SUPPLY CHAIN RISK MANAGEMENT ON MEDICINE SUPPLY USING HOUSE OF RISK (HOR) AND VALUE AT RISK METHOD AT RSUD PANDAN ARANG

UNDERGRADUATE THESIS

Submitted to International Undergraduate Program in Industrial Engineering in Partial Fulfilment of Requirement for the Degree of Sarjana Teknik at the Faculty of Industrial Technology Universitas Islam Indonesia

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UNDERGRADUATE PROGRAM IN INDUSTRIAL ENGINEERING

FACULTY OF INDUSTRIAL TECHNOLOGY

UNIVERSITAS ISLAM INDONESIA

YOGYAKARTA

2024

AUTHENTICITY STATEMENT

For the sake of Allah SWT, I admit this work is the result of my own work, except for the excerpts and summaries from which I have explained the source. If in the future, it turns out that my confession is proven to be untrue and violates the legal regulations in the paper and intellectual property rights. In that case, I am willing to get a diploma that I have received to be withdrawn by Universitas Islam Indonesia.

Yogyakarta, June 08, 2024

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RESEARCH COMPLETION LETTER

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Dalam rangka menyelesaikan pendidikannya, Mahasiswa yang bernama tersebut diatas pada tanggal **27 Maret – 27 September 2023** telah melakukan **Penelitian** di RSUD Pandan Arang Boyolali dengan judul "***Supply Chain Risk Management on Medecine Supply Using House of Risk (HOR) and Value at Risk Method at RSUD Pandan Arang***"

Demikian surat keterangan ini kami buat untuk dapat dipergunakan seperlunya.

Boyolali, 16 November 2023

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SUPPLY CHAIN RISK MANAGEMENT ON MEDICINE SUPPLY USING HOUSE OF RISK (HOR) AND VALUE AT RISK METHOD AT RSUD PANDAN ARANG

UNDERGRADUATE THESIS

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V

EXAMINER APPROVAL PAGE

SUPPLY CHAIN RISK MANAGEMENT ON MEDICINE SUPPLYUSING HOUSE OF RISK (HOR) AND VALUE AT RISK METHOD AT RSUD PANDAN ARANG

UNDERGRADUATE THESIS

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Yogyakarta, June 10 2024

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DEDICATION PAGE

This undergraduate thesis that spent a lot of time and resources is dedicated to my family, especially Bapak, Ibund, Pak Kyai, Bu Nyai, Mbak and Mas who always support me in any situation and condition.

To all my best friends who always share happiness and sadness.

This thesis also would not be possible to be completed without the assistance of my supervisor,
Prof. Dr. Ir. Elisa Kusrini, M.T., CPIM., CSCP.

MOTTO

"Indeed, Allah would never change a people's state 'of favor' until they change their own state" – surah Ar Ra'd verse 11

PREFACE

Assalamu'alaikum Warahmatullahi Wabarakatuh.

Alhamdullillah, all praise to Allah SWT, because only with his permission the author can finish the undergraduate thesis. Shalawat and greetings to the Prophet Muhammad SAW who has saved the mankind from the jahiliyyah era to the Islamiyah era and also will give syafa'at into Yaumul Akhir.

This report was made to fulfill the requirements for completing a degree in Industrial Engineering at Universitas Islam Indonesia. The author realizes that she cannot finish the undergraduate thesis without the support, prayers, and motivation from all parties. Thus, the author would like to thank:

1. Mr. Prof. Dr. Ir. Hari Purnomo, M.T. as Dean of Industrial Technology Faculty, Universitas Islam Indonesia.
2. Mr. Dr. Drs. Imam Djati Widodo, M.Eng.Sc. the Head of the Undergraduate Program in Industrial Engineering, at Universitas Islam Indonesia.
3. Mrs. Ir. Ira Promasanti Rachmadewi, M. Eng., the Secretary of the International Undergraduate Program Industrial Engineering, Universitas Islam Indonesia.
4. Mrs. Prof. Dr. Ir. Elisa Kusrini, M.T., CPIM., CSCP., SCOR-P. as the supervisor who always provides guidance and knowledge to help the author finish this undergraduate thesis.
5. Mrs. Devy Nurrahma, S. Kom as the staff of the International Undergraduate Program in Industrial Engineering, Universitas Islam Indonesia who always there to help the author in providing administrative aspects during this undergraduate thesis report.
6. The author's beloved parents, Dr. Muhtadin, MA and Drs. Ika Dyah Damayanti DP, the author's sisters, Nur Fadhillah Al-Karimah and Nur Rizqiyah Al Karimah who always give support, motivation and prayer.
7. All IP students batch 2018, Santri Ponpes Ki Ageng Giring, the students of LPC, my family that I found in Peduly Yogyakarta and all friends for the togetherness and encouragement that cannot be mentioned one by one.
8. The author's best friends who always give motivation and support in finishing this undergraduate thesis.

The author realizes this undergraduate thesis cannot be said as perfect, so the author appreciates if the reader gives critics and recommendation. The author hopes that this report can give many benefits to all parties.

Wassalamu'alaikum Warahmatullahi Wabarakatuh.

ABSTRACT

Hospitals, as defined by the World Health Organization, play a crucial role as essential components within medical and social structures, offering comprehensive healthcare services. The effective management of hospitals is of utmost importance, requiring enhancements in quality to fortify healthcare provisions. This investigation delves into the pivotal role of pharmacy installations in hospitals, underscoring their significance in pharmaceutical planning, supply, and oversight. The focus is on RSUD Pandan Arang, a government-owned hospital in Boyolali, Central Java, to assess the contribution of pharmaceutical installations in supporting diverse medical services, particularly those under BPJS. The study identifies inherent uncertainties in the future that pose risks to the overall business process, stressing the need for efficient drug supply chain management to ensure optimal service delivery, patient safety, and consultation availability. To address these challenges, the study employs the House of Risk (HOR) technique and the Value at Risk (VaR) method to identify, analyze, and mitigate potential hazards. Drawing on historical data, the study pinpoints 17 risk events and agents, with a focus on two high-risk, low-incidence primary agents: "lack of supervision of medicine by the head of the pharmacy department" and "lack of communication with distributors." Additionally, the VaR technique estimates potential financial impacts over a three-month period with a 95% confidence level, suggesting losses ranging from Rp 2,645,000.00 to Rp 183,522,609.07. These risks encompass inaccuracies in RAB calculations, forecasting issues, fluctuations in pharmaceutical prices, ordering errors, shortages, communication gaps, shipping negligence, quality control lapses, and extended return timeframes. The research concludes by highlighting the importance of implementing effective risk management measures.

Keyword: *house of risk, risk management, hazards*

TABLE OF CONTENTS

TABLE OF TABLE

TABLE OF FIGURES

CHAPTER 1
INTRODUCTION

1.1 Background

According to the World Health Organization, the definition of a hospital is a part of a medical and social organization that has the function of giving complete health services to society, both curative and preventive. The hospital aims to provide health services, curing, caring, and health improvement according to medical needs and hospital service standards (Law of the Republic of Indonesia Number 44 of 2009, about hospitals, 2009). Hospitals are a complex organization that needs to be managed effectively. In supporting health services, upgrading and improving the quality is a must. According to Sholikhah (2010), upgrading and improving the quality can be done by managing the organization so the hospital can give optimal service to society to reach the health purpose.

Pharmacy installation is the important thing in hospitals because it is functional. Pharmacy installation is a service provided by pharmacists by doing pharmaceutical activities such as planning, supplying, producing, saving, dispensing, quality control, also pharmaceutical preparation, and controlling consumables and medical equipment at the hospital.

According to the law of health ministry (Kemenkes) number 58 of 2014 about the standard pharmacy service in hospitals, to improve pharmacy quality service in hospitals that are oriented on patient safety, the standard is needed as a parameter on pharmacy, especially on managing medicine since medicine is one of important parts in healing process also in caring patient. In managing the supply of medicine, hospitals must ensure the stock of medicine is fulfilled. This management can be achieved by managing the medicine supply chain management well, to help hospitals lessen inefficiency in managing the supply of medicine. According to Quick (1997), process saving and distributing is an activity that needs more attention because this process is important, complex, and also needs a big budget. The unmanaged process of the medicine supply chain could be caused by waste, damage to medicine, and expiration, to the undelivered medicine to the patient.

Some mistakes in medicine supply chain management could occur because of the uncertainty in the future which can make a risk. Risk itself could mean a negative

impact that is occurring in the future. The risk, in the supply chain according to Kersten et, al (2007), is defined as an incident that interferes with the business process in a company's supply chain. Several factors that could be the risk for the supply chain could be caused by internal factors (company relationship with supplier network) and external factors (supplier network with the environment). In an attempt to decrease the risk to an acceptable level, effort is needed such as measurement, management, also monitoring which are called risk management.

RSUD Pandan Arang is a hospital in Boyolali, Central Java that is owned by the government and classified as a type B hospital. RSUD Pandan Arang has facilities in the form of outpatient installation, inpatient installation, emergency department, and intensive care installation. This hospital also serves the patients who do the treatment using BPJS. So there needs to be good support from pharmaceutical installations as providers, planning, distribution, and storage of medicines, medical devices, pharmaceutical radio regencies & medical gases. In addition, the pharmacy installation is also responsible for providing 24-hour drug services and consultations. But, according to the data obtained from the complaints division of RSUD Pandan Arang for three months from June into August 2023, the most common complaints from the patients are not only about the dissatisfied the services (33,33%) but also the shortage of medicine stock (26,32%) as in the table below.

Table 1. 1 Complaint Recap from June into August 2023

No	Form of Complaint	Complaint	Percentage
1	Dissatisfied with the services	19	33,33%
2	The schedule of doctor	8	14,04%
3	Shortage of medicine stock	15	26,32%
4	BPJS	9	15,79%
5	Parking	6	10,53%
	Total	57	100%

This research is focused on identifying and determining the risk possibility that could occur in medicine supply chain management in pharmacy installation RSUD Pandan Arang, also strategic mitigation is made for decreasing the impact of risk. This research uses using House of Risk (HOR) method to know the risk agent the reason why risk occurs and the strategy to decrease the risk agent, also uses the Value at Risk method for calculating the total loss RSUD Pandan Arang. There are two steps in using

the House of Risk method. First, is using House of Risk level 1 to do risk identification according to the framework of the business process using SCOR (Supply Chain Operation Reference). Furthermore, House of Risk level 2 is done to determine the strategy for risk mitigation, also using the Value at Risk method as a tool for calculating the total risk impact in this research that could occur in a certain time. This method is used by looking the past historical data (Kountur, 2008 in Indira & Trimo, 2021)

1.2 Problem Formulation

Based on the background that has been described, the researcher formulated the problems as follows:

1. How does the risk that will occur in the supply chain of medicine at pharmacy installation RSUD Pandan Arang?
2. How is the financial impact that occurs in the company based on the risk that occurs in pharmacy installation RSUD Pandan Arang using the VaR method?

1.3 Research Objective

Based on the problem formulation above, the objectives of the research can be arranged as follows:

1. Identifying the risk priority on the supply chain using the House of Risk method.
2. Knowing the financial impact of the company according to the risk that occurs in pharmacy installation RSUD Pandang Arang using the Value at Risk method.

1.4 Scope of Research

There are several limitations of research that must be taken as guidelines in carrying out this undergraduate research. the limitations of this undergraduate research are:

1. The research was conducted at RSUD Pandan Arang.
2. The research focused on the medicine supply chain of internal companies.
3. The data were taken from 2023.

1.5 Benefit of Research

The benefits expected from the implementation of this research work are:

1. Benefit for student

Obtaining an overview of the risks and ways to overcome them that can be significant additional knowledge for future working life. Especially regarding supply chain management.

2. Benefit for company

   For the company, this research hopes can be a reference for evaluation so that in the future the company could be more optimal.

1.6 Systematic Research

Study writing is based on the rules of scientific writing in accordance with the systematics as follows:

CHAPTER I INTRODUCTION

This chapter consists of background problems, formulation of the problem, research question, problem limitation of the research, the objectives or purpose of research, the benefits of research, and systematic writing.

CHAPTER II LITERATURE REVIEW

In this chapter, there will be an elaboration on the theories of reference books and journals as well as the results of previous researchers related to the research problem which are used as a reference for problem-solving.

CHAPTER III METHODOLOGY

This section describes the framework, flow chart, and data collection method of this undergraduate research. This will help to make the research more structured and organized. Here, the flow of the research will be explained in detail so that the readers can understand the research methodology.

CHAPTER IV DATA COLLECTION AND PROCESSING

This chapter contains the data obtained during the research and how to analyze the data. Data processing results are displayed in the form of tables and graphs. What is meant by processing the data also includes analysis of the results obtained. This section is a reference to the discussion of the results to be written in Chapter V.

CHAPTER V RESULT AND DISCUSSION

This chapter presents a discussion of the results of data processing that have been done in research, compatibility with the objectives of research to produce a recommendation.

CHAPTER VI CONCLUSION AND SUGGESTION

This chapter consists of the conclusion of the research and is completed with recommendations for future research.

CHAPTER 2
LITERTURE REVIEW

This chapter will explain the literature review studies which are divided into two, preliminary study and Fundamental theory. A preliminary study is a study from previous research that already has a reputation. Besides, the fundamental theory is a study that would explain the basic theory that has relation with research that would be conducted from the textbooks. Preliminary and fundamental studies need to be done to find out the gap between previous studies and the research that would be conducted and to be done to avoid plagiarism. This literature review will be divided into several sub-chapters.

2.1 Empirical Study

2.1.1 Supply Chain

Pujawan, 2005, defined a supply chain as a collection of businesses that collaborate to produce and deliver goods to consumers. Moreover, the supply chain can be defined as the group of parties involved in the development of new products and services, the acquisition of raw materials, the transformation of those resources into semifinished and finished goods, and the delivery of those goods to the final consumers (Swaminathan, 2001).

2.1.2 Supply Chain Management

One of the most crucial facets of running a business is supply chain management. Supply Chain Management (SCM) is an integrated program that provides information system support to management in terms of procurement of goods and services for businesses while managing connections between partners to maximize the availability of products and services required by businesses (Anwar, 2013). Furthermore, Supply chain management refers to the effective management of the entire end-to-end process, beginning with the creation of the good or service and ending with the consumer's final disposal of it after it has been purchased, used, and sold. Design, procurement, planning, forecasting, production, distribution, fulfillment, and after-sales support are all included in this comprehensive process (Lu & Swaminathan, 2015).

2.1.3 Supply Chain Operation References (SCOR)

The SCOR model evaluates an entity's supply chain performance (Wati, Prasetyo, & Wulandari, 2021). The SCOR model describes a business process model, work factors, practice guidelines, and technology to support communication as well as communication and collaboration between supply chain partners, thereby increasing the efficacy of supply chain management and the efficacy of supply chain improvements (Paul, 2014).

SCOR is divided into five distinct management processes: Plan, Source, Manufacture, Deliver, and Return; from supplier to consumer. Process, Practice, Performance, and Human Resource Skills make up the SCOR methodology. The SCOR model's implementation significantly enhances the effectiveness of supply chain operations' logistics (Salazar, Caro, & Cavazos, 2012).

2.1.4 Supply Chain Risk Management (SCRM)

Supply chain risk management refers to the risk management process that occurs when goods are distributed from suppliers to end users (Puspadina, Oetari, & Widodo, 2021;Rozudin & Mahbubah, 2021). To lessen the negative effects of supply chain management through planning and recognizing supply chain risks, coordination across supply chain organizations is necessary (Jayawati, Taufik, & Taryana, 2020). Supply Chain Risk Management (SCRM), which employs the risk management method and engages with supply chain partners, is the result of the combination of risk management and supply chain management ideas.

2.1.5 Risk Management

Risk management is the study of how businesses use measures to map different problems that already exist by putting different management approaches thoroughly and methodically (Fahmi, 2010). The goal of risk management is to assist the project team in making the best choice possible at the appropriate moment when identifying, classifying, and quantifying the risks before managing and controlling them. By balancing the input to manage the risks with the advantages of such an act, the goal is to secure the best value for the project in terms of cost, time, and quality (Srinivas, 2019).

2.1.6 House of Risk (HoR)

A fresh approach to risk analysis is the House of Risk. In order to prioritize risk agents that must be prioritized first and then choose the most effective actions to reduce potential risks posed by risk agents, its implementation uses the principles of FMEA (Failure Mode and Error Analysis) in conjunction with the House of Quality (HOQ) model to quantify risk measurement (Pujawan & Geraldin, House of Risk: A Model for Proactive Supply Chain Risk Management, 2009).

The HOR model supports risk management with a prevention-focused approach, i.e., lowering the likelihood that risk agents may materialize (Febrianto, 2017). Hence, identifying risk occurrences and risk agents is the first step. Only risk agents and the degree of risk occurrences are given probability by the HOR approach. It is vital to establish an aggregate potential risk quantity for the risk agent since it is possible for one risk agent to result in multiple risk events. The next step is to process the matrix of risk agents and risk events to determine the priority order of the risks that need to be mitigated. After that, the risk matrix is processed again using preventive measures, and the output from the house of risk is the priority order of risk mitigation. The House of Risk (HOR) model, a variation of the HOQ model, has these two distributions (Pujawan & Geraldin, House of Risk: A Model for Proactive Supply Chain Risk Management, 2009).

1. HOR 1 is used to establish the level of risk agents that must be administered as a preventive step.
2. HOR 2 is a priority when performing activities that are regarded effective.

2.1.7 Value at Risk (VaR)

Value at Risk (VaR) is a metric used in risk management to quantify risk. The value at risk (VaR) is defined as the estimated worst loss over a certain period at a given level of confidence (Jorion, Value at RIsk - The New Benchmark for Managing Financial Risk, 2007). VaR simply seeks to answer the question "how much (in percentage or monetary terms) investors can expect to lose due to uncertain conditions during the investment interval T with a confidence level of" (Annas, Nasrulloh, & Mawardi, 2020). The method for calculating VaR is as follows:

1. Value at Risk Historical Method

$$Return = \{[P(t+1) - Pt)]/Pt\}x100\%$$

Information:

Pt = Return in t period

P(t+1) = Return in t + 1 period

2. Value at Risk Portfolio Method

$$VaR\ Portfolio = [VaRx^2 + VaRy^2 + 2 \times Pxy \times VaRx \times VaRy]^{1/2}$$

Information:

VaRx = VaR (Value at Risk Portfolio X)

VaRy = VaR (Value at Risk Portfolio Y)

Pxy = Correlation of X portfolio and Y portfolio's return

2.2 Inductive Study

The inductive review consists of previous literature that correlates with this current research that talks about supply chain risk management using house of risk method in hospital industry. So, here is the inductive review of previous literature:

Table 0.1 Inductive Study

No	Author	Title	Research Method	Result
1	Magdalena & Vannie, 2019	Analisis Risiko Supply Chain dengan Model House of Risk (HoR) pada PT Tatalogam Lestari	House of Risk	The research uncovered 20 risk agents and 21 risk events. At HOR 1, risk events, the occurrence of risk agents, and the relationship between risk events and risk agents are used to determine severity. This yields the value of aggregate risk potential, where 8 risk agents were discovered and Pareto diagrams revealed that they accounted for 80% of the issues in operational activities. Based on the ratio between the effectiveness

No	Author	Title	Research Method	Result
				and complexity of performing preventive activities, HOR 2 identifies 8 preventive actions and the calculation of mitigation priority that should be carried out by the firm.
2	Puji, Yul, & Rafian, 2020	Desain Manajemen Risiko Rantai Pasok Darah Menggunakan House of Risk Model (Studi Kasus : PMI Kota Pekanbaru)	Supply Chain Operation Reference, House of Risk	It was determined from the study's findings that there were 24 possible dangers and 23 risk agents. There are 12 handling strategies that have been identified as mitigation actions, including routine training for all employees (PA1), raising standards for health condition checks (PA12), finishing up supporting facilities and infrastructure, and negotiating (PA11). With the help of these mitigations, it is anticipated that existing risks can be reduced.
3	Nafiáh & Mahbubah, 2021	Managing Risk on A pharmacy Enterprise Supply Chain using House of Risk Approach	SCOR, HOR	In this study, 45 risk occurrences, 23 risk agents, and 19 risk-reduction measures were identified. HOR 1 results in the calculation of total risk potential. Ten risk agents are prioritized out of 23 based on which ones have the

No	Author	Title	Research Method	Result
				highest ARP values. To reduce risk along with the supply chain stream, 10 risk mitigation methods are found by the computation of HOR 2. The ten mitigations can be implemented using one of four methods: facility design, supplier relationship management, customer relationship management, or human resource development.
4	Ridwan, Trenggonowati, & Parida, 2019	Usulan Aksi Mitigasi Risiko Rantai Pasok Halal pada IKM Tahu Bandung Sutra Menggunakan Metode House of Risk	SCOR, HOR	There are 21 risk events that have been discovered, including 4 from the plan, 3 from the source, 9 from the make, 2 from the deliver, and 3 from the return. According to the ARP value, there are eight risk agents (sources of risk) that are favored, including worker negligence during production (A11), production process errors that lead to contamination (A9), the absence of proper and adequate SOPs (A10), the absence of facilities and equipment (A4), the failure to check and hygienic equipment and machines before use (A8), crowded

No	Author	Title	Research Method	Result
				production rooms (A12), clean production rooms, and unhygienic production processes (A1). There are 9 proposed mitigation actions in the risk of the halal supply chain at Milkfish Sate IKM.
5	Permanasari & Prasetyowati, 2021	Risiko Pasar Saham Perbankan Syariah dengan Metode Standar Deviasi Markowitz dan Value at Risk (VAR)	Markowitz standard deviation, Value at Risk	The findings revealed that BRIS banks had a risk level of 1.33% and an E (R) of 8.5%. The 47th day has the highest investment returns of 0.0769%, while the 60th day sees the lowest investment returns of -0.1109%. Then The lowest daily 5% return for BRIS on the daily 95% VAR is 5% from 108 days, on the 85th day of -0.248%, while the best daily 5% return is on the 47th day of 0.1444%. The 5% daily return of BTPN Syariah is 5% from 108 days, with the lowest return occurring on the 67th day of -0.247% and the highest return occurring on the 47th day of 0.758%, according to the daily 95% VAR. The 5% daily return of BTPN Syariah is 5% from 108 days, with the

No	Author	Title	Research Method	Result
				lowest return occurring on the 67th day of -0.247% and the highest return occurring on the 47th day of 0.758%, according to the daily 95% VAR. At the daily 95%, the VAR with PANIN SYARIAH's lowest daily return of 5% is 5% from 108 days. The 108th day is when the highest return happens. There is no market risk (loss rate) if there are 1 billion rupiahs worth of PANIN SYARIAH shares. 5% chance of a portfolio loss on BRIS shares tomorrow.
6	Sarjono, Suprapto, & Megasari, 2017	Supply Chain Performance Measurement Using SCOR Model in the Distribution Company in Indonesia	SCOR	According to the analysis of the company's real data, the supply chain performance of the business has been strong. It is clear from the data that Perfect Order Fulfillment (POF) data totaling 100% has already surpassed expectations, Order Fulfillment Cycle Time (OFCT) data totaling 3 days has also met expectations for superior performance, Cost of Good Sold (COGS) data totaling 14.53% has met expectations for an advantage, and Cash-to-

No	Author	Title	Research Method	Result
				Cash Cycle Time (CTCCT) data totaling 41 days has met expectations for parity. Further mapping in this study is not required because the actual data for those indicators has already exceeded performance goals and even taken the top spot.
7	Wahyudi, Syarwani, & Anggani, 2017	Pengukuran Kinerja Supply Chain dengan Pendekatan Supply Chain Operation References (SCOR)	SCOR	In this research, by using subjective questionnaires to weight performance attributes, the level of importance is determined. Values of the performance attributes attained were asset management (12.26), responsiveness (16.91), agility (11.0), and dependability (19.74). 59.90 is the overall performance rating. This number suggests that the supply chain's performance is about average.
8	Kurniawan, Marzuky, Ryanto, & Agustine, 2021	Risk and Supply Chain Mitigation Analysis Using House of Risk Method and Analytical Network Process	SCOR, HOR, ANP	According to the findings, there are 35 risk agents and 36 risk events. PT XYZ proposes to implement 11 preventative measures, and 19 risk agents are classified as priority hazards. According to the research's findings, the company

No	Author	Title	Research Method	Result
				should take mitigation measures in the order of priority.
9	Cahyani, Pribadi, & Baihaqi, 2016	Studi Implementasi Model House of Risk (HOR) untuk Mitigasi Risiko Keterlambatan Material dan Komponen Impor pada Pembangunan Kapal Baru	HOR	A risk agent is produced from HOR 1, notably the shipyard's dismal payment history. As this is going on, six components, including deck machinery, navigation and communication, harbor diesel generator, main diesel engine, shafting and z-peller, and main diesel engine, are categorized as high risk in the business process of acquiring each imported material and component. The length of the buying negotiation is one of the risk factors. Priority risk agents are created from HOR phase 1, specifically a lengthy technical review. In order to develop preventative actions for general procurement business processes starting with HOR 2, including managerial improvement training and the competency of each competency. The goal of the procurement procedure is to process import documentation for

No	Author	Title	Research Method	Result
				each component as quickly as possible.
10	Kristanto & Hariastuti, 2014	Aplikasi Model House of Risk (HOR) untuk Mitigasi Risiko pada Supply Chain Bahan Baku Kulit	HOR, Aggregate Risk Priority	The house of risk model, which was used to this study and has two phases, was used. After identifying risks and risk agents, the first step analyzes risk occurrence and severity before calculating the aggregate risk priority (ARP) value. Managing risks is the second stage. There were 52 risk agents and 27 risk events, according to the study's findings. In an effort to reduce risks in the supply chain for leather raw materials, there are six mitigation measures that can be implemented.
11	Sugihartanto, Mahendra, Baihaqi, Rizaldy (2024)	Supply Chain Risk Management Assessment and Strategy: Case Study in a Hospital Pharmacy	Supply Chain Risk Management	The SCRM and supply chain risk assessments at XYZ Hospital's pharmaceutical installation revealed a good overall risk management system, but with insufficient risk identification due to infrequent supplier analysis. The House of Risk stages identified 20 risk events and agents, prioritizing 11 risk

No	Author	Title	Research Method	Result
				management strategies for immediate action. These findings, while insightful, are limited to this single case, indicating a need for broader studies involving the entire hospital and more stakeholders at a macro level.
12	Nafi'ah & Mahbubah (2021)	Managing Risk on A Pharmacy Enterprise Supply Chain Using House of Risk Approach	SCRM, SCOR, and HOR	This research identified 45 risk events in the pharmacy supply chain, categorized into various activities: planning, sourcing, making, delivering, and returning. It also validated 23 risk agents, with 16 risk events having high occurrence values, such as planning errors, labor negligence, drug scarcity, and SOP non-compliance. The ten most prominent risk agents include labor negligence, incomplete supplier SOPs, and the lack of a FIFO system.
13	Lhassan, Ali, & Majda (	Combining SCOR and BPMN to support supply chain decision-making of the pharmaceutical wholesaler-	SCOR and BPMN	This work focuses on modeling the supply chain of pharmaceutical wholesaler-distributors, key players between pharmaceutical laboratories and pharmacies, who face significant challenges

No	Author	Title	Research Method	Result
		distributor		requiring effective supply chain management. A new method integrating the SCOR model and BPMN2.0 was proposed to address these issues, facilitating better communication, decision-making, and process analysis. Future work will focus on selecting and implementing performance indicators for each hierarchical level of the supply chain processes.
14	Imane & Fouad (2021)	Improving sustainability in public hospital through Medicines Supply chain management	SCOR Model, Supply Chain Master, and ASLOG	This study assessed the sustainability of the drug supply chain at a public hospital in Morocco, finding it lacking in both economic and social performance, mainly due to poor forecasting and centralized planning. To improve sustainability, it recommends revising the supply system for greater flexibility and reconfiguring care unit replenishment to use drug stocks more rationally.
15	Sibevei, Azar, Zandieh, Khalili, & Yazdani (2022)	Developing a Risk Reduction Support	Supply Chain Risk Management, Multi-Criteria	Blood supply chains (BSCs) face numerous risks that can lead to significant complications, and supply

No	Author	Title	Research Method	Result
		System for Health System in Iran: A Case Study in Blood Supply Chain Management	Decision-Making (MCDM)	chain risk management (SCRM) can help managers better prepare by identifying and analyzing these risks. This research proposed a new systemic approach (SSI) to identify and analyze supply chain risks (SCRs), using a holistic view, rich picture within SSM, and SNA to ascertain relationships among risks, followed by ISM to establish key risk relationships. Key risks identified include low employee productivity, earthquakes, exchange rate changes, and late blood bag deliveries, with ISM and MICMAC analyses highlighting the high impact and low dependency of economic and political risks, necessitating special strategies to enhance supply chain resilience.
16	Martínez et al. (2023)	Examination of the Protein Drug Supply Chain in a Swedish University Hospital:	Protein Drug Supply Chain Observation Method (Double Diamond) & Failure Mode	Protein drugs at the studied hospital are exposed to various stress factors, analyzed and mitigated using Failure Mode Effects Analysis and the Double Diamond methods.

No	Author	Title	Research Method	Result
		Focus on Handling Risks and Mitigation Measures	and Effects Analysis (FMEA)	Reconstituting these drugs in pharmacy cleanrooms according to validated protocols ensures their quality if transported and administered properly. Effective communication of procedures and continuous education of personnel are essential to reducing failures.
17	Oliveira et al. (2022)	Medication supply chain risk management for a brazilian home care provider: a business sustainability study	Supply Chain Risk Management, Failure Mode and Effect Analysis (FMEA), Risk Analysis and Assessment Tools	This study evaluated operational risks in a home care health services organization using ISO 31010 standard RM tools, process mapping, and brainstorming with experts. Critical processes and failure modes were identified, with FMEA analyzing the warehousing process to list failure modes, causes, and effects. Implementing an integrated management system and training initiatives effectively mitigated high-risk failure modes, though the study's single-case nature and FMEA's subjectivity may limit broader applicability.
18	Moons,	Measuring the	Multi-Criteria	This literature review

No	Author	Title	Research Method	Result
	Waeyenbergh, & Pintelon (2018)	logistics performance of internal hospital supply chains – a literature study	Decision-Making, Supply Logistics	explores the unique internal supply chain management challenges in hospital operating rooms, emphasizing the need for effective coordination between clinical, material, and information flows to enhance operational performance. Despite the critical role of logistics in ensuring timely, safe, and cost-effective supply delivery, issues like poor visibility, low traceability, and inadequate coordination hinder supply chain excellence. Future research aims to develop a framework for evaluating logistics performance using methods like AHP or ANP, focusing on time and cost savings while maintaining high service levels, with a case study planned to validate this framework in the operating room.
19	Silva, Araujo, & Marques (2020)	Siloed Perceptions in Pharmaceutical Supply Chain Risk Management:	Supply Chain Risk Management	This study reveals that participants in the Brazilian pharmaceutical supply chain (PSC) have a siloed view of risks, which limits their understanding of the overall

No	Author	Title	Research Method	Result
		A Brazilian Perspective		supply chain performance. It identifies ten key risks, including new risks like price regulation, and highlights a lack of concern for counterfeit drugs despite its significant global scrutiny. By using AHP, the study improves understanding of risk impacts and offers practical insights for managing operational and regulatory challenges in Brazil and Latin America, emphasizing the need for better integration and strategic alignment among PSC players.
20	El Farouk, Frichi, Jawab (2020)	An Innovative Approach to Develop Performance Indicators for Medicines Supply Chain in Moroccan Public Hospitals	SCOR Model	This paper introduces the OPRI methodology for developing drug supply chain performance indicators, combining SCOR, ARIS, and risk analysis to monitor and enhance performance through risk warnings. OPRI aims to improve performance measurement in hospitals, specifically tailored to contexts like Moroccan hospitals. Future research should focus on

No	Author	Title	Research Method	Result
				implementing a performance monitoring system with continuous KPI updates and analysis to address gaps and enhance overall performance.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Research Object

This research is focused on analyzing the risk that occurs in the supply chain of medicine at the pharmacy installation of RSUD Pandan Arang. This research also would identify the priority of risk that will be conducted and calculate the impact of financial risk. This research uses the House of Risk (HOR) method and value at risk to know the financial impact. The respondents in this research include the manager of administration and also the staff of pharmacy installation.

3.2 Research Instrument

The research instrument that will be used in this research is a questionnaire. The questionnaire will be used to interview the manager of administration and the staff of pharmacy installation RSUD Pandan Arang. The Questionnaire will be an instrument to obtain the data that will be needed, supply chain assets.

3.3 Data Collection Method

There are two types of data used to support this research, primary and secondary data. Those two types of data have different data collection methods. The following explains the data used and the data collection method.

3.3.1 Primary Data

Primary data is the data that is directly related to the processing data in this research. In this research primary data is obtained from the interviews with the experts who have been determined criteria.

3.3.2 Secondary Data

Secondary data is the data that is not directly related to the processing data in this research. This data is used as supporting data and indirectly related to calculating. In this research, secondary data which is used consists of various source literature such as books, journals, and earlier thesis.

3.3.3 Observation

Observation is done within the observing of supply chain medicine activity to know the problems that may occur in supply chain medicine.

3.3.4 Interview

The interview is done by the researcher with the person who is involved with the activity of supply chain medicine. The interview is done to know the risks that may occur, and also to identify the factors that can cause risks in the activity of the medicine supply chain.

3.3.5 Questionnaire

The questionnaire is spread by a person who is responsible for the activity of supply chain medicine to know the relationship between the source of risk and the occurrence of risk.

3.4 Research Tools and Devices

This research was carried out by utilizing an application, Microsoft Excel to help with processing data to calculate the weight of house of risk 1, house of risk 2, and the analytical hierarchy process.

3.5 Research Flowchart

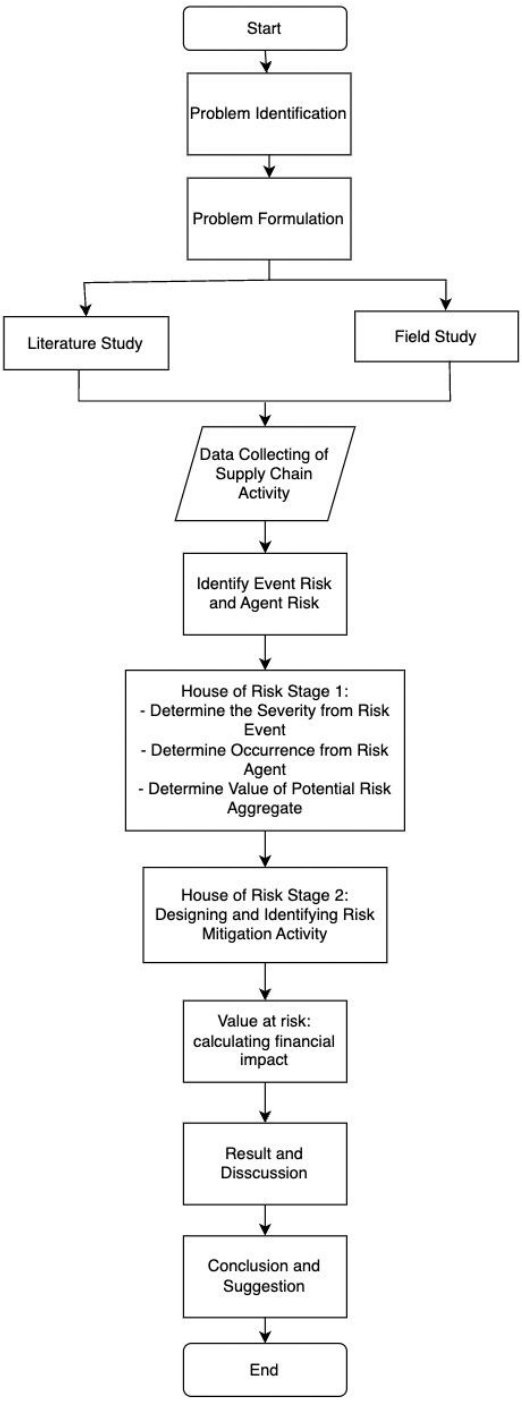

Figure 0.1 Research Flowchart

The following is the explanation of the flowchart:

1. Problem Identification

   The first step is identifying the existing problems in the company, as an object for research. Identification occurs by prefix observation at RSUD Pandan Arang

Boyolali to identify the problem that can be solved using the Industrial Engineering method.

2. Problem Formulation

   In this step, problem formulation is done based on identifying the research at RSUD Pandan Arang. This stage aims to determine the topic of the problem in this research.

3. Literature Study and Field Study

   Study literature is done by reading the source that is related to the purpose of the research. This literature study consists of deductive study and inductive study. Besides, a comparison between the literature study with the actual situation in the field is made by the researcher.

4. Data Collection

   Collecting data is done by doing interviews and spreading the questionnaire, after that, the data would be processed into secondary data and primary data. The data collected insist on the supply chain activity of the company, potential risk genesis from the supply chain, risk agent, and risk mitigation action.

5. Identify the Activity of the Supply Chain

   For doing the identification, the Supply Chain Operation Reference (SCOR) is employed. To identify the activities of the supply chain, they have to be identified to filter t the occurrences that may raise risks in the supply chain.

6. Identify the Risk Event and Risk Agent

   After identifying the activity of the supply chain, the next step is identifying the activity that can give disadvantages for the company and the risk that can be held.

7. Processing House of Risk Stage 1

   In this step, a questionnaire is distributed to calculate every risk that can be held with value occurrence and severity from the risk event. The next step is performing risk mapping, calculating the value of the risk agent, and also calculating the correlation between the risk event and the risk agent.

8. Processing House of Risk Stage 2

   This stage is about designing the strategy priority of risk mitigation that is based on preventive action which has the highest value of effectiveness to difficulty ratio (ETDk).

9. Value at Risk

Value at risk is a method used for calculating the financial impact that occurs in RSUD Pandan Arang.

10. Result and Discussion

    This step is about an explanation of the result of the research and an explanation data processing result of the house of risk and Value at Risk.

11. Conclusion and Suggestion

    In this step, there is the answer to the aim of this research and advising this research.

CHAPTER 4
DATA COLLECTING AND PROCESSING

4.1 Company Profile

A general description of the company could be obtained by interviewing the expert of the hospital, and then the data such as the description of the company, vision, mission, and structure of the organization could be collected. A general description is used to know the background of the company that would be researched.

4.1.1 Company Profile

RSUD Pandan Arang is a regional technical institution according to the local regulation Number 4 of the year 2008 about the formation of the regional structure and Main tasks of the Regional Technical Institution and Civil Service Police Unit of Boyolali Regency. Regent's Decree Number 900/57 of 2009 concerning the Determination of Pandan Arang Hospital as a Regional Work Unit that implements the Regional Regional Public Service Agency Financial Management Pattern (PPK-BLUD).

Figure 0.1 RSUD Pandan Arang

Here is the company profile of RSUD Pandan Arang

Hospital Code	: 3309015
Hospital Name	: RSUD Pandan Arang Boyolali
Type of Hospital	: RSUD
Inaugurated	: 12 November 1961

CEO	: dr. FX Kristandiyoko, MPH
Owned	: Government of Boyolali
Address	: St. Kantil No. 14, Pulisen, Boyolali, Jawa Tengah
Phone	: (0276) 321 065; Fax (0276) 321 435
E-mail	: rsupa@boyolali.go.id
Website	: www.rsudpandanarang.boyolali.go.id
Instagram	: www.instagram.com/rsudpandanarang
Type / Class	: B
Total of bed	: 243 Bed

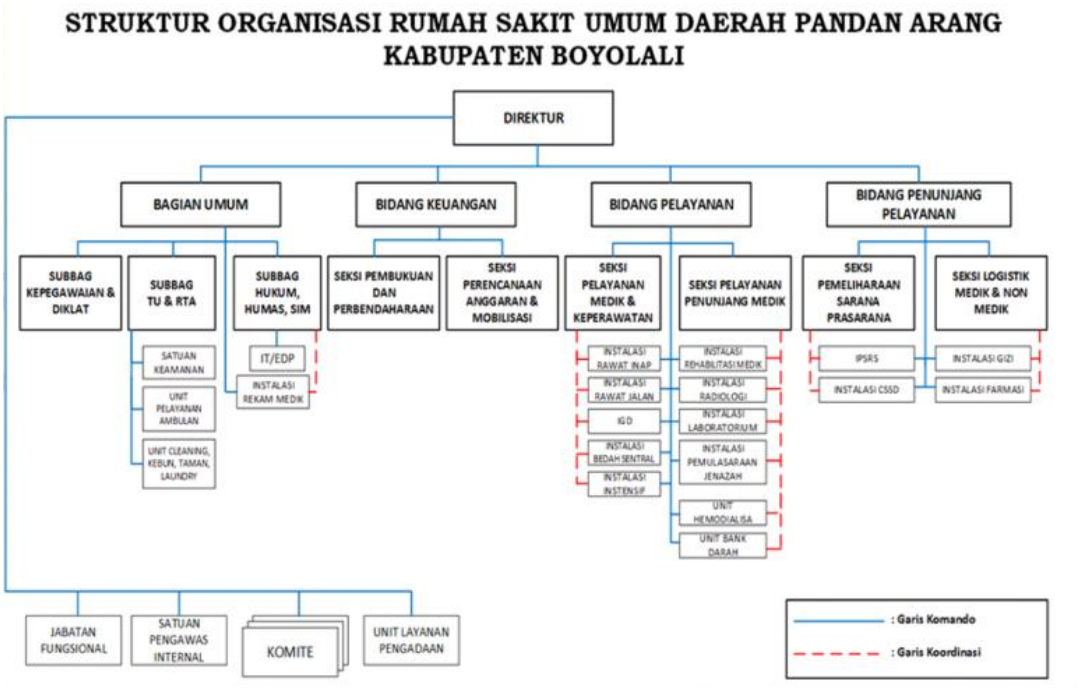

Figure 0.2 Organization Structure

Types of health service facilities in RSUD Pandan Arang Boyolali included:

a. Medical Services

1) Outpatient Installation
2) Emergency care installation
3) Inpatient Installation
4) Central Surgical Installation
5) Medical Rehabilitation Installation
6) Birthing room
7) High Risk Perinatal Pare
8) ICU, PICU, NICU dan High Care Unit (HCU)

9) Installation Room

b. Medical Support Service

1) Medical Records
2) Medical Rehabilitation
3) Laboratory
4) Radiodiagnosis
5) Diagnostic Electromedical
6) Electromedical using
7) Diagnostic Special Electromedical
8) Nutrition
9) Pharmacy
10) Hemodialysis
11) Corpse Care
12) VCT
13) Blood Bank
14) Laundry and Linen
15) Medical gas

c. Non-Medical Support Service

1) Ambulance/ Hearse
2) Treatment of clinical solid waste

d. Non-Medical Service

1) Education
2) Training
3) Comparative Study

4.1.2 Company Vision and Mission Statement

Here is the RSUD Pandan arang's vision and mission statement:

1. Vision: Serve wholeheartedly.
2. Mission:
    1) Being a hospital, which oriented on plenary service and quality for every level of society.

2) Supporting Boyolali is healthy, productive, and competitive in order to Boyolali pro-investment.
3) Realizing an advanced Boyolali and more prosperous supported with professional human resources, productive and commitment also independent management, effective and efficient.

4.1.3 Flow of Medicine Supply Chain

To fulfill the needs of medicine requests, RSUD Pandan Arang has a flow of medicine supply chain itself, which is started from the pharmacy factory, PBF, warehouse of RSUD Pandan Arang, pharmacy warehouse, pharmacy depo, and patient. However, RSUD Pandan Arang could not order medicine directly from the pharmacy factory, it needs PBF to order the medicine from the pharmacy factory.

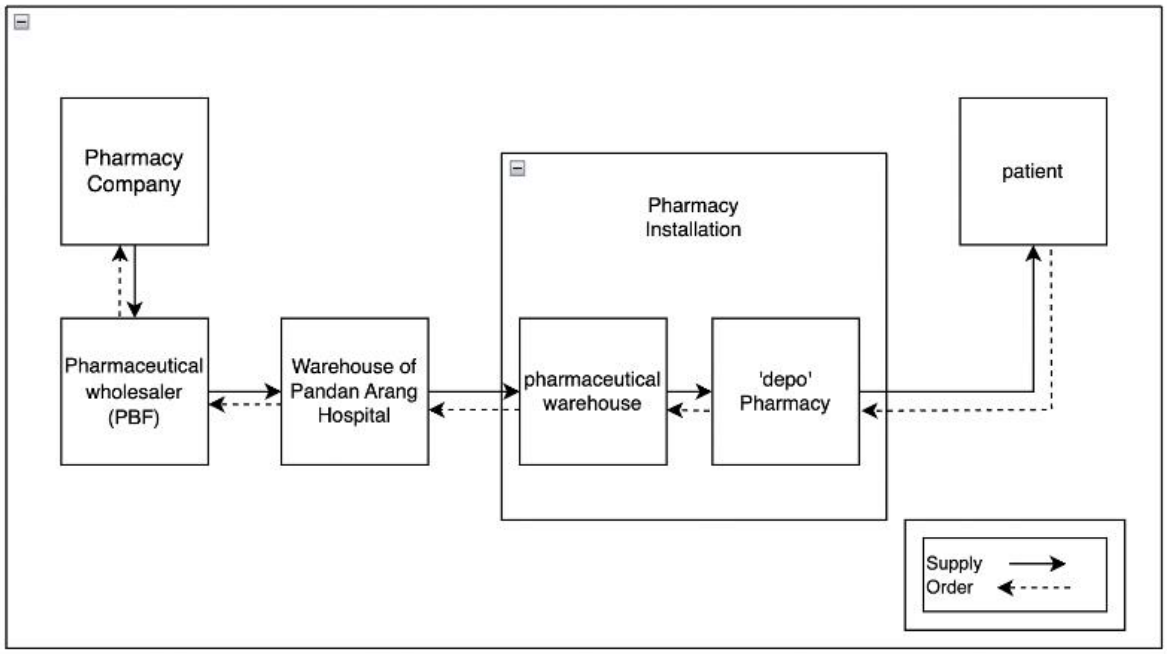

Figure 0.3 The flow of Medicine Supply Chain

RSUD Pandan Arang has 3 core variables in the medicine supply chain concept, which are PBF as the medicine Supplier, RSUD Pandan Arang, and the patient as the end consumer. In the process of supplying medicine, RSUD Pandan Arang starts with planning, annual budgeting, formulating hospitals' needs also doing auctions to supply products to the PBF that occur once a year. Medicine for the non-BPJS program is ordered every day, and for the BPJS program, the order is made once a week according to EOQ. The medicine that has arrived in the hospital warehouse would be saved inside the pharmacy warehouse, then would be packed, and would be given to the patient.

4.2 Data Collecting

In data collecting, the data such as activities supply chain according to SCOR model form plan, source, make, deliver, and return. After obtaining the activities of the supply chain, it would determine the risk agent and risk event in each supply chain activity then evaluation of severity and occurrence could be done, after that, the aggregate risk potential would be calculated to know the ranking of risk agent. From the result of the ARP ranking, risk agent mapping would be done to reveal the position of the dominant risk agent. After that, the recommendation for risk mitigation would be delivered. Later, the risk of loss in this research will be calculated using the Value at Risk method.

4.2.1 Process Supply Chain Activity

In collecting data on process supply chain activity, the SCOR model is used for clearly describing the scope and flow of the supply chain starting from the process of plan, source, make, deliver, and return so it is capable of helping to repair the process of supply chain. By using SCOR, the identification of risk causes is easier to process. In carrying out the SCOR model, focus group discussion is used with the experts involved with the flow of the medicine supply chain in RSUD Pandan Arang. Below are the experts who participated in the process of data collecting:

Name	Position	Length of Work
Placidia Hana O, S.Si., Apt	Director	22 years
Tyas Aru, Amd. Far	Pharmacy Coordinator	9 years

This research uses the SCOR10 model as a grouping reference on process supply chain activity, so describing the scope of each process is required. The description of the scope can be seen in Table 4.1:

Table 0.1 The Scope of the SCOR10 Model

Process	Goal	Scope
Plan	The aims of planning process are for equalizing between demand and resource.	Prioritizing the demand

Process	Goal	Scope
	Process planning aims to integrate between another elements process and supplier/consument.	Planning inventory, distribution, production, material, and raw material for the products.
		Do source planning, long-term capacity, manufacturing ramp-up, product-line management
Source	This process aims to explain ordering and receipt the product from supplier	This process consists of purchasing, delivery scheduling, receipt the product, storage, validation product, and accepting the facture from supplier. Also, in this process there are supplier performance assistants and contracts with suppliers.
Make	In this process, raw material is processing into finished good.	This process is containing assembling process, packaging, recycle, fixing, renovation, and material conversion.
Deliver	The aim of this process is for delivering the product into consumer	This process is related with customer invoice, product delivery into consumer, scheduling delivery.
Return	Return process contain activities that handle returning product, include returning to supplier and returning the	This process is divided into 2 processes, first is returning source, in this process is containing returning the

Process	Goal	Scope
	product from consumer	product to supplier, this activity includes scheduling return, delivery the product return, and communicating product return. The second process is about deliver return that contained product receipt from consumer

After knowing the scope of the supply chain, an interview is conducted with the expert, hence the result of the supply chain activity is obtained as follows:

Table 0.2 The activity of Medicine Supply Chain

Process	Acitivty	Code
Plan	Annual budget planning of medicine procurement	C1
	Annual planning the order of stock medicine	C2
	Planning the annual medicine formalium draft	C3
Source	Choosing the medicine's distributor	C4
	Procuring the medicine by distributor	C5
Make	Packing the medicine	C6
	Making the 'concoction medicine'	C7
Deliver	Distribute the medicine to the pharmacy and patient	C8
Return	Returning the damage medicine, expired and excess to supplier	C9
	Returning the damage medicine, expired and excess by patient	C10

4.2.2 Identifying Risk of Supply Chain

In the table above, the supply chain activity in RSUD Pandan Arang has been explained. The next step that should be done is to identify the risk by interviewing experts related to the medicine supply chain RSUD Pandan Arang, including the head of the pharmacy installation and pharmacy staff. Severity appraisal is used for measuring the impact that could be caused. The greater the severity rate the greater the impact of a risk. In deciding the rate of severity, some indicators which must be considered:

1. Customer effect: this indicator intends to reveal the rate of customer effect such as the risk of death, injury, and disease in the patient, employee, and other person because of service.
2. Service: this indicator aims to know the rate of risk effectiveness on pharmacy service at the hospital if the risk happened.
3. Financial loss: This indicator aims to know the rate of risk of financial loss that potentially happens to the hospital, in terms of budget for the annual medicine procurement, if the risk happens.
4. Reputation: this indicator aims to measure the rate of risk on the reputational decline of the hospital if the risk happened.

Severity is divided into five rates, Table 4.3 below is the explanation:

Table 0.3 Identification Risk of Medicine Supply Chain

Rank	Effect of Severity	Customer Effect	Service	Financial loss	Reputation
1	No Effect	No effect caused	Service interruption <30 minutes	Financial loss very small	Rumors
2	Minor	Can be help with first aid	Service interruption 30 minutes - 8 hours	Financial loss >0,1% from the budget	Little impact on public trust

Rank	Effect of Severity	Customer Effect	Service	Financial loss	Reputation
3	Moderate	Decreasing the motoric and sensory function temporarily	Service interruption >8 hours	Financial loss >0,25% from the budget	Big impact on public trust
4	Major	Disable permanent	Service interruption >1 day	Financial loss >0,75% from the budget	Serious news on media
5	*Catastrophic*	Death	Service interruption >1 week	Financial loss >1,5% from the budget	There is operational stoppage from government

From the grouping activity of the supply chain using SCOR, a list of risk events is obtained with the impact rate generated (severity), there are:

Table 0.4 Severity Level

Activity	Code	Risk Event	Code	*Severity*
Plan	C1	Shortage in the annual budget	E1	7
	C2	Some of medicine are not used	E2	3
		The medicine in pharmacy installation is less stock	E3	4
	C3	Variety requested medicine is out of hospital formula	E4	3
Source	C4	Distributor could not fulfill the contract with hospital	E5	4
		Hospital could not pay the bill to the distributor	E6	5

Activity	Code	Risk Event	Code	*Severity*
	C5	Lateness of delivering medicine non BPJS	E7	3
		Lateness of delivering BPJS medicine in end of year	E8	5
		Ordering e-catalog could not made	E9	4
		There is fragile medicine	E10	3
		There is dent on the wrap	E11	1
Make	C6	Packing time is too long	E12	2
	C7	There is error in compounding medicine	E13	2
Deliver	C8	Lateness in delivering medicine to the inpatient	E14	3
Return	C9	Claim could not be accepted by distributor	E15	3
		Respond from distributor to the return claim need a long time	E16	4
	C10	Returning medicine by patient because the medicine is expired	E17	3

Determining the rate of risk incident obtained by questionnaire and interviewing with the expert, here is the explanation:

1. A shortfall in the annual budget (E1) is rated 7 with the level of risk financial loss being more than 1.5% of procurement budget planning costs with total fast-moving medicine reaching 60% and total slow-moving medicine reaching 11% so it makes stagnant, which means the stock of medicine more than average use and stockout, means the total stock less than the total of use.
2. There are some medicines causes not used (E2) is rated 3 with the risk level of financial loss that could reach 0,25% of pharmacy budget costs because there is slow-moving medicine that causes stagnant and could reach expiration time.

3. The pharmacy is in shortage stock of medicine (E3) due to inaccurate planning so the pharmacy experienced a stockout with the risk level 4 because the pharmacy had to reorder to distributor and could be shipped a day after ordering.
4. The request for medicine that does not fit the hospital formula (E4) is rated 3 on its severity level because it could result in a financial loss of 0,25% from the budget. After all, there is medicine that is always stagnant.
5. The distributor could not fulfill the contract with the hospital (E5) is rated 4 because the pharmacy installation has service disruption caused by the distributor that fail to fulfill the contract, such as the lateness of medicine delivery, and unable to fulfill the needs of the pharmacy installation.
6. The hospital could not pay the medicine bill to the distributor (E6) is rated 5 because it could disrupt the service of the hospital for more than a week due to the delayed payment from the BPJS program to the hospital automatically leading to a delay in settling the payment to the distributor.
7. Delivery lateness of medicine non-BPJS (E7) is rated 3 since it could disrupt the services for up to 8 hours because should wait for reshipment by the distributor.
8. Delivery lateness of medicine BPJS (E8) is rated 5 because it could disrupt the service of the pharmacy for more than a week. The shipment lateness of medicine BPJS at the end of the year usually happens for up to a month so the pharmacy installation is forced to reject the order of run-out-stock BPJS medicine and change the prescription to the more expensive patent medicine.
9. Ordering e-catalog could not be processed (E9) it rated 4 because the pharmacy installation should have waited to fix the system to do re-ordering that disrupting service.
10. There is a defect/broken (E10), which is rated 3 because it could disrupt the service for up to 8 hours to wait for the reshipment of defect/broken medicine and it caused budget loss of up to 0,25% from the pharmacy annual budget.
11. There is a dent on the wrap (E11) is rated 1 because it counted less than 0.1% of the pharmacy's annual budget since the medicine is still intact and could be used with notes if the damage is minor.
12. Packing time is too long (E12) and is rated 2 because it could disrupt the

service between 30 minutes and 8 hours depending on the queue for medicine service.

13. There is an error in compounding medicine (E13) is rated 3 because it can affect the level of customer effect so it could enlarge a patient's resistance against a certain dosage of medicine, or it could give certain side effects.
14. Lateness in delivering medicine to the inpatient (E14) is rated 3 because the lateness would give certain effects such as shortness of breath, seizures, and vomiting.
15. The claim could not be accepted by the distributor (E15) is rated 4 because it caused pharmaceutical budget losses of more than 0,75%.
16. Respond from the distributor to the return claim needs a long time (E16) it rated 3 because it caused pharmaceutical budget losses of more than 0,25% then make some of the claims could not be granted.
17. Returning medicine by the patient because the patient suffers from medicine use disorders (E17) is rated 3 because if this problem occurs, rumors will arise and reduce the patient's trust in the hospital.

In the first stage questionnaire, the identification of risk events and risk agents is conducted, followed by identifying risk agents taken from the reason of risk occurred. The result of the interview determined the possibility rate of risk occurring (occurrence). The level of occurrence can be seen in the table occurrence rating:

Table 0.5 Occurrence Parameter

Rating	Probability	Description
1	Rarely	Once in more than 3 years
2	Seldom	Once in 1-3 year
3	Sometimes	Once in six months
4	Often	Once in a month
5	Very often	> 4 times in a week

From the result of the interview with the expert, it is later generated the list of risk agent on medicine supply chain in RSUD Pandan Arang, as follows:

Table 0.6 List of Risk Agent

Risk Agent	Code	*Occurrence*
Calculation error on annual RAB	A1	2
Forecasting error	A2	3
There is increasing in medicine prices from the factory	A3	3
There is ordering error by pharmacy department	A4	1
Lack of supervision medicine by head of pharmacy department	A5	2
There is shortage medicine	A6	4
Lack of socialization by management to doctors regarding the hospital formulary	A7	2
Lack of communication with the distributors	A8	2
Payment arrears by BPJS	A9	3
Negligence from the shipping process	A10	2
System maintenance	A11	2
Lack of quality control when receiving goods	A12	2
Lack of human resources	A13	3
The respond of supplier is too long	A14	4
Lack of pharmacist knowledge/ human error	A15	1
The medicine purchase invoice is incomplete/ missing	A16	2
The medicine return time is too long	A17	1

4.3 Data Processing

Data processing is done with two stages, that is house of risk stage 1 and house of risk stage 2. House of Risk Stage 1 is done by finding the correlation between severity and occurrence using the ARP (aggregate risk potential) method after that making a diagram Pareto to rank the result data.

4.3.1 House of Risk Stage 1

In the House of Risk, Stage 1, aggregate risk potential (ARP) is calculated after that Pareto diagram is used to discover the priority of risk agents. After identifying the priority of risk agents, the mapping process is done to know the risk position according to the rate of probability and severity.

4.3.1.1 Calculating ARP (Aggregate Risk Potential)

Calculating aggregate risk potential (ARP) is done to determine the probability of risk agent and severity level of a risk. In addition, a risk agent could cause several risk events so measuring aggregate risk potential from a risk agent is needed (Pujawan dan Geraldin, 2009). The value of ARP can be seen by calculating each risk using the following calculation:

$$ARP_j = O_j \Sigma S_i R_{ij}$$

Explanation:

ARP_j : Aggregate risk potential from risk (j)

O_j : rate of probability risk agent happened (j)

S_i : impact severity level if risk happened (i)

R_{ij} : correlation between risk agent (j) and risk (i)

From the equation above, ARP could be calculated from each risk agent and the highest ARP is the risk agent priority for carrying out the mitigation. Below is the calculation of ARP for each risk agent:

Risk Event	Risk Agent																	Si
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	
E1	9	9	9	3	3	1	0	0	9	0	0	0	0	0	0	0	0	7
E2	0	9	0	3	9	0	0	3	0	0	0	0	0	0	0	0	0	3
E3	3	9	3	3	3	9	3	3	3	3	9	3	1	3	0	0	0	4
E4	3	9	1	9	9	9	9	0	0	0	0	0	3	0	9	0	0	3
E5	0	0	0	3	9	3	0	9	0	9	0	3	3	9	0	3	3	4
E6	9	9	3	0	0	0	0	0	9	0	0	0	0	0	0	0	0	5
E7	0	0	0	0	9	0	0	9	0	9	0	9	0	0	0	0	0	3
E8	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	5
E9	9	9	0	0	9	0	0	9	0	0	0	0	0	0	0	0	0	4
E10	0	0	0	0	9	0	0	3	0	9	0	9	0	0	0	0	0	3
E11	0	0	0	0	3	0	0	3	0	9	0	9	0	0	0	0	0	1
E12	0	0	0	0	0	0	0	9	0	0	0	0	0	9	0	3	3	2
E13	0	0	0	0	9	0	9	0	0	0	0	0	0	0	9	0	0	2
E14	0	0	0	0	9	0	0	0	0	9	0	0	0	9	0	1	3	3
E15	0	0	0	0	3	0	0	9	0	0	0	9	0	0	3	0	0	3
E16	0	0	0	0	3	0	0	9	0	9	0	0	0	9	0	3	9	4
E17	0	0	0	0	3	0	0	9	0	9	0	0	0	9	0	9	9	3
Oi	2	3	3	1	2	4	2	2	3	2	2	2	3	4	1	2	1	
ARP	167	237	96	82	293	86	59	242	168	203	38	116	28	160	55	62	91	
Pi	6	3	9	12	1	11	14	2	5	4	16	8	17	7	15	13	10	

Figure 0.4 HOR Phase 1 Calculation

House of Risk Phase 1 in Figure 4.4 above, the result of the risk agent with the highest aggregate risk potential value is risk agent A5, namely lack of drug supervision by the head of the pharmacy department. Meanwhile, the risk agent with the lowest aggregate potential risk value is risk agent A13, namely lack of human resources. After obtaining a dominant risk agent, the next step is to evaluate risk.

The table above is the result of calculating aggregate risk potential (ARP) that involves the value of occurrence from the risk agent and severity score from the risk event to determine the priority rate of the risk agent, after identifying the rate of ARP with the calculation of equation 2.1. For determining the rate of risk agent priority the result from calculating ARP on each risk agent shorted from the biggest to smallest value. The risk agent with the biggest ARP value is the priority of the risk agent.

Based on the previously processed Aggregate Risk Potential (ARP) value, as shown in the above table, this risk evaluation seeks to identify the predominant risk agent that will be managed. A Pareto diagram will be used in the risk appraisal process. A data classification will be arranged from left to right on a Pareto diagram according to highest to lowest order. The Pareto diagram aims to determine which issue should receive priority attention. The Pareto graphic illustrates the 80:20 principle, which states that if 20% of the main risk factors are improved, 80% of the remaining risk sources should be reduced. A Pareto diagram illustrating the most prevalent risk agents is provided below:

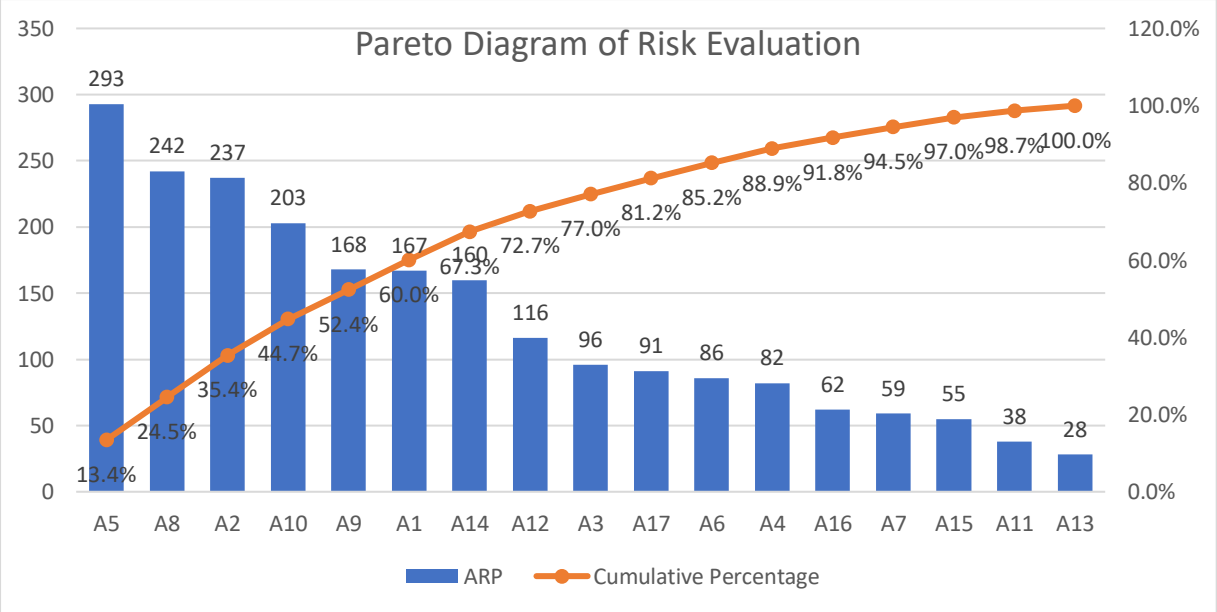

Figure 0.5 Pareto Diagram of Risk Evaluation

Several of dominant risk agents can be handled, as shown in Figure 4.5 above. Based on the Pareto diagram above, three main risk agents may be addressed by creating a risk mitigation plan in accordance with these risk agents. The Pareto principle states that 24.5% of risk agents are the primary cause, which should lower

75.5% of other risk agents. Agents A5 and A8 are the two main risk factors. The two risk agents' dominating aggregate risk potential values are listed in Table 4.7 below:

Table 0.7 The Dominant Risk Agents

ARP Ranking	Code	Risk Agent	ARP	Oj	Si
1	A5	Lack of supervision medicine by the head of pharmacy department	296	4	9
2	A8	Lack of communication with the distributors	248	5	7

The following stage is to develop a risk map based on the risk assessment level of the chosen risk sources once a list of selected dominant risk sources (risk agents) has been obtained. Using risk mapping, one can examine the position of risks and choose the best mitigation approach based on the risk map's quadrants. Table 4.8 below displays the degree of risk assessment:

Table 0.8 Level of Risk Assessment

Level	Level of Risk Assessment	
	Severity	Occurrence
Very Low	1,2,3,4	1,2,3,4
Low	5	5
Medium	6	6
High	7,8	7,8
Very High	9,10	9,10

Before addressing the chosen risk sources, the risk level can be evaluated based on circumstances based on the occurrence and severity values of the chosen risk sources. The position of the risk source, or risk agent, chosen throughout the making process prior to risk handling is depicted in Table 4.9 below:

Table 0.9 Risk Analysis Matrix

Risk Analysis Matrix		Severity Level				
		Very Low	Low	Medium	High	Very High
Occurrence Level	Very High					A5
	High				A8	
	Medium					

Low				
Very Low				

This risk map is divided into four parts as can be seen in Table 4.10:

Table 0.10 The Risk Map Information

Level	Information
Low (Green)	Risk could be accepted; it just needs monitoring
Medium (Yellow)	Risk could be tolerated; it just needs to be monitored and regular risk discussion
High (Orange)	Risk could not be accepted, need some detailed review and immediate treatment by management
Extreme (Red)	Risk could not be accepted, need some reviews and treatment from board level and discussion by director.

Based on the occurrence and severity data, the risk map above assigns the chosen risk agent to the appropriate risk assessment level table. Code A5, "Lack of supervision of medicine by the head of the pharmacy department," was determined to have a very high incidence rate and a very high risk level based on the risk map results. Code A8, "Lack of communication with the distributors," is associated with a high frequency of occurrence and a high danger. Since these two threats are on the extreme risk map, something needs to be done. These two risks could not be taken; they require board-level reviews, treatment, and director debate.

4.3.2 House of Risk Stage 2

House of Risk Phase 2 is the next step following the acquisition of the Priority Risk Agent. Based on the risk agent, HOR phase 2 is used to identify the best risk mitigation strategies to reduce the likelihood of risk events. Several mitigating measures were identified by using references drawn from diverse sources and in-person consultations with specialists, considering the degree of complexity and efficacy upon execution. Next, each handling strategy's degree or level of difficulty (Dk) is ascertained.

Table 0.11 Risk Mitigation's Difficulty Degree Identified

Code	Risk Mitigation	Dk
PA1	Creating a healthy and enjoyable work environment	4

Code	Risk Mitigation	Dk
PA2	Provide a forum for good communication	3
PA3	Maintain good communication between divisions/internal divisions/personal/external parties	3
PA4	Hold regular meetings to discuss progress and obstacles	3
PA5	Carry out evaluations of each completed project	3
PA6	Establish an information technology system that helps integrate the entire drug/medicine service process	5
PA7	Medicine inventory management	4
PA8	Carry out routine checks on medication supplies	3
PA9	Provide mutual feedback with suppliers	3
PA10	Make payment transactions to suppliers on time	4

The following is an explanation of the difficulty degree (Dk) value categories:

Table 0.12 Degree of Difficulty Category

Weight	Degree of Difficulty
3	Mitigation actions are easy to implement
4	Mitigation actions are relatively easy to implement
5	Mitigation actions are difficult to implement

Weighing the association between the mitigation approach and the dominant risk agent, as determined by expert interviews, comes next after acquiring the mitigation design and the degree of difficulty. The mitigation strategy's effectiveness value will be computed based on the correlation values' weighting. The formula utilized to calculate the overall effectiveness value is as follows:

$$TE_k = \sum ARP_j . E_{jk}$$

Information:

Te_k = The sum of the effectiveness of each action
ARP_j = Aggregate Risk Potential
E_{jk} = Correlation between each prevention action and each risk agent

The next step is to calculate the Effectiveness to Difficulty ratio value to ascertain the effectiveness and difficulty ratio in carrying out each mitigation activity after obtaining the total effectiveness value. The following formula is used to get the difficulty ratio value:

$$ETD_k = \frac{TE_k}{D_k}$$

Information:

ETD_k = Total effectiveness degree of difficulty
TE_k = The total effectiveness of each action
D_k = Degree of difficulty

As the last stage of HOR phase 2, all calculations made during that phase will be included in Figure 4.6 below. A variety of variables, including data from strategic planning, calculations of aggregate risk potential from dominant risk agents, data on degree of difficulty, and calculations of total effectiveness and effectiveness to difficulty, are combined in this phase 2 HOR table to determine the priority order of risk mitigation. The HOR phase 2 figure looks as this:

Risk Agent	Prevention Action										ARP
	PA1	PA2	PA3	PA4	PA5	PA6	PA7	PA8	PA9	PA10	
A5	3	1	1	1	3	9	3	0	0	0	296
A8	0	0	0	3	1	0	0	1	1	1	248
Total Effectiveness of Action	888	296	296	1040	1136	2664	888	248	248	248	
Degree of Difficulty Performing Action	4	3	3	3	3	5	4	3	3	4	
Effectiveness to Difficulty Ratio	222	98,66667	98,66667	346,6667	378,6667	532,8	222	82,66667	82,66667	62	
Rank Priority	4	9	8	3	2	1	5	6	7	10	

Figure 0.6 HOR Phase 2 Calculation

Figure 4.6 HOR phase 2 above is used to generate a list of mitigation solutions in order of highest ETDk value. A prioritized list of mitigation solutions based on the house of risk phase 2 calculations is provided below in Table 4.13:

Table 0.13 Risk Mitigation's Priority Rank

Code	Risk Mitigation	Priority
PA6	Establish an information technology system that helps integrate the entire drug/medicine service process	1
PA5	Carry out evaluations of each completed project	2
PA4	Hold regular meetings to discuss progress and obstacles	3
PA1	Creating a healthy and enjoyable work environment	4
PA7	Medicine inventory management	5
PA2	Provide a forum for good communication	6
PA3	Maintain good communication between divisions/internal divisions/personal/external parties	7
PA8	Carry out routine checks on medication supplies	8
PA9	Provide mutual feedback with suppliers	9

Code	Risk Mitigation	Priority
PA10	Make payment transactions to suppliers on time	10

The next step is to decide which of the 11 mitigation actions will be the highest priority. This is done by looking at the priority order of the actions in Table 4.13; the higher the ETD value, or effectiveness value, of the mitigation action, the more successful it will be to implement. The ETD value is represented as follows in a Pareto diagram:

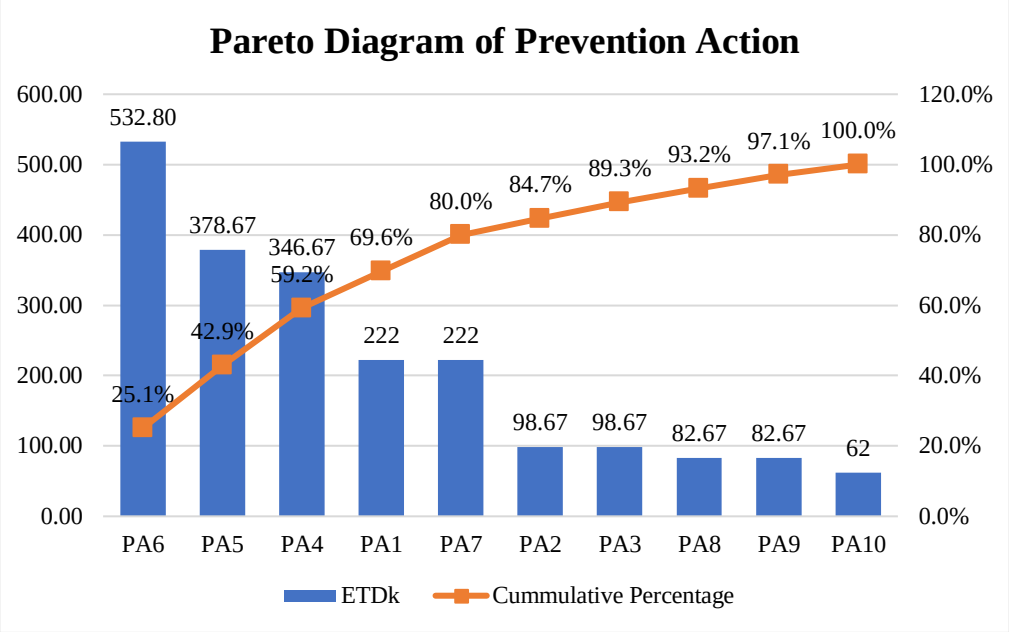

Figure 0.7 Pareto Diagram of Prevention Action

According to Figure 4.7 above, three mitigation techniques were prioritized based on how effective they were in implementing the strategies. This led to an effectiveness of 59.2% of the entire cumulative ETD value. Thus, the following are the three primary mitigation measures that can be used:

1. The first strategy with an ETD value of 532.8 is to establish an information technology system that helps integrate the entire drug/medicine service process to help all work to be more effective and efficient, makes decision-making easier, and makes it easier to retrieve data in real-time.
2. The second strategy with an ETD value of 378.6667 is to carry out evaluations of each completed project to assess team performance, see the impact and effectiveness of the project, and find out aspects that need to be improved.

3. The third strategy with an ETD value of 346,6667 is to hold regular meetings to discuss progress and obstacles to improve team communication and coordination.

4.3.3 Value At Risk

In calculating loss in rupiah from every risk source on job activity in the services logistic department which can influence the income of the company needed VaR method. Measuring risk with VAR is measuring risk statistically which estimates the maximum loss that may occur in a portfolio at a certain level of confidence (Jorion, Financial Risk Manager Handbook, 2007). The VaR approach is a technique that estimates the largest loss that could occur during a certain period and be predicted with a given degree of confidence. This process involves looking over previous data (Indira & Trimo, 2021).

Analyzing risk effect in this research used for calculating how much loss in rupiah from every operational risk source and administration on a project delivering according to ground transportation within scope services logistic department that could influence the income of the company according to result of failure risk identification for FMEA method, there are 4 variables or failure sub-criteria and HIRARC method, a project that had direct risk to transport and load or also affected on SHE (Safety, Health, Environment) (Indira & Trimo, 2021).

The VaR calculation uses a confidence level of 95 percent, and the remaining 5 percent is an error. Work results reports for each project, data from monthly work project reports (DTNTR) that are compared with profitability data, data on monthly logistics department operational costs, data on discrepancies or shortages in the Settlement budget (operational road allowances), and data on work accidents are the data used in this computation. The table presents a comparison between the effects of operational risk, as determined by the VaR calculations, on four sub-criteria and field transportation work (HSE). The VaR method is calculated with a 95% confidence rate; the remaining 5% rate is an error. The information utilized in this computation comes from the project report. Here is the identified impact of the losses can be seen in Table 4.14:

Table 0.14 Impact of Losses Identified

Risk Agent	Code	Impact of Losses
Calculation error on annual RAB	A1	Shortfall fees for lack of budget
Forecasting error	A2	Daily depreciation loss costs that must be achieved from drug purchases
		Additional costs for purchasing medication
There is increasing in medicine prