch in raw material quality	E11	9
	Quantity of goods not in accordance with agreements	E12	8
	Human errors in raw material inspection	E13	6
	Insufficient raw material stock	E14	8
	Raw material damage due to storage with machinery in the same warehouse	E15	9
Make	Insufficient resources	E16	3
	Delays in production processes	E17	6
	Inaccurate sorting	E18	8
	Time-consuming drying process	E19	6
	High number of defective products in production (production defects)	E20	8
	Inadequate quality inspection	E21	8
	Product damage during storage	E22	8
Delivery	Delays in product delivery	E23	9
	Product damage during shipment	E24	8
Return	Product returns	E25	6

Based on the identification results, 24 risk agents were found and given an occurrence rating, as shown in Table 4, which includes the coding according to Pujawan and Geraldin (2009)

Table 4. Risk Agent

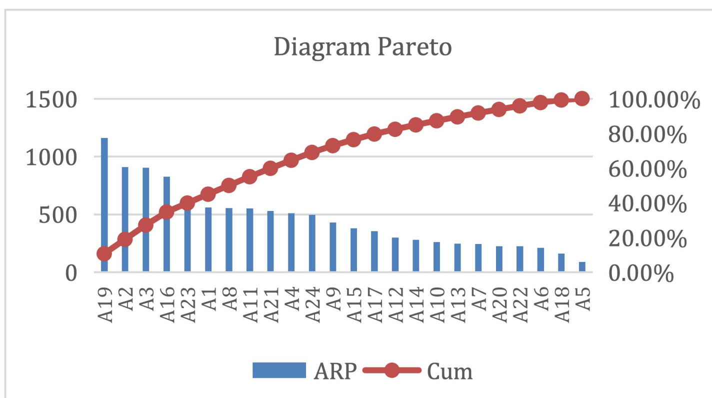
Kode	Risk Agent	Occurrence
A1	Poor warehouse management	4
A2	Limited production equipment capacity	7
A3	Limited number of suppliers	7
A4	Uncertain purchase demand	6
A5	High market demand	2
A6	Lack of formal contracts with suppliers	2
A7	Human error	2
A8	Harvest season changes	5
A9	Suboptimal forecasting system	5
A10	Inadequate workforce skills	4
A11	Supplier's inability to provide raw materials	4
A12	Quality inspection errors during goods loading	4
A13	Products not meeting quality standards	4
A14	Transportation constraints	3
A15	Competition with other competitors	5
A16	Raw material scarcity	5
A17	Inadequate workforce skills	3
A18	Product damage during shipping	3
A19	Weather factors	7
A20	Inadequate packaging	3
A21	Supplier misconduct	5
A22	Errors in resource quantity planning	5
A23	Lack of supporting equipment and technology at the farmer level	7
A24	Lack of coordination with farmer suppliers	5

Risks are prioritized based on the Aggregate Risk Potential (ARP) value, from highest to lowest. Implementation of ARP Calculation Results in Table 5:

Table 5. The Correlation Between Risk Events and Risk Agents

Risk Event (E)	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	*Severity*
	Risk Agent (A)																								
E1	0	0	1	1	9	0	0	3	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3
E2	1	0	3	3	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
E3	1	9	0	0	0	0	0	0	0	3	0	0	0	0	0	0	1	0	0	0	0	3	0	0	4
E4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	9	3
E5	0	0	1	1	1	0	0	0	3	0	0	0	0	0	9	9	0	0	0	0	0	0	0	0	5
E6	3	0	0	0	0	0	0	3	1	0	0	0	0	1	0	0	0	0	3	0	0	0	0	0	4
E7	1	0	3	9	0	0	0	0	9	0	1	0	0	0	0	3	0	0	0	0	0	0	0	0	6
E8	0	0	0	0	0	9	0	9	0	0	3	0	0	0	1	0	0	0	1	0	1	0	0	3	7
E9	0	0	0	0	0	1	0	1	0	0	9	0	0	0	0	3	0	0	1	0	0	0	0	0	7
E10	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
E11	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	3	0	3	0	9	3	9
E12	0	0	0	0	0	1	0	1	0	0	3	0	0	0	0	0	0	0	0	0	9	0	0	3	8
E13	0	0	0	0	0	1	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	6
E14	0	0	9	1	1	0	0	0	1	0	3	0	0	0	3	9	0	0	0	0	0	0	0	0	8
E15	9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	9
E16	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	9	0	0	3
E17	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3	0	3	0	0	1	0	0	6
E18	0	1	0	0	0	0	3	0	0	3	0	0	0	0	0	0	9	0	0	0	0	0	0	0	8
E19	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	6
E20	1	1	0	0	0	0	1	0	0	1	0	3	1	0	0	0	3	0	0	0	0	0	0	0	8
E21	0	0	0	0	0	0	9	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	8
E22	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	8
E23	0	1	1	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	9
E24	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	3	0	0	0	0	8
E25	0	0	0	0	0	0	0	0	0	0	0	9	9	0	0	0	0	9	0	0	0	0	0	0	6
Occurance	4	7	7	6	2	2	2	5	5	4	4	4	4	3	5	5	3	3	7	3	5	5	7	5	
ARP	560	910	903	510	90	210	244	555	430	260	552	300	248	279	380	825	354	162	1162	225	530	225	567	495	
Ranking	6	2	3	10	24	22	19	7	12	17	8	15	18	16	13	4	14	23	1	20	9	21	5	11	

