



## Managing Risk on A Pharmacy Enterprise Supply Chain Using House of Risk Approach

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### ABSTRACT

Pharmacy CBA is a trading business which engages in pharmaceutical and medical devices. Uncertainty and complexity have been identified as risk in business supply chains. Further measurement is needed in order to enhance the effectiveness of the pharmacy business process. The purpose of this study is to identify risk events and risk agents, calculate the risk value in the supply chain flow from upstream to downstream, and determine efforts to minimise risk. The method used in this research is HOR 2 phases, through a SCOR based approach. The study begins with the identification of risk events and risk agents based on SCOR, then calculates the level of severity, occurrence and correlation for the calculation of the HOR 1. Identified 45 risk events, 23 risk agents, and 19 actions to minimise risk. Aggregate risk potential is calculated as a result of HOR 1. From 23 risk agents, ten are prioritised based on the most significant ARP value. In the calculation of HOR 2, 10 risk mitigation strategies are obtained to minimise risk along with the supply chain stream. There are four approaches to implementing the ten mitigations: HR Development, Customer Relationship Management-based approach, Supplier relationship management, and facility design.



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### 1. Introduction

Risk and business are considered as part of the development of business activities. However, the company can control it according to its needs. Managing risk is a necessity in providing sustainable business. Disruption in the supply chain is one of the risks that can coerce the sustainability of the company's business (Kurnia Ramadhan et al., 2021). CBA pharmacy is a trading business engaged in services. The pharmacy provides drugs and medical devices. This pharmacy firm also plays an essential role in meeting several factories' drugs and medical needs in Bojonegoro Regency, East Java. Supply chain management is essential to control potential failures in the continuity of the supply chain process and minimise its impact (Teniwut, Hamid, et al., 2020; Wati et al., 2021a). The CBA pharmacy enterprise supply chain configuration is illustrated in Figure 1.

Figure 1 shows three essential elements of the pharmacy supply chain from upstream to downstream. CBA Pharmacy purchases medicines and pharmaceutical equipment from at least 5 suppliers. PBF pharmaceutical wholesalers, PT ZO, PT GEM, PT SEL, and PT MM.



Figure 1. Supply chain configuration of BCA pharmacy enterprise

Source: Authors illustration

The target market is several public and private corporates as well as end customers. The drug procurement process to suppliers is four times a week. Pharmacists stated that drug orders every two times a week. It is found that CBA pharmacy does not have a computerised system for stock monitoring. As a result, it impacts the drug procurement process that lasts a long time because employees have to take manual stock-taking. The lack of human resources and employee negligence are also factors that cause the length of the process. Even though the firm performed a schedule of procurement activities, it was identified that employees were negligent in coordination between shifts, so they forgot to place orders. The firm management stated a separate contract agreement in the payment process, order, or goods/returns. The return process happens when there is a discrepancy between the item/quantity sent with the order letter and when there is damage to the item and expired. For expired submissions, it is done three months before the expired period. In distributing drugs from suppliers, sometimes it is also unstable, affecting the supply chain at pharmacies.

These problems are identified as uncertainties and complexity through the upstream and downstream firm supply chain. Supply chain risk management is a method used to solve problems along the supply chain (Pujawan & Geraldin, 2009). The HOR method has been implemented to map risks and causes of risk in a service firm (Samodro, 2020). Mitigating the supply chain using HOR is also implemented in manufacturing roofing accessories and roof tiles (Magdalena & Vannie, 2019). There were 21 risk events, 20 risk causes, and eight prioritised risk causes. The HOR approach also manages the risk of the hospital supply chain (Chaisani, 2021). Moreover, (Ramadhan et al., 2020) found 24 risk events, 32 risk causes and 19 prioritised managing the food processing supply chain.

Even though HOR is used in previous research, however, a pharmacy firm as this research object differentiates in comparison with previous research (Chaisani, 2021; Kurnia Ramadhan et al., 2021; Magdalena & Vannie, 2019; Samodro, 2020). In addition, the mitigation scenario of this research is considered the second research gap, which combines the theory provided in managing business processes. This research provides action in mitigating risk, which do not conduct in the previous studies. this study aims and objectives to mitigate risks upstream to the downstream pharmacy supply chain.

## 2. Literature Review

### Supply Chain Risk Management (SCRM)

Supply chain risk management is a risk management process that may happen while distributing materials from suppliers to end customers (Puspadina et al., 2021; Rozudin & Mahbubah, 2021). Coordination between supply chain entities is needed to reduce the negative impact of supply chain management by planning and identifying supply chain risks (Jayawati et al., 2020). The integration between Risk Management and Supply Chain Management concepts generates SCRM, which applies the risk management process; SCRM collaborates with supply chain partners. Several stages must be

carried out in carrying out the SCRM process, including risk identification, assessment, mitigation, and monitoring (Handayani, 2016).

