Jurnal Teknologi Industri Pertanian 35 (2): 157-167, August 2025
DOI: https://doi.org/10.24961/j.tek.ind.pert.2025.35.2.157
ISSN: 0216-3160 EISSN: 2252-3901

Terakreditasi Peringkat 2
SK Dirjen Pendidikan Tinggi, Riset, dan Teknologi No. 158/E/KPT/2021
Tersedia online http://journal.ipb.ac.id/index.php/jurnaltin

DESIGN SUPPLY CHAIN RISK MANAGEMENT USING HOUSE OF RISK (HOR) METHOD AT IBUNMANIS COKLAT MSMES

PERANCANGAN SUPPLY CHAIN RISK MANAGEMENT MENGGUNAKAN METODE HOUSE OF RISK (HOR) PADA UMKMIBUNMANIS COKLAT

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Paper: Received September 03, 2024; Revised February January 10, 2025; Accepted March 20, 2025

ABSTRAK

UMKM Ibunmanis Coklat adalah sebuah bisnis dalam industri makanan yang memproduksi cokelat batang dan cokelat isi, termasuk dalam kategori Usaha Kecil Menengah (UKM). Selama satu tahun, UMKM ini mengalami total loss supply sebesar 33% dari target permintaan yang diharapkan. Terdapat 51 kejadian keterlambatan bahan baku utama dalam setahun, sementara bahan baku penunjang mengalami sembilan kali keterlambatan, dan bahan kemasan sekali. Permasalahan dalam pasokan ini menyebabkan loss production sebanyak 10 kali dalam setahun. Tiga isu utama yang dihadapi adalah ketidakpastian pemesanan, keterlambatan bahan baku, dan cacat dalam proses produksi. Untuk memperbaiki kinerja rantai pasok, UMKM Ibunmanis Coklat melakukan analisis risiko rantai pasok menggunakan model SCOR 12.0 yang mengidentifikasi 24 risk event dan 29 risk agent. Berdasarkan analisis model HOR 1 dan pareto, 80% risk agent prioritas diidentifikasi dan membutuhkan mitigasi untuk mengurangi 20% penyebab risiko. Dengan model HOR 2, ditetapkan strategi mitigasi prioritas yang melibatkan integrasi perencanaan dan penjadwalan. Risiko tersebut dikelola dengan menggunakan indikator kinerja yang diukur dengan snorm de boer, serta visualisasi historis untuk memantau dampaknya.

Keywords: house of risk, manajemen risiko, mitigasi risiko rantai pasok, SCOR

ABSTRACT

Ibunmanis Coklat MSMEs is a business in the food industry that produces chocolate bars and filled chocolates, categorised as a Small and Medium Enterprise (SME). Over a year, this SME experienced a total supply loss of 33% of the target demand. There were 51 delays in the main raw materials over the year, while supporting raw materials faced nine delays, and packaging materials were delayed once. These supplyissues led to 10 instances of production loss throughout the year. The three main issues faced were order uncertainty, raw material delays, and production process defects. To improve supply chain performance, Ibunmanis Coklat MSMEs conducted a supply chain risk analysis using the SCOR 12.0 model, identifying 24 risk events and 29 risk agents. Based on the HOR 1 model and Pareto analysis, 80% of the priority risk agentswere identified, requiring mitigation to reduce 20% of the risk causes. Through the HOR 2model, priority mitigation strategies were established, involving the integration of planning and scheduling. These risks are managed using performance indicators measured by Snorm de Boer, along with historical visualisation to monitor their impact.

Keywords**:** house of risk, risk management, supply chain risk mitigation, SCOR

INTRODUCTION

Ibunmanis Coklat MSMEs face several challenges in their supply chain process, especially related to the increase in demand and supply. The process begins when consumers or retailers place orders directly with Ibunmanis Coklat MSMEs. If the consumer requests packaging customization, the design is discussed with the graphic design team. Once the design is approved, the order is prepared for production. Ibunmanis Coklat MSMEs then ensures the availability of raw materials in the warehouse before ordering the necessary materials from three mainsuppliers: one for the primary raw materials, one for supporting materials, and one for packaging materials. The received raw materials are inspected, and if defects are found, the materials are returned to the supplier. Materials that pass inspectionare stored in the warehouse before further processing. However, limitations in managing increases in demand and supply are a significant problem for IbunmanisCoklat MSMEs, as shown by the demand fluctuation graph for 2023.