4.2 Risk Evaluation



Picture 1. Pareto Diagram of Risk Agents

Based on the analysis using the Pareto concept, it was found that 20% of the risk causes originate from the three main risk causes: weather factors (A19), limitations in production equipment capacity (A2), and the limited number of suppliers (A3). Of the total ARP value calculated, these three risk agents contributed 27.10% of the total identified risks, while the remaining risks were distributed across other risk agents with smaller contributions.

4.3 House of Risk Stage 2

The next stage is HOR Stage 2, which aims to minimize risks by determining effective mitigation steps. Based on Table 6, there are 3 risk agents that will be the focus of mitigation, with a total of 9 mitigation steps that have been designed. Below is Table 4.10, which presents the proposed risk mitigation actions.

Table 6. Risk Mitigation Strategies

Risk Agent	Kode	Preventive Action	Kode
Weather factors	A19	Using modern drying equipment (drying oven).	PA1
		Building storage warehouses with temperature and humidity control.	PA2
		Scheduling production based on seasons to take advantage of optimal weather conditions.	PA3
Limitations in production equipment capacity	A2	Adding or upgrading production equipment with larger capacity.	PA4
		Seeking funding sources for new equipment investment.	PA5
		Conducting regular maintenance on production equipment to reduce downtime.	PA6
Limitations in the number of suppliers	A3	Establishing cooperation contracts with more farmers or suppliers.	PA7
		Building distribution networks to access new suppliers from other regions.	PA8
		Diversifying raw material sources to reduce dependence on specific suppliers.	PA9

After the identification process is completed, an assessment of the mitigation strategies is carried out, calculating the effectiveness level of each mitigation action and determining the Effectiveness to Difficulty (ETD) ratio. This ratio is used to evaluate the effectiveness of the mitigation strategy in comparison to the level of difficulty in its implementation. The results of the calculation are presented in Table 4.12.

Table 7. HOR Phase 2

	Preventive Action									ARP
	PA1	PA2	PA3	PA4	PA5	PA6	PA7	PA8	PA9	
A19	9	3	9	0	0	0	0	0	0	1162
A2	3	0	0	9	9	3	0	0	0	910
A3	0	0	0	0	0	0	9	9	3	903
TE_k	13188	3486	10458	8190	8190	2730	8127	8127	2709	
D_k	5	3	4	3	3	5	4	5	4	
ETD_k	2637,6	1162	2614,5	2730	2730	546	2031,8	1625,4	677,25	
Ranking	3	7	4	2	1	9	5	6	8	

5. Discussion

5.1 Analysis of House of Risk Phase 1

In the supply chain activities of Kapulaga SMEs, risk identification revealed 25 risk events divided into five main processes: planning, procurement, production, delivery, and returns. Each process has risk events with varying levels of severity. The planning process involves seven potential risks (E1-E7), the procurement process records eight risks (E8-

E15), the production process identifies seven risks (E16-E22), delivery notes two risks (E23-E24), and returns have only one risk (E25).

The occurrence assessment identified 24 risk agents, with the highest score (7) found in A2 (limited production capacity), A3 (limited number of suppliers), A19 (weather factors), and A23. Risk agents with an occurrence score of 6 were found in A4, while an occurrence score of 5 was identified in A8, A9, A15, A16, A21, A22, and A24. The rest had lower values.

The data analysis showed that the risk agent A19 (weather factors) had the highest ARP score of 1,162, contributing 10.59% cumulatively. This risk significantly impacts production, storage, and delivery processes. A2 (limited production capacity) recorded an ARP score of 910 with an 18.88% cumulative contribution, while A3 (limited number of suppliers) recorded an ARP score of 903 with a 27.10% cumulative contribution. The high ARP values for these risk agents were influenced by the severity of the risks, the frequency of their occurrence, and the significant correlations between risk events and risk agents.

5.2 Analysis of House of Risk Phase 2

The second phase of the House of Risk (HOR) aims to design effective mitigation strategies based on the ARP values calculated in the first phase. Using the Pareto 80/20 principle, the focus is directed toward the top 20% of risks to reduce 80% of their impact.

From the analysis, three priority risk agents were selected: A19 (weather factors), A2 (limited production capacity), and A3 (limited number of suppliers). Mitigation strategies were designed through literature review and discussions with the SME owner. Nine mitigation actions were proposed, with priorities determined based on the Effectiveness to Difficulty Ratio (ETDk) and Pareto diagram evaluation.

5.3 Risk Mitigation Priorities

Risk mitigation priorities were determined based on the evaluation of nine proposed mitigation strategies. The Pareto diagram was used to identify strategies that provide significant impact with minimal effort. The evaluation identified four priority mitigation actions that deliver 64% of the desired outcomes while only accounting for 44% of the total mitigation effort. The four mitigation strategies are as follows: Seeking funding sources for new equipment investment (PA5), Upgrading or adding production equipment with higher capacity (PA4), Using modern drying equipment (drying oven) (PA1), Scheduling production based on seasons to optimize weather conditions (PA3)

6. Conclusion

By implementing these four mitigation strategies, Kapulaga SMEs can address the main risks affecting their operations. The HOR-based approach provides a systematic framework for identifying, prioritizing, and mitigating supply chain risks. By focusing on productive efforts and significant outcomes, these strategies can improve operational efficiency, minimize risk impacts, and support business sustainability.

References

Anggreani, M., Ratih, A., Husaini, M., Emalia, Z., Usman, M., Aida, N., & Ciptawaty, U. (2023). Analisis pengaruh sektor pertaian terhadap PDRB sektor pertanian di Indonesia tahun 2015-2021. Journal on Education, 6(1), 6490–6507. https://doi.org/10.31004/joe.v6i1.3871

Julianto, A. R., Kurnia, I., & Assidiq, M. N. (2024). Menurunkan reject berlubang pada nyy cable menggunakan metode Fault Tree Analysisi (FTA) dan Failure Mode And Effect Analysis (FMEA) di PT. Kabelindo Murni Tbk. Industrikrisna, 13(2).

Magdalena, R., & Vannie, V. (2019). Analisis risiko supply chain dengan model House Of Risk (HOR) pada PT Tatalogam Lestari. J@ti Undip: Jurnal Teknik Industri, 14(2), 53–62. https://doi.org/10.14710/jati.14.2.%p

Nadhira, A. H. K., Oktiarso, T., & Harsoyo, T. D. (2019). Manajemen risiko rantai pasok produk sayuran menggunakan metode supply chain operation reference dan model house of risk. 2.

Natalia, C., Oktavia, C. W., Makatita, W. V., & Suprata, F. (2021). Integrasi model House Of Risk Dan Analytical Networking Process (ANP) untuk mitigasi risiko supply chain. Jurnal METRIS, 22(01), 57–66. https://doi.org/10.25170/metris.v22i01.2619

Pratiwi, W. E., Lestari, S. D., Suana, S., Mafazi, A. F., Rahmatullah, M. F., & Herliana, O. (2023). Pendampingan petani guna meningkatkan produksi dan kualitas kapulaga di Desa Baseh Kedungbanteng Banyumas. Darma Sabha Cendekia. https://doi.org/10.32424/dsc.v5i2.9862

Pujawan, I. N., & Geraldin, L. H. (2009a). House of risk: A model for proactive supply chain risk management. Business Process Management Journal, 15(6), 953–967. https://doi.org/10.1108/14637150911003801

Pujawan, I. N., & Geraldin, L. H. (2009b). Business process management journal, 15(6), 953–967. https://doi.org/10.1108/14637150911003801

Pujawan, I. N., & Er, M. (2017). Supply chain management edisi 3. Penerbit Andi.

Purwaningsih, R.-, Ibrahim, C. N., & Susanto, N. (2021). Analisis dan mitigasi risiko supply chain pada pengadaan material produksi dengan model House Of Risk (HOR) pada PT. Toba Pulp Lestari Tbk, Porsea, Sumatra Utara. Mix: Jurnal Ilmiah Manajemen, 11(1), 64. https://doi.org/10.22441/mix.2021.v11i1.005

Putri, D. D. (2023). Analisis karakteristik dan motivasi sosial ekonomi petani kapulaga di lahan perhutani Kabupaten Banyumas. SEPA: Jurnal Sosial Ekonomi Pertanian dan Agribisnis, 20(1), 107. https://doi.org/10.20961/sepa.v20i1.62114

Saputro, C. P. C. (2022). Analisis resiko supply chain di PT. BMI dengan menggunakan metode HOR (House Of Risk) untuk menentukan mitigasi resiko tertinggi.

Turban et al. 2004. Information technology for management 4th edition. John Wiley & Sons, Inc.

Ulfah, M. (2022). Mitigasi risiko rantai pasok industri kue menggunakan house of risk. Journal Industrial Servicess, 8(1), 63. https://doi.org/10.36055/jiss.v8i1.14315

Zaroni, D. (2015). Manajemen risiko rantai pasok dalam model SCOR. Supply Chain Indonesia. Com.

Zuhdi, F., Lola, R., & Maulana, A. S. (2020). Daya saing ekspor rempah Indonesia ke European Union-15. AGRIC: Jurnal Ilmu Pertanian, 15(21), 139–152..