### **Supply Chain Operation Reference (SCOR) Model**

The SCOR model is alike supply chain performance of an enterprise (Wati et al., 2021b). SCOR model includes business process frameworks, technology to support comprehension communication between supply chain partners, work indicators, best practices to improve supply chain effectiveness (Magdalena & Vannie, 2019; Wati et al., 2021). SCOR is divided into five activities: Plan, Source, Make, Deliver, and Return (Maulidya et al., 2014). SCOR development through several approaches consisting of process, realisation, performance, and HR skills (Ramadhan et al., 2020). Moreover, the SCOR model also evaluates supply chain performance in both manufacture and service enterprises (Alamsyah & Misbah, 2020; Wati et al., 2021). SCOR performance evaluation is used in a fishery firm and service business with respect to sustainable business improvement (Alamsyah & Misbah, 2020; Wati et al., 2021a).

### **House Of Risk (HOR) Model**

House of Risk is developed using the concepts of Failure Models and Effects Analysis and House of Quality (Pujawan & Geraldin, 2009). HOR modelling focuses on risk agent prevention actions and reducing the potential for risk agents to occur (Febrianto, 2017). Risk agent prevention actions will usually also have an impact on risk events, which is the same as preventing them as well. A risk agent usually causes more than one risk event (Tampubolon et al., 2013; Teniwut & Hasyim, 2020). Therefore, taking action to reduce the cause of risk means reducing the incidence of risk events. The HOR approach has 2 phases. The first stage is used to determine the priority level of risk agents that must be given as a preventive measure (Trenngonowati & Pertiwi, 2017). HOR phase 2 is a treatment strategy that is considered adequate will be selected to reduce the impact caused by risk agents (Kusnindah et al., 2015).

## **3. Methodology**

### **Sampling**

Descriptive analysis is used as the research method of this study. This method uses problem solving-based study by examining individuals, conditions, or events (Irawan, 2020). The research approach is used to determine the causes and sources of risk in CBA pharmacy, both from external and internal parties of the trading business. This research was conducted at CBA Pharmacy from June to October 2021. CBA Pharmacy is a trading business engaged in services, which sells medicines and medical devices. This research was carried out by conducting surveys on the research object, submitting questionnaires, interviews and brainstorming. A walkthrough survey was conducted to gather data of man, machine, money, methods, materials within business activities. To find out risk events and agents was mastered using questionnaire design filled by three participants, pharmacists, service staff, and owners. The questionnaire attributes were obtained from previous research by (Chaisani, 2021; Magdalena & Vannie, 2019; Puspadina et al., 2021; Samodro, 2020). Interview activities were carried out to determine the level of correlation between risk events and risk agents. Furthermore, brainstorming activities were performed to determine risk minimisation actions.

### **Measurement**

The research stages are conducted using mapping business activity, House of Risk phase 1, and House of Risk phase 2. The research flow is described as follows.

### a. Mapping Business activity

The first stage is mapping the company's supply chain activities using the SCOR model obtained from surveys and interviews with the owner.

### b. HOR phase 1

#### 1. Risk identification and assessment

Firm risk assessments were conducted using a questionnaire that has been designed with the owner and the researcher. Once the design is fixed, the next stage is validation. An assessment of the risk is carried out by determining the severity value on a scale of 1 to 5. A value of 1 indicates the lowest impact, and the larger the scale, the more significant the impact. The second assessment is an assessment of occurrence on a risk agent with a scale of 1 to 5. Number 1 indicates a risk that never occurred. The larger the scale, the more frequent the occurrence. This stage produces a list of risks.

#### 2. Correlation

The correlation between the two variables correlates with a value of 0, 1, 3, and 9. 0 indicates no correlation, number 1 indicates a low correlation, 3 indicates a moderate correlation, and 9 indicates a high correlation. Furthermore, the Aggregate Risk Potential (ARP) is the most significant value between each risk agent. Formula to calculate the ARP score as follow (Pujawan & Geraldin, 2009):

$$ARP_j = O_j \sum_i S_i R_{ij} \text{ (Equation 1)}$$

Where:

- ARP<sub>j</sub> = Aggregate Risk Potential of the risk agent j  
O<sub>j</sub> = The probability value (occurrence) of the risk agent j  
S<sub>i</sub> = value of risk impact (severity) of risk event I occur  
R<sub>ij</sub> = correlation between risk event and risk agent.

### c. HOR phase 2

#### 1. Mitigating risk strategy determination

The researcher brainstormed with three respondents in this stage, namely the owner, service staff, and pharmacist.

#### 2. Correlation

The first stage assesses the correlation between the mitigation strategy and the risk agent. The scale range consists of 0, 1, 3, 9. Number 0 indicates no correlation, number 1 indicates a low correlation, 3 indicates a moderate correlation, and 9 indicates a high correlation.

#### 3. Determination of rank priority

Determining rank priority is performed by calculating Total Effectiveness (Tek), effectiveness to difficulty (ETD), and determination of the rank of priority identify the Value of ETD. Tek formula as follow (Pujawan & Geraldin, 2009):

$$Tek = \sum_j ARP_j E_{jk} \text{ (Equation 2)}$$

Where:

- Tek = Total Effectiveness of counter measures  
S<sub>i</sub> = value of aggregate risk potential  
E<sub>jk</sub> = correlation between preventive measures (k) and risk agents (j)  
Furthermore, the ETD calculate with the following formula (Pujawan & Geraldin, 2009):

$$ETDk = TEk/Dk \text{ (Equation 3)}$$

Description: Tech = Total effectiveness, Dk = Degree of difficulty. Once the ETD value calculate, the last stage is creating mitigate strategy.

#### 4. Results and Discussion

##### Mapping Business activity

The business activity process at CBA Pharmacy has three main entities: Supplier, CBA Pharmacy, and customer. Based on the SCOR model, supply chain activities were divided into the plan, source, make, deliver and return. The results of the mapping are in table 1.

Table 1. Business activities

Plan	1. Plan the number of products ordered
	2. Planning the type of product ordered
	3. Recruitment of employees
	4. Monitoring
Source	1. Drafting contracts with suppliers
	2. Place an order for a product
	3. Doing product storage
Make	1. Doing product handling
	2. Doing business activities
	3. Designing SOPs according to government regulations
Delivery	1. Delivery of products from suppliers
	2. Product display
	3. Conduct product inspection
	4. The buying and selling process
Return	1. Return of medicine to supplier

Source: Data processing results

Table 1 shows the results of mapping business activities based on the SCOR model. There were 15 business activities through the pharmacy supply chain. 4 activity plans focus on planning activities for procurement of goods, human resources, and monitoring. Three sourcing activities concentrate on activities related to suppliers, inventory and product ordering. Three sourcing activities focus on activities related to suppliers, inventory and product ordering. The focus of making activities is SOP design, arrangement and product handling. 4 Delivery activities include product delivery, product display, inspection, and the buying and selling process. In comparison, the return activity itself focuses on the activities of returning products to suppliers.

##### HOR Phase 1

HOR phase 1 is the initial stage in the HOR method. Risk events identification classifies to determine the priority of risk agents as a reference for deciding preventive actions.

###### 1. Risk identification and assessment

Risk identification and assessment include risk event, risk agent, severity level, the occurrence score of validated risks. Risk event identification is by questionnaire result. Forty-five potential risks are validated by the pharmacy using the SCOR method. Grouped based on the plan, source, make, delivery, return activities. Risk events and risk agents illustrate in tables 2. Table 2 shows 13 risk events based on business plan activities, which have been validated by respondents and severity values and risk event codes.

Table 2. Risk eve In Accordance With SCOR

No	Risk Event	Confirmation		Severity	Code
		Yes	No		
Plan Business Activities					
1	Amount of fluctuating drug demand	√		3	E1
2	Sudden changes in drug stock	√		3	E2
3	Sudden purchase of raw materials	√		4	E3
4	Planning for ordering product types is not correct	√		3	E4
5	Lost order	√		2	E5
6	Increased prices of raw materials from suppliers	√		3	E6
7	Quantity of raw materials does not match	√		4	E7
8	Calculation errors in raw material planning	√		4	E8
9	Uncertainty about orders from consumers	√		4	E9
10	Planning the number of human resources needed is not appropriate	√		2	E10
11	Mismatch between stock and records	√		4	E11
12	Cost constrains Procurement process	√		3	E12
13	The generation of administrative data paper waste	√		2	E13
Source Business Activities					
1	Error in choosing a supplier	√		4	E14
2	Violation of the contract agreement by the supplier	√		4	E15
3	No supplier criteria defined	√		3	E16
4	Product delivery schedule error	√		4	E17
5	Products not sold/expired	√		5	E18
Make Business Activities					
1	Drug storage warehouse unable to accommodate drugs	√		3	E19
2	Potential exposure to COVID-19 during the process of receiving products and buying and selling	√		4	E20
3	Workers error in raw material inspection	√		5	E21
4	Insufficient stock of products and supporting materials	√		5	E22
5	An accident occurred at work	√		5	E23
6	Lack of supervision from Pharmacists	√		3	E24
7	Lack of human resources skills and qualifications	√		3	E25
8	Changes in government policy on procurement of goods	√		4	E26
9	Poor coordination within the company	√		4	E27
10	There is a queue during processing	√		5	E28
11	Customers do not understand how to use drugs	√		3	E29
Business Activities of <i>Delivery</i>					
1	Quantity, quality and items received do not match the request	√		5	E30
2	Scarcity of logistics	√		4	E31
3	Late delivery orders from drug suppliers to the drug store	√		5	E32
4	Unfavourable conditions at the supplier's location	√		4	E33
5	Natural disasters occurred during delivery	√		4	E34
6	Existing goods expired	√		5	E35
7	Accidents happened in the shipping process	√		5	E36
8	No checking of product quality before deliver and sell	√		4	E37
9	Poor sales process	√		4	E38
10	Complaints from customers	√		5	E39
11	Completeness of packing does not match the dimensions and weight of goods	√		5	E40
12	Incomplete shipping documents	√		2	E41
Business Activities of <i>Return</i>					
1	Drug return to PBF due to delivery error	√		5	E42
2	Return of drugs to PBF due to expired drugs	√		5	E43
3	The process of returning goods to suppliers is almost not carried out even though the quality is not according to specifications	√		4	E44
4	Delay in returning the product to the supplier	√		5	E45

Source: Data processing result

Table 2 shows five risk events from source activities as well as severity scores. These five activities focus on designing contracts with suppliers, ordering products, and inventory processes. Table 2 also shows 11 risk events based on make's business activities, as well as severity scores. The risk event includes the drug storage warehouse cannot accommodate drugs (E19) the first. The last make an activity with a code E26 changes to government policy on procurement of goods and focused on SOP design activities. In addition, table 2 shows 12 risk events based on Delivery business activities, which have been validated by pharmacists, accompanied by severity values. The first risk event with a code E30 is Quantity. Table 2 shows four risk events based on Return business activities, which pharmacists have validated, accompanied by severity values. The focus of attention on business return activities is on the process of returning drugs to supplier

Table 3. Occurrence score of risk agent

No	Risk Agent	Occurrence	Code
1	Error planning ordering types of drugs	5	A1
2	Supplier SOPs are not comprehensive	4	A2
3	Labour negligence	5	A3
4	There is a shortage of medicines	5	A4
5	Errors in prescribing and medication to customers	5	A5
6	No substitute supplier	5	A6
7	Material handling at the wrong time of delivery	4	A7
8	The employees do not comply with standard operational procedure	5	A8
9	Limitations in capacity (machines, human resources, facilities)	5	A9
10	Not implementing the FIFO system	5	A10
11	Uncertain timing of drug delivery from PBF	5	A11
12	Incomplete/missing drug purchase invoice	5	A12
13	Seasonal disease factors (epidemic disease)	5	A13
14	The number of returned goods exceeds the quota	5	A14
15	Significant increases in demand	2	A15
16	No computerised system	5	A16
17	Annual RAB calculation error	3	A17
18	Warehouse does not have safety stock	5	A18
19	Lack of awareness of health protocols	4	A19
20	Damaged packaging	5	A20
21	Regulations with stakeholders are tightened	3	A21
22	There is an increase in drug prices from factories	5	A22
23	Pharmacists are considered unclear in providing information	4	A23

Source: Data processing results

Table 3 shows 23 risk agent identification from the pharmacy firm. The numbering in the risk agent table is only nominal, not the agent's order with the highest to the lowest occurrence. Some of the causes of these risks include 1) Errors in prescribing and medication to customers (A1), with a severity value of 5. 2) Supplier SOPs are less comprehensive (A2), the severity value is 4. 3) Staff carelessness (A3), with severity value 5. 4) There is a scarcity of drugs, with a severity value of 5. 5) Errors in prescribing and drugs to customers (A5), with an occurrence value 5.

## 2. Correlation

The assessment results of the correlation between risk events and risk agents determine the priority strategy of risk agents used for calculations in HOR phase 2. Several correlations between risk events and agents are, 1) The number of fluctuating drug requests (E1) has a correlation with risk agent A13 (seasonal disease factor) with a value of 3. 2) Sudden changes in drug stock (E2) due to an error in planning an order for the type of drug (A1) with a correlation value of 9. 3) Sudden purchase of raw materials (E3) due to planning errors ordering drug types (A1) and a significant increase in demand (A15), each of which has a correlation value of 9.

### 3. Prioritisation

Once assessing both risk event and agent correlation was done, the next stage calculates the ARP value to create a Matrix of HOR 1. The ARP score was calculated using Formula number 1. Table 4 illustrates the matrix of HOR.

Table 4. House of risk matrix

Risk Event	Risk Agent																				S i			
	A 1	A 2	A 3	A 4	A 5	A 6	A 7	A 8	A 9	A 10	A 11	A 12	A 13	A 14	A 15	A 16	A 17	A 18	A 19	A 20		A 21	A 22	A 23
E1													3											3
E2	9																							3
E3	9														9									4
E4			9																					3
E5				9																				2
E6		9		9																				3
E7		9																						4
E8			9																					4
E9												9												4
E10			9																					2
E11			3													9								4
E12																	9					9		3
E13																3								2
E14		9	9			9																		4
E15		9				3																		4
E16						9																		3
E17		9																						4
E18										9														5
E19									9															3
E20																			9					4
E21			9																					5
E22	9																							5
E23																			3					5
E24									3															3
E25		9																					3	3
E26																					9			4
E27									9															4
E28				3																				5
E29																						9		3
E30				9			9														9			5
E31									9															4
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E34											3													4
E35										9														5
E36			9																					5
E37									9															4
E38		9																						4
E39					9																			5
E40									9															5
E41												9												2
E42			9																					5
E43											9													5
E44																9								4
E45									9															4
Oj	5	4	5	5	5	5	4	5	5	5	5	5	5	5	2	5	3	5	4	5	3	5	4	
ARP	5 4 0	9 3 6	10 95	5 2 5	2 2 5	3 7 5	1 8 0	6 3 0	4 9 5	67 5	46 5	90	22 5	18 0	72	21 0	81	75	14 4	22 5	10 8	13 5	14 4	
Ran king	5	2	1	6	10	9	14	4	7	3	8	20	11	15	23	13	21	22	16	12	19	18	17	

Source: Data processing results

Table 4 illustrate Matrix of HOR 1. In addition, the Matrix of HOR 1 describes the correlation of 45 risk events and 23 risk agents. Prioritized preventive strategy is by ten highest ARP values. Ten scenarios are as follow. The first factor with code number A3 is staff inattention. Followed by A2, supplier SOP is not comprehensive, A10 does not apply the FIFO system, and A8, some workers do not follow SOP. Pareto Diagram illustrates in Figure 3. The diagram provides better visualization in prioritizing risk agents based on 80 % 20% theory. In addition, it is stated that 80% majority of risk comes from 20 % probability.

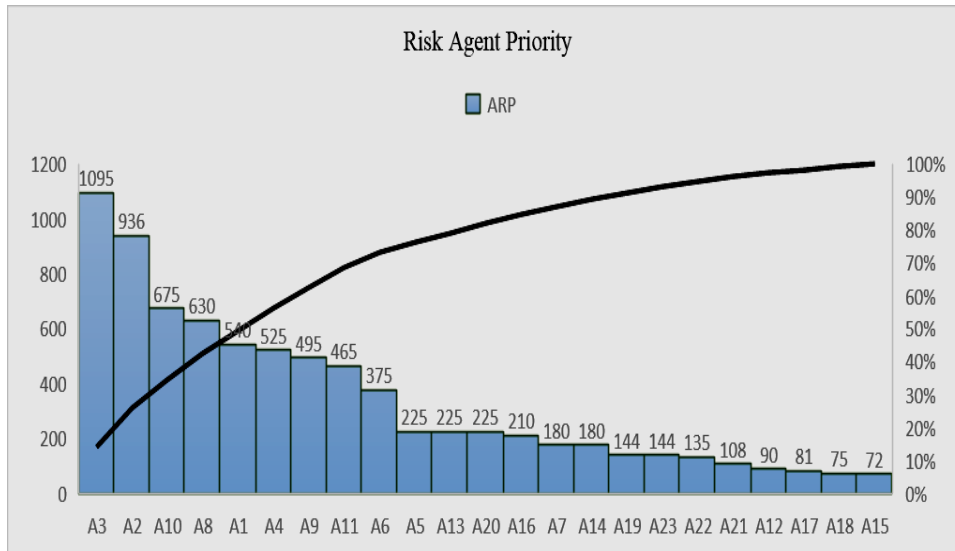


Figure 3. Pareto diagram of risk agent priority

Source: Data processing result

Figure 3 shows the risk agent by the calculation of ARP. In addition, the highest ARP with a score of 1095 is A3, namely Staff negligence. It is followed by the second to ten ranks which are A2 A10, A8, A1, A4, A9, A11, A6, and the last one is A3 with risk agent Errors in prescribing and treatment customers. The ten highest ranks shown on Pareto Diagram illustrates the highlight risk map in Figure 4.

Severity	Risk level	occurrence				
		very low (1)	low (2)	medium (3)	high (4)	very high (5)
very high (5)		High	High	High	High	A3 A10 A1 A4 A9 A11 A6 A5
high (4)		High	High	High	High	A2 A8
medium (3)		High	High	High	High	
low (2)		High	High	High	High	
very low (1)		High	High	High	High	

Figure 4. Risk map

	High to very high
	medium
	Low

It is shown in Figure 4 that risk agents with code A3 A10 A1 A4 A9 A11 A6 A5 were considered as very high risk and two other risks slightly lower than the previous one, namely A2 A8. Based on the highlighted map, the risk level can be concluded that the agent's ten highest ranks are considered high risk and ret alert. Further risk treatment action is needed in order to mitigate risk.

### HOR Phase 2

The HOR 2 stage is in line with the mitigation strategy. It calculates the value of Total Effectiveness (TEk), Degree of Difficulty (Dk) and calculating the value of Effectiveness to Difficulty (ETDk).

### 1. Mitigation strategy determination.

Based on the ten priority risk agents obtained from the calculation of the ARP value, brainstorming was carried out with the three respondents with the results of the strategy to minimize the occurrence of risk agents. The recommended strategy is presented in Table 5.

Table 5. Mitigation measurement

No.	Mitigation Scenarios	Detection	Code
1	Data-driven demand forecasting historical	4	P1
2	Sharing and updating information with Supplier	5	P2
3	Conduct periodic training and appeal to all employees	3	P3
4	Looking for alternative drugs with similar functions	4	P4
5	Provide reward, penalty, and work motivation to all employees	4	P5
6	Provide a product inventory that is more than the existing inventory	4	P6
7	Make SOPs for shipping, receiving, and handling goods	4	P7
8	Improve and increase the capacity of facilities the pharmacy	5	P8
9	Performing SOP for storing goods	3	P9
10	Make an agreement with the distributor regarding the delivery time	3	P10
11	Sharing and conducting medical education regarding the importance of health protocols.	3	P11
12	Implement FIFO procedures and regular stock monitoring	4	P12
13	Sharing and updating information on how to make good and correct RAB	3	P13
14	Sharing and conducting medical education regarding the importance of health protocols	3	P14
15	Performing proper material handling	4	P15
16	Make a work agreement in advance that is agreed upon by all parties	4	P16
17	Buying drugs at alternative suppliers at lower prices	3	P17
18	Strengthening cooperation by establishing good communication	3	P18

Source: Data processing results

Table 5 shows 18 strategies for minimising risk agents as well as the degree of difficulty in implementation. Five mitigation actions explain as follow. The first action is Forecasting demand based on historical data with a score difficulty 4. The following action is sharing and updating information with the supplier with five difficulty levels. The third level of difficulty is conducting periodic training and appeals to all employees. Looking for alternative drugs with similar functions is the 4th action with a level of difficulty 4. The 5th action provides reward, punishment, and work motivation to all employees (P5), with a difficulty value of 4.

### 4. Correlation of mitigating strategy with risk agent

Table 6 is the result of assessing the correlation between the minimisation strategy and the risk agent. Table 6 shows the correlation between risk agents and management strategies and their assessments. There were 23 factors relating between mitigating strategy and risk agent. The five correlation strategies have a score of 6, which means the correlation is very high.

Table 6. Correlation of mitigation strategy and risk agent

No	Risk Agent	S	Code	D	Strategy	Correlation
1	Messaging message planning error	5	A1	4	P1	9
2	Supplier SOPs are not comprehensive	4	A2	5	P2	9
3	Employment negligence	5	A3	3	P3	9
4	There is a shortage of medicines	5	A4	4	P4	9
5	Errors in prescribing and medication	5	A5	4	P5	9
6	No alternative supplier	5	A6	4	P6	9
7	Material handling at the wrong time of delivery	4	A7	4	P7	9
8	SOPs are not followed by some workers	5	A8	3	P5	9
9	Machine limitations, human resources, facilities	5	A9	5	P8	9
10	Not implementing the FIFO system	5	A10	3	P9	9
11	The timing of drugs delivery from PBF is uncertain	5	A11	3	P10	9
12	Incomplete/missing drug purchase invoice	5	A12	3	P3	9
13	Infirmity epidemic factors	5	A13	3	P11	9
14	The number of returned goods exceeds the quota	5	A14	4	P12	9

15	Significant increases in demand	2	A15	4	P13	9
16	No computerised system	5	A16	5	P8	9
17	Annual RAB calculation error	3	A17	3	P14	9
18	Warehouse does not have safety stock	5	A18	5	P8	9
19	Lack of awareness of healthiness protocols	4	A19	3	P15	9
20	Damaged packaging	5	A20	4	P16	9
21	Strengthen equal information in terms of regulations with stakeholders	3	A21	4	P17	9
22	Sharp increase trends in drug prices from factories	5	A22	3	P18	9
23	Pharmacists are considered unclear in providing information	4	A23	3	P19	9

Source: Data processing results

### 5. Determination of rank priority

HOR phase 2 is the output of the HOR phase 1 data processing method. The selection of the handling strategy by the company can be seen based on the ranking of priority. The reference for determining the ranking is the amount of the ETD (Effectiveness To Difficult) value. Table 7 illustrate HOR Phase 2.

Table 7. HOR Model Phase 2

Code	Mitigation Strategy										ARP
	P1	P2	P3	P4	P5	P6	P5	P8	P9	P10	
A1	9										540
A2		9									936
A3			9								1095
A19				9							525
A5					9						225
A6						9					375
A8							9				630
A9								9			495
A10									9		675
A11										9	465
Tek	4860	8424	9855	4725	2025	3375	5670	4455	6075	4185	
Difficulty	4	5	3	4	4	4	4	5	3	3	
ETD	1215	1685	3285	1181	506	844	1418	891	2025	1395	
Rank	6	3	1	7	10	9	4	8	2	5	

Source: Data processing result

Table 7. shows ten risk-minimising actions along with their application difficulty (Dk), total effectiveness and ETD. The following is the order of priority ranking of risk minimisation actions to be carried out. Based on the ten actions in mitigating risks obtained from HOR 2, a number of strategies are proposed to provide an effective risk mitigation strategy by utilising scientific disciplines (Rozudin & Mahbubah, 2021). The first proposed risk mitigation strategy is related to risk minimisation actions P3, P5, and P1. The aspect related to the three actions is the development of human resources. Previous studies in terms of human resource development are identified. This approach is known as training methods, such as simulation, brainstorming, case study, understudy method, job rotation, counselling & coaching (Wijaya, 2013). In addition, Human Resource Development relies on improving conceptual abilities, decision-making, and expanding relationships that are carried out in a structured way to achieve goals (Bukit et al., 2017).

The second proposed strategy is related to actions to minimise the risks of P1 and P4. This strategy is in line with the needs of the customer. The appropriate approach is the concept of customer relationship management (CRM), which optimises profitability through the development of customer satisfaction (Joshi et al., 2020; Mustika, 2017). The third proposed strategy is related to P10 and P2 risk minimisation actions. The appropriate approach is the concept of Supplier Relationship Management (SRM), which is the process of planning and managing strategic interactions with suppliers to maximise cooperation (Singh et al., 2017). The last proposed mitigation strategy is related

to risk minimisation actions P9, P8, P6. The appropriate approach is the concept of facility layout design, where the analysis, planning, and arrangement of facilities and equipment for business activities can improve effective and efficient processes (Setiabudi, 2016). In addition, a recent trend in increasing demand for healthcare due to pandemics must take into account as part of the mitigation strategy (Alamsyah & Misbah, 2020; Panjaitan et al., 2021). Mitigating strategies based on service quality can implement to service quality improvement (Alamsyah & Misbah, 2020). Ten risk agents as a mitigation strategy basis are used to minimize risks in the CBA firm supply chain. Group discussions have been performed to gain better solutions in minimizing business risk. Action to be taken mostly by human resources. Table 8 shows a reduction of occurrence and severity scores.

Table 8. Occurrence and severity score risk treatment

Rank	Code	Risk Agent	Current O and S score		O and S score after treatment	
			Oj	Si	Oj	Si
1	A3	Staff negligence	5	5	4	4
2	A2	Supplier SOPs are not comprehensive	4	4	3	3
3	A10	Not implementing the FIFO system	5	5	3	3
4	A8	The employees do not comply with standard operational procedure	4	5	3	4
5	A1	Error planning ordering types of drugs	5	5	3	4
6	A4	There is a shortage of drugs from suppliers	5	5	4	4
7	A9	Limitations in capacity (machines, human resources, facilities)	5	5	3	4
8	A11	Uncertain timing of drug delivery from PBF	5	5	3	3
9	A6	No substitute supplier	5	5	3	3
19	A5	Errors in prescribing and treatment to customers	5	5	4	3

Source: Data processing result

The risk treatment map is illustrated in Figure 5. The occurrence and severity scores have been reduced. Four risk agents become medium risk levels, namely A10, A11, A6, and A2

severity	occurrence					
	Risk level	very low (1)	low (2)	medium (3)	high (4)	very high (5)
very high (5)						
high (4)				A1 A8 A9	A3 A4	
medium (3)				A10 A11 A6 A2	A5	
low (2)						
very low (1)						

Figure 5. Risk treatment map  
 Source: Data processing result

### Comparison with the results of previous studies And Business Implication

This research method is in line with previous studies as follow (Kurnia Ramadhan et al., 2021; Puspadina et al., 2021; Samodro, 2020; Teniwut, Betaubun, et al., 2020). However, the research results are different. In addition, the differences rely on the number and risk events & agents and mitigation proposals, thus causing differences in data processing and research finding. Moreover, (Samodro, 2020) research findings are procurement, forecasting demand, making agreements related to drug delivery, mapping customers' drug needs, and adding inventory. (Magdalena & Vannie, 2019) focus on installing engine SOPs, improving layouts, and assessing operator performance.

The difference in research conducted by (Puspadina et al., 2021) is in terms of the method used. (Puspadina et al., 2021) used a combination of HOR and AHP methods, while this study only used 2-phase HOR. In addition, this results in prioritised treatment strategies focused on developing human resources with regular pharmacist training and improving internal communication between employees. In addition, (Sulistiyowati & Primyastanto, 2021) research strategy focuses on improving the business's internal SOPs, such as adding facilities and implementing regulations that can improve employee health and avoid injury.

While the final result of this research focuses on four mitigation strategies as follow. Firstly, Human Resource Development, by conducting regular business SOP training, giving rewards, punishments, and work motivation to all employees. The second approach is engaging with suppliers. Supplier Relationship Management can be done by sharing and updating information to determine product quality. In addition, factors such as track record analysis, consistency, supplier policies, and mutual agreements in scheduling product delivery with predetermined suppliers. The third approach is related to the customer using the Customer Relationship Management (CSM) concept. The CSM can be done by forecasting demand. The forecasting data is based on historical data on customer product purchases to avoid a shortage of medicines that can lead to customer complaints. 4) Adding facilities that can support the smooth running of the business, such as using a computerised system/POS (Point of sale) machine and adding inventory for both areas and products.

The results of this study are adequate to use since the firm has never evaluated distinguished risk along a stream of supply chains. As such, these research findings can be used as view for pharmacy owners, pharmacists and employees to make improvements that researchers have proposed to smooth business processes in the future.

## 5. Conclusion

This research's finding is summarised in three points as follow. Firstly, 45 risk events are identified through the stream of pharmacy's supply chains. In addition, SCOR breakdown regarding 43 risk events: 13 risks gathered from plan activities, 5 risks classified as source activities, 11 risks considered as make, 12 risks from delivery activities, and finally 4 risks from return activities. The second finding is regarding the degree of occurrence in terms of risk events. There are 23 that are validated as risk agents. In addition, 16 risk events with an occurrence value of 5, including planning errors in ordering types of drugs (A1), negligence of labour (A3), scarcity of drugs (A4), Errors in prescribing and medication to customers (A5). There is no alternative supplier (A6), SOPs are not followed by some workers (A8). Limitations in capacity of machinery, human resources, facilities (A9). Not implementing the FIFO system (A10), Uncertain delivery time of drugs from PBF (A11). Incomplete or missing drug purchase invoice (A12). Seasonal disease factor (epidemic) (A13). The number of returned goods exceeds the quota (A14). There is no computerised system in managing stocks (A16). The warehouse does not have safety stock (A18). Damaged packaging (A20). An increasing trend in the price of drugs from the factory (A22). There are four risk events with an occurrence score of 4. These factors include the Supplier SOP is not comprehensive (A2) and a factor such as Material handling at the wrong time of delivery (A7). Moreover, factors such as lack of awareness of health protocols (A19) and Pharmacists are considered unclear in providing information (A23). There are two risk events with an occurrence value of 3, including Errors in calculating the annual RAB (A17), regulations with stakeholders being tightened (A21). Furthermore, one risk event has an occurrence value of 2, namely a significant increase in demand (A15).

This research found that the ten most prominent risk agents as a result of on ARP calculation. Namely, labour negligence (A3), Supplier SOPs are less comprehensive (A2), Does not apply the FIFO system (A10), SOPs are not followed by some workers (A8), Errors in planning for ordering types of drugs (A1), There is a shortage of medicines (A4), Limitations in capacity (machinery, human resources, facilities) (A9), Uncertain delivery time of drugs from PBF (A11), No alternative supplier (A6), Errors in prescribing and medication to customers (A5).

## Action recommendations

Based on risk mitigation strategy planning in HOR 2, 10 priority risk mitigation actions are obtained. Namely, Conducting periodic training and appeals to all employees (P3), Performing SOPs for storing goods (P9), Sharing and updating information with Suppliers (P2), Providing rewards, punishment, and work motivation to all employees (P5), Make a mutual agreement with distributors regarding the delivery time of drugs to the pharmacy (P10), Forecasting demand based on historical

data (P1), Looking for alternative drugs with similar functions (P4), Repairing and adding capacity of facilities to facilitate every business activity at the pharmacy (P8), Provide inventory (inventory) that is more than the existing inventory (P6), Provide reward, punishment, and work motivation to all employees (P5)

In line with the ten risk mitigation strategies recommendation, four proposed strategies are recommended to minimise short term risk. Namely 1) implementing HR Development methods by conducting regular business SOP training and providing rewards, punishments, and work motivation to all employees. 2) taking a customer-focused approach following the concept of Customer Relationship Management by forecasting demand based on historical data on customer product purchases to avoid a shortage of medicines that can lead to customer complaints. 3) Establish supplier selection policies with the Supplier Relationship Management approach by sharing and updating information to determine product quality and track record analysis. This approach also considers consistency and supplier policies as mutual agreements in scheduling product delivery with suppliers who have determined. 4) The design of facilities, according to (Setiabudi, 2016), such as Point of sale software and product inventory software system.

### Research limitations and Future Work

This research points at least three limitations. Firstly, there are inadequate data provided due to data confidentiality. The second part is in line with inadequate respondents due to research consents. In addition, it is insufficient enterprise participating in this study. This research is also mapping risk events and agents based on a middle stream of the supply chain. Future research with more enterprises participating in mitigating risk and involving all streams of the supply chain as research participants would be proper to provide comprehension theory in supply chain risk management.

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