Based on the Figure 1, several increases and decreases in demand and supply were observed in 2023. Over the course of the year, a total supply loss of 33% from the target demand was recorded. These delays in supply significantly affect various operational aspects of Ibunmanis Coklat MSMEs. However, Ibunmanis Coklat MSMEs currently lack

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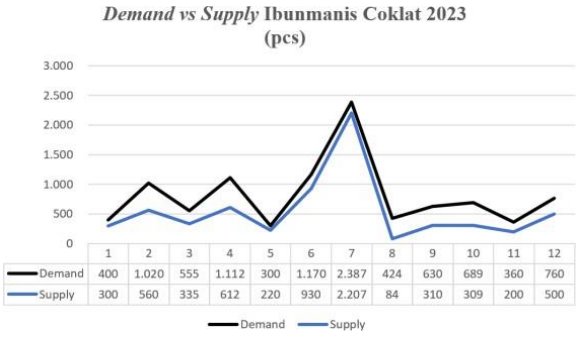
an adequate real-time monitoring system for its productionactivities. Therefore, risk management is necessary to identify, evaluate, and control these risks. In supply chain risk management are required to be able to manage risks, so that impact of the risk can be avoided or minimized (Marimin and Muzakki, 2021).



	1	2	3	4	5	6	7	8	9	10	11	12
Demand	400	1.020	555	1.112	300	1.170	2.387	424	630	689	360	760
Supply	300	560	335	612	220	930	2.207	84	310	309	200	500

Figure 1. Demand Ibunmanis Coklat Tahun 2023

The supply chain risk management (SCRM) process in this study includes several stages. Firstly, risk identification (risk agent and risk event) was conducted using the SCOR process (plan, source, make, deliver, return). Secondly, prioritised risk analysis was conducted using the House of Risk (HOR) to determine the main risks that must be addressed in the object. Thirdly, risk evaluation is carried out to determine the risk agents that require action, using the HOR results and pareto diagrams. Finally, risks are controlled with preventive actions according to Martono (2020) and the creation of a dashboard for real-time risk monitoring. Effective integration between the Founder, Co-Founder, chocolate bar production division, chocolate filling production division, packaging division involved at each stage of the supply chain process is essential to ensure that the final product reaches the consumer with the expected quality and on time, given the complexity of activities that can pose a risk to the company.

Based on the issues faced by Ibunmanis Coklat MSMEs, several alternative solutions have been identified to address the existing problems. Ibunmanis Coklat MSMEs aims to improve performance in managing the supply of raw materials provided by suppliers through the enhancement of their supply chain processes. This involves analyzing risks to effectively monitor the current supply chain at Ibunmanis Coklat MSMEs. This background underpins the research to analyze therisks within the supply chain of Ibunmanis Coklat MSMEs, with the goal of identifying risks and evaluating decision-making opportunities for future supply chain activities. According to Mahroby, Baihaqi, and Bramati (2021), SCOR can map parts of the supply chain. Applying the SCOR method for supply chain management allows for comprehensive observation and measurement of the supplychain processes. The SCOR Model framework includes five core processes: plan, source, make, deliver, and return (Sriwana *et al.*, 2021). Meanwhile, the HOR (House of Risk) method can be used to mitigate risks by analyzing and identifying potential risks and their consequences (Jiroyah & Muflihah, 2022). According to Magdalena & Vannie (2019), House of Risk combines FMEA (Failure Mode and Effect Analysis) with HOQ (House of Quality) to create a simple quantitative risk prioritization calculation. The application uses FMEA principles to quantify risk, combined with the House of Quality model to prioritize risk agents and select the most effective actions to mitigate potential risks (Magdalena). For agro-industrial supply chains, including Coklat MSMEs, managing a long supply chain is essential for maintaining quality and timely delivery of MSMEs products (Nisa *et al.*, 2023). Risk and uncertainty will always be crucial issues for supply chain management as an industry requirement. To address these risks, appropriate supply chain risk management is needed (Lima *et al.*, 2023). The objectives of this research are: (1) to identify potential risks in the supply chain of Ibunmanis Coklat MSMEs, (2) to design and formulate supply chain risk management for Ibunmanis Coklat MSMEs, and (3) to develop risk monitoring forthe supply chain of Ibunmanis Coklat MSMEs.

RESEARCH AND METHODS

A conceptual model is an abstract representation of the relationships amongtheories that will be used in research. In this study, the conceptual model is illustrated using an influence diagram.

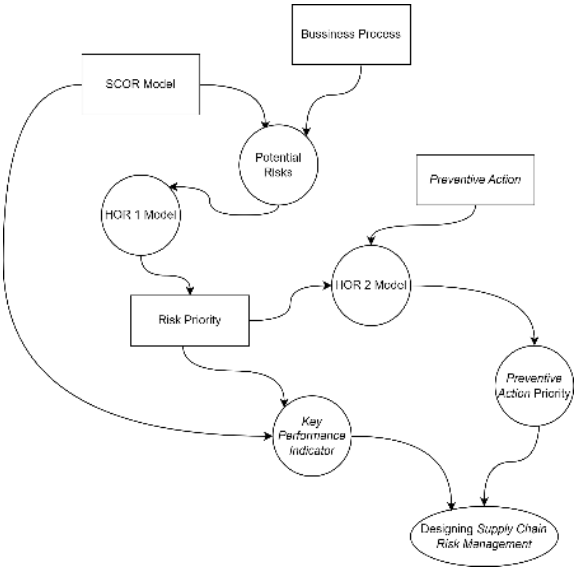


Figure 2. Conceptual Model

Based on Figure 2, there are two initial inputs: Business Processes and the SCOR Model, which produce an output of potential risks. These potential risks are then assessed using the HOR 1 Model Method, which yields an output of risk priorities.

These risk priorities, along with preventive actions, are used in the HOR 2 Model Method to calculate prioritized preventive actions. The results from this prioritization process form the basis for designing the supply chain risk management.

The research process begins with problem identification, goal formulation, and a preliminary study that includes a literature review on Supply Chain Management, Risk Management, SCOR Model, and House of Risk. In addition, interviews were conducted with the owner of Ibunmanis Cokelat MSME and field observations to understand the business processes and risks faced. Data collection starts with mapping business processes using the SCOR model. Interviews with the owner of Ibunmanis Coklat MSMEs are conducted to understand business processes and existing risks. Furthermore, the data that has been collected is analysed using the *De Boer Snorm* normalisation method. This method is used to normalise the risk values that have been identified with the following formula:

$$S = \frac{X - Xmin}{Xmax - Xmin} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where:

S	:	normalised risk value
X	:	actual measured risk value
Xmin	:	minimum risk value identified
Xmax	:	maximum risk value identified

The first questionnaire assesses the impact to MSMEs of how serious the frequently occurring risks are that could potentially affect MSMEs, frequency of risks, and the relationship between risk causes and events to identify primary risk causes, while the second questionnaire determines the most effective preventive actions. Data from the first questionnaire was obtained from respondents including the founder, co-founder, chocolate bar production division, filled chocolate production division, packaging division so that it could be analysed using HOR 1 to identify priority risks, with Pareto 80/20 analysis used to highlight the most impactful risks. These results, along with the second questionnaire, was obtained from respondents including the founder, co-founder, chocolate bar production division, filled chocolate production division, packaging division in HOR 2 to evaluate the difficulty of risk prevention and establish prioritized mitigation actions. Additionally, the results from HOR 1 aid in mapping SCOR performance against risk agents and developing risk severity indicators for supply chain risk management.

RESULTS AND DISCUSSIONS

Based on Figure 3, the business process of Ibunmanis Cokelat MSME starts when a customer orders a product from the owner. Once the request is communicated and agreed upon, including packaging customisation, an invoice is issued. The owner then develops a production plan and sends purchase orders (POs) to suppliers for raw materials, supporting materials and packaging. Received materials are checked to ensure quality and quantity.

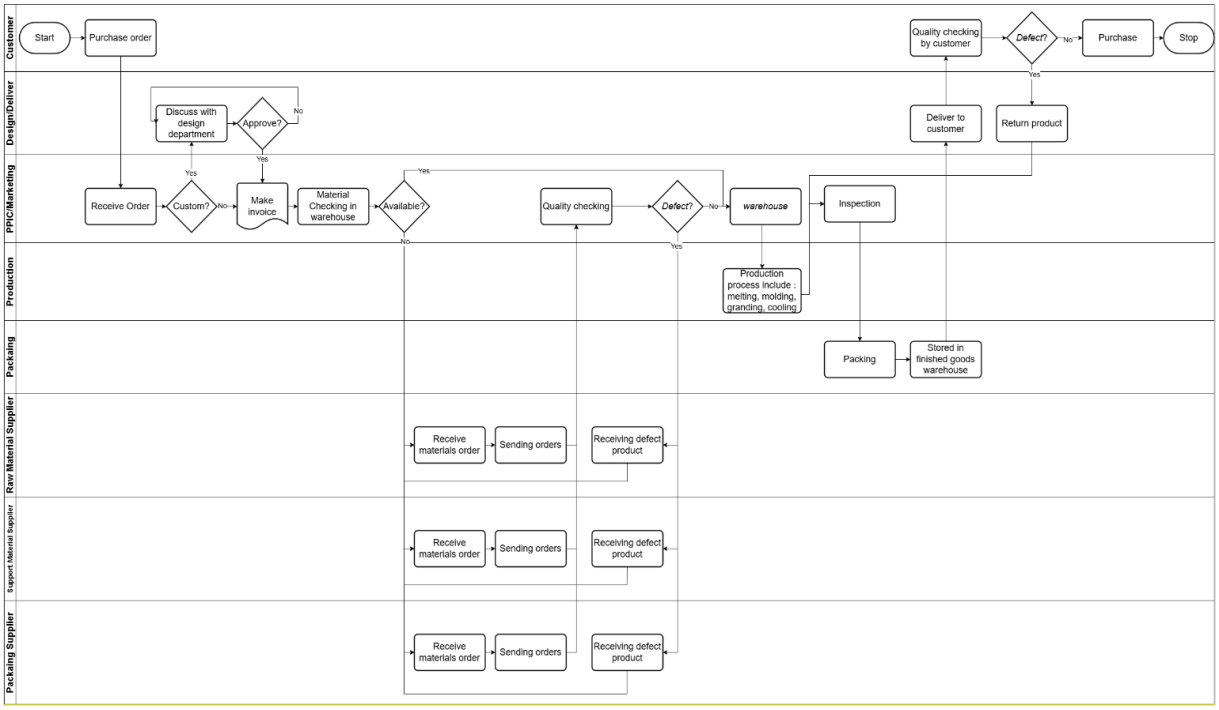


Figure 3. Business Process of Ibunmanis

Materials that do not meet the standards are returned, while those that do are paid for. Production is carried out as requested, and after inspection, the products are packed and stored in the warehouse. Deliveries are made using company vehicles without involving third parties. The consumer then inspects the product, and if compliant, payment is made; if not, a complaint is lodged.

Business Process Mapping with the SCOR Model

At this stage, the business process mapping is carried out using the SCOR 12.0 model, and the identification of Risk Events and Risk Agents in the supply chain of Ibunmanis Coklat MSMEs is conducted through literature review This was verified by the company through interviews with five people familiar with the company's supply chain processes and experts with a deep understanding of the company's supply chain system, as shown in the Table 1.

Identification of Correlation Between Risk Events and Risk Agents

According to Kusrini and Handayani (2020), when assessing the correlation between each risk event and its corresponding risk agent, four levels of correlation weighting are used, with a value range of 0, 1, 3, and 9. The higher the correlation weight, the stronger the relationship between the risk agent and the risk event. The correlation between the risk events and the risk agents as shown in the Table 2.

The correlation assessment between each risk event and risk agent will result in the Aggregate Risk Potentials value which is shown in the image Figure 4. The first rank is the risk agent with code A2 and ARP value 2712, the second rank is the risk agent with code A3 and ARP value 1872, the third rank is the risk agent with code A4 and ARP value 1530. Furthermore, the fourth ranked risk agent with code A14 and ARP value 1113, the fifth ranked risk agent with code A7 and ARP value 1080, the sixth ranked risk agent with code A9 and ARP value 889. Then at number seven there is risk agent A13 with an ARP value of 750 followed by risk agent with code A23 with an ARP value of 720 at number eight. The ninth rank is a risk agent with code A21 and an ARP value of 680, 10th rank risk agent A29 with ARP value 612, 11th rank risk agent A16 with ARP value 528. In the 12th rank there is a risk agent with code A15 followed by A19 and A20 getting the same ARP value of 432. The 15th rank is risk agent A5 and ARP value 396, then risk agent A12 at 16th rank with ARP value 342, followed by 17th risk agent code A11 and ARP value 340 and 18th risk agent with risk agent A10 and ARP value 336. The next ranking is risk agent A1 with an ARP value of 324, ranking 20th risk agent A25 and an ARP value of 216 and ranking 21st risk agent A6 with an ARP value of 198. The 22nd rank is risk agent A26 with an ARP value of 162 followed by the next rank is risk agent A27 with the same ARP value. Risk agent A18 with an ARP value of 144 is ranked k-24, risk agent A28 with an ARP value of 126, risk agent A22 with an ARP value of 108 is ranked 26th. Then at 27th rank there is risk agent A8 with an ARP value of 62, 28th rank there is risk agent A17 with an ARP value of 48 and risk agent A24 at 29th rank gets an ARP value of 24.

In Figure 4, a Pareto diagram is presented, illustrating the ranking of risk agents. According to the Pareto principle, 80% of the risk events originate from 20% of the risk agents (Suryaningrat and Paramudita, 2021). Therefore, the priority risk agents are those with a cumulative percentage below 80%. As a result, the priority risk agents in this design include codes A2, A3, A4, A14, A7, A9, A13, A23, A21, A29, A16, A15, and A19.

Identification of Mitigation Strategies

At this stage, the research focuses on identifying mitigation strategies that can be implemented by the company. The following is a list of proposed mitigation strategies based on Martono (2020) (Table 3).

The preventive action will be assessed by the company according to the level of difficulty to implement with values 3, 4, and 5. And to determine the value of the relationship between mitigation strategies and prioritised risk factors using values 1, 3, and 9 which will be filled in by respondents consisting of 5 respondents from the company among them the founder, co-founder, chocolate bar production division, filled chocolate production division, packaging division. The correlation assessment using the HOR 2 model is presented in Table 4.

The calculation results of the Effectiveness to Difficulty ratio reveal that PA1 has an Effectiveness to Difficulty value of 11,872.8, followed by PA2 with a value of 11,845.5. PA3 has a value of 2,160, while PA4 scores 15,912. PA5 has a value of 13,761, PA6 scores 7,810, and PA7 has a value of 4,819.5. PA8 scores 4,590, followed by PA9 with a value of 2,826. PA10 has an Effectiveness to Difficulty value of 14,586.8, and PA11 scores 3,411. result of the above calculation is the ARP value of the risk agent that has been calculated on the strength of the relationship between risks and the frequency of occurrence of these risks. so that the priority of risks that need action is obtained from the highest ARP value. in ranking, the same value will be sorted according to the risks that occur in the supply chain process.

Dashboard Supply Chain Risk Management

A dashboard is a data visualization tool that aids in the analysis, observation, and decision-making process. The following is a design for a supply chain risk management dashboard that Ibunmanis Coklat MSMEs can use to monitor its supply chain risks.

Table 1. SCOR Model Mapping

Major Process	***Sub Process***	***Risk Event***	***Risk Agent***	***Referensi***
*sP – **Plan***	Demand Forecasting	Significant increase in demand	Demand is difficult topredict	(Marchello *et al*, 2023)& (Rahman andDestiarni, 2023)
	Inventory Planning	Mismatch of ordered raw material types	Demand uncertainty	(Adriant *et al*., 2022)
		Errors in raw material procurement	Ineffective inventory management	(Paramita *et al.*, 2023) & (Rahman and Destiarni, 2023)
	Production Planning	Errors in raw material requirement calculations	Inaccuracy in material planning	(Ulfah, 2020) & (Padhil *et al.*, 2021)
		Production planning errors	Ineffective production planning	(Paramita *et al.*,2023) & (Ulfah *et al.*,2023)
*sS - **Source***	Receipt and Quality Inspection ofRaw Materials	Delay in raw materials from suppliers	Disruptions during thedelivery process	(Padhil *et al.*,2021) &(Adriant *et al.*, 2022)
		Overloaded capacity	Inadequate transportation	(Ulfah *et al.*, 2023) & (Rahman and Destiarni, 2023)
		Inadequate raw material quality	Raw materials damaged intransit	(Padhil *et al.*, 2021)
		Raw material quantity doesnot match requirements	Supplier lacks attention todetail in raw material delivery	(Padhil *et al.*, 2021) &(Rahman and Destiarni, 2023)
		Raw material unavailability	No re-confirmation	(Padhil *et al.*, 2021)
*sM - **Make***	Production Process	Production process delays	Unexpected power outages	(Rahman and Destiarni, 2023) & (Padhil *et al.*, 2021)
		Damaged raw materials	Storage limitations	(Padhil *et al.*, 2021) & (Adriant *et al.*, 2022)
		Work accidents	Workers not following SOP	(Rahman and Destiarni, 2023) & (Padhil *et al.*, 2021)

Table 1. SCOR Model Mapping (Continued)

Major Process	***Sub Process***	***Risk Event***	***Risk Agent***	***Referensi***
		Product contamination by foreign objects	Worker negligence	(Rahman and Destiarni, 2023) & (Ulfah, 2020)
		Product defects	Inconsistent temperature checks in cold storage	(Padhil *et al.*, 2021 and Saleh, 2021) & (Trimaryono and Sulistiyowati, 2024)
			Insufficient inspection processes	(Padhil *et al.*, 2021) & (Sumantri and Marwati, 2023)
		Unmaintained cleanliness in the production process	No cleanliness checks on equipment and machinery	(Adriant *et al.*, 2022) & (Padhil *et al.*, 2021)
		Packaging errors	Production quantity not met, causing delays in packaging	(Koespratiwi *et al.*, 2021) & (Sumantri and Marwati, 2023)
			Errors in packaging	(Koespratiwi, et.al,, 2021)
		Inappropriate storage conditions	Limited resources	(Trimaryono and Sulistiyowati, 2024) & (Rahman and Destiarni, 2023)
			Lack of coordination among workers	(Padhil *et al.*, 2021)
*sD – **Deliver***	Product Shipping	Shipping delays	Transportation limitations	(Azhra, 2021) & (Taufiqurrahman and Sulistyowati, 2024)
			Production delays	(Azhra, 2021) & (Prasetyo *et al.*, 2022) (Ulfah, 2022)
		Vehicle breakdowns	Lack of machine maintenance	(Nadhira *et al.*, 2019) & (Taufiqurrahman and Sulistyowati, 2024)
			Workers' lack of caution	(Padhil *et al.*, 2021) & (Ulfah, 2022)
		Product damage during transit	Bad weather during shipping	(Taufiqurrahman and Sulistyowati, 2024) & (Ulfah, 2022)
		Bad credit	Consumers' late payments	(Padhil *et al.*, 2021) & (Rahman and Destiarni, 2023)
sR – Return	Return to Supplier	Return of raw materials to suppliers	Holes in raw material packaging	(Taufiqurrahman and Sulistyowati, 2024) & (Adriant *et al.*, 2022)
	Product Return	Consumer complaints	Decreased product quality	(Padhil *et al.*, 2021)

Table 2. Correlation of risk events and risk agents in HOR 1

Risk Event	Risk Agent																												Severity
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	
E1	9	9			1																									6
E2		1	9	9				1	9	3																				4
E3		9	9		1																									8
E4		3	9	9	1																									8
E5		3	9	9	1																									6
E6		9			3	9	9		1																					10
E7		1					9																							5
E8						1	1	3	1																					9
E9				1	1		9		9																					8
E10		9								9																				8
E11											9																			6
E12												3	3																	6
E13													3	3											9					3
E14												9		9		9	1													6
E15											1	3	3	3	9	9					3									8
E16													1			3	9				9									2
E17											1		9	9				3	9		3		3							6
E18												3	3	3						9	3									6
E19																						1	9		1	3				6
E20																								3						4
E21																					1	3			3	9			3	7
E22																												9		9
E23																													3	7
E24																													9	9
Occurance	6	8	8	9	6	2	5	2	7	4	5	3	6	7	6	4	2	8	8	8	8	4	10	2	4	2	2	6	6	
ARP	324	2712	1872	1530	396	198	1080	62	889	336	340	342	750	1113	432	528	48	144	432	432	680	108	720	24	216	162	162	126	612	
Rank	19	1	2	3	15	21	5	27	6	18	17	16	7	4	12	11	28	24	13	14	9	26	8	29	20	22	23	25	10	

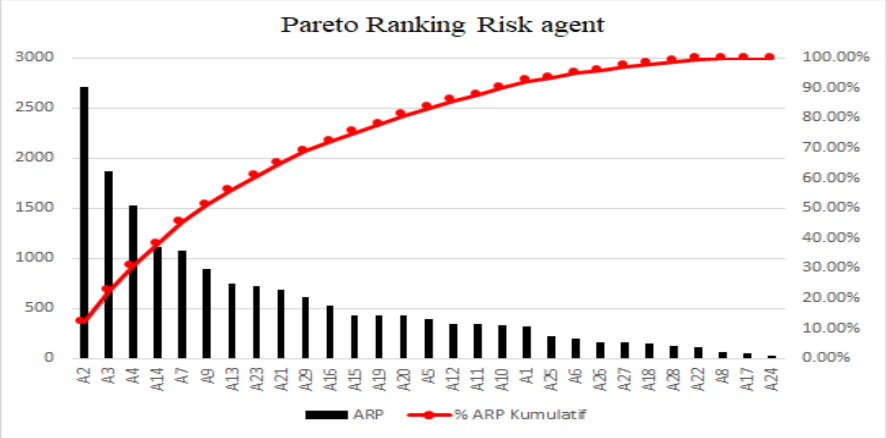


Figure 4. Pareto diagram HOR 1

Table 3. Preventive action

Primary Strategy	**Critical Supply Chain Practices (Preventive Action)**	**Code**
Innovation	Integrate all parts of supply chain	PA1
	Collaborate with suppliers in improving supply chain process	PA 2
	Designing supply chain models according to product spesifications	PA 3
Cost	Integrate planning with scheduling	PA 4
	Appling standardization the raw material procurement process and production process	PA 5
	Making procurement process more flexible	PA 6
Service	Customer feedback	PA 7
	Market segmentation	PA 8
	Pospomenet	PA 9
Quality	Tracked production by batch	PA 10
	Product lifespan monitoring	PA 11

Table 4. HOR 2 relationship matrix

Risk Agent	Preventive Action											ARP
	PA1	PA2	PA3	PA4	PA5	PA6	PA7	PA8	PA9	PA10	PA11	
A2		3				9	9	9	3			2712
A3	9	3		9		1				9	3	1872
A4	9	9		9		3						1530
A14					9					9		1113
A7		9										1080
A9		9										889
A13					9					9		750
A23	9			9	9	1				9		720
A21	9											680
A29	9	9			9	1	9			9	9	612
A16			9		9							528
A15			9		9					3		432
A19					9				9	9		432
Total Effectiveness	59364	47382	8640	47736	41283	23430	19278	13770	8478	58347	13644	
Degree of Difficulty Performing Action	5	4	4	3	3	3	4	3	3	4	4	
Effectiveness to Difficulty Ratio	11872,8	11845,5	2160	15912	13761	7810	4819,5	4590	2826	14586,8	3411	
Rank of Proactive Action	4	5	11	1	3	6	7	8	10	2	9	

This supply chain risk management dashboard contains information about key indicators, visualizing these indicators based on metric calculations, and suggesting mitigation strategies to address the risks being monitored. supply chain risk management design obtained KPIs to measure each priority risk agent that has been normalized using the de boer snorm. The risk monitoring visualizes the performance indicators of the metrics of the causes of thepreviously identified priority risk agent, displays historical data as a reference for the impact of priority risk agent that need special action, and displays mitigation recommendations that can be done to deal with these risks.

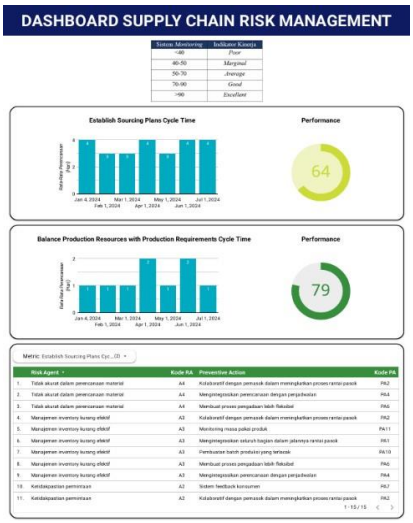


Figure 5. Dashboard display for the plan process

Figure 5 displays the supply chain risk management dashboard for the "plan" process, showcasing metrics such as "establish sourcing plans cycle time" and "production resources with production requirements cycle time." It also presents mitigation strategies to aid in decision-making for addressing risks associated withthese metrics in the planning process. In calculating the performance of establish sourcing plans cycle time where Si = 3 minus Smin = 4 the results are shared with Smax 4 minus Smin = 4 and then multiplied by 100 so that the snorm is obtained = 64. and for the calculation of production resources with production requirements cycle time where Si = 1 minus Smin = 2 the results are shared with Smax = 1 minus Smin = 2 and then multiplied by 100 so that the snorm is obtained = 78.

Figure 6. Dashboard display for the source process

Figure 6 presents the supply chain risk management dashboard for the "source" process, displaying metrics such as "Orders/Lines Received On-Time To Demand Requirement" and "Orders/Lines Received with Correct Packaging." It also includes mitigation strategies to support decision-making in addressing risksrelated to these sourcing metrics. In calculating the performance of Orders/Lines Received On-Time To Demand Requirement where Si = 86% minus Smin = 62.3% the results are shared with Smax 100% minus Smin = 62.3% and then multiplied by 100 so that the snorm is obtained = 63. and for the calculation of Orders/Lines Received with Correct Packaging where Si = 98% minus Smin = 93.8% the results are shared with Smax = 100% minus Smin = 93.8% and then multiplied by 100 so that the snorm is obtained = 68.

Figure 7. Dashboard display for the make process

Figure 7 displays the supply chain risk management dashboard for the "make" process, showcasing metrics such as "Yield Variability," "Warranty Costs," "Package Cycle Time," and "Stage Finished Product Cycle Time." This dashboardalso presents mitigation strategies to aid in decision-making for addressing risks associated with these production metrics. In the calculation of performance from Yield Variability where Si = 92.4% minus Smin = 88.1% the results are shared with Smax = 98.4 minus Smin = 88.1% and then multiplied by 100 so that the snorm is obtained = 42. for the calculation of Warranty Costs where Si = Rp 317,256 minus Smin = Rp 33,806 the results are shared with Smax = Rp 664,007 minus Smin = Rp 33,806 and then multiplied by 100 so that the snorm is obtained = 55. for the calculation of the Package Cycle Time where Si = 19 minus Smin = 21 the results are shared with Smax = 16 minus Smin = 21 and then multiplied by 100 so that the snorm is obtained = 50. and for the calculation of the Finished Product Cycle Time Stage. where Si = 138 minus Smin = 145 the results are shared with Smax = 130 minus Smin = 145 and then multiplied by 100 so that the snorm is obtained = 50.

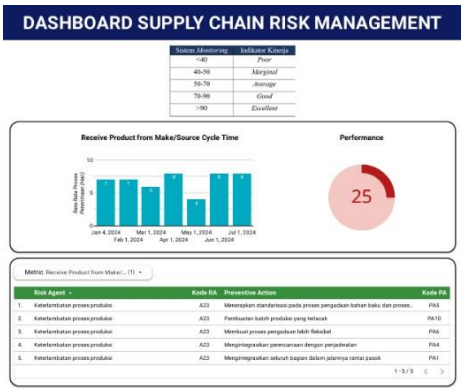


Figure 8. Dashboard display for the deliver process

Figure 8 illustrates the supply chain risk management dashboard for the "deliver" process. It features the metric "Receive Product from Make/Source Cycle Time" and provides mitigation strategies to support decision-making for risks related to this delivery metric. In calculating the performance of Receive Product from Make/Source Cycle Time where Si = 7 minus Smin = 8 the results are shared with Smax = 4 minus Smin = 8 and then multiplied by 100 so that the snorm is obtained = 25.

Figure 9. Dashboard display for the return process

Figure 9 displays the supply chain risk management dashboard for the "return" process. It showcases the metric "Authorized Defective Return Cycle Time" and presents mitigation strategies to aid in decision-making for risks associated with this return process metric. In calculating the performance of Authorized Defective Return Cycle Time where Si = 357 minus Smin = 394 the results are shared with Smax 315

minus Smin = 394 and then multiplied by 100 so that the snorm is obtained = 47.

CONCLUSIONS AND RECOMENDATIONS

Conclusions

Ibunmanis Cokelat MSMEs, which is engaged in the food industry by producing chocolate bars and filled chocolates, has conducted a business process mapping using the SCOR 12.0 model. From the results of this mapping, 24 risk events and 29 risk agents were identified in the supply chain. Risks arise at every stage, from planning, procurement, production, delivery, to product returns.

Based on analysis using the House of Risk (HOR) 1 and Pareto models, it was found that 80% of risk agents require mitigation actions to reduce 20% of the main causes of risk. The main mitigation strategies proposed, using the HOR 2 model, include integration of planning with scheduling, collaboration with suppliers, and implementation of standardisation in procurement and production processes. The top mitigation priority is the integration of planning with scheduling. Risk indicators were obtained from SCOR performance mapping which were then measured by Key Performance Indicators (KPIs) and normalised using *de boer snorm*. Risk monitoring is done through historical data visualisation that displays the impact of priority risks and recommended mitigation actions.

Recomendations

The company can consider implementing the mitigation strategies developed in this study to enhance risk management within the supply chain of Ibunmanis Coklat MSMEs. The implementation of these strategies not only helps in reducing potential risks but also allows the company to be more proactive in managing emerging challenges. Additionally, the company needs to closely monitor the risks present in the supply chain to ensure that the mitigation actions taken are effective and aligned with the current business dynamics.

For future research, it is essential to continue and deepen the proposed mitigation actions formulated in this study. This will provide greater contributions in helping the company mitigate risks comprehensively, particularly in the development of a more integrated supply chain risk management. This development is crucial as it can assist the company in monitoring risks more comprehensively throughout the supply chain process.

Besides focusing on supply chain risk management, further analysis is needed on the impact of risks related to worker productivity. A decline in productivity can directly affect the financial aspects of Ibunmanis Coklat MSMEs, making an in- depth analysis of these risks is important to support the financial stability of the company. By continuing research in this area, it is hoped that more effective solutions will be found to address productivity issues and their impact on financial performance. Further research will enrich the mitigation strategies that can be applied and strengthen risk management across the entire supply chain process, enabling UMKM Ibunmanis Coklat to grow and develop more effectively in the future.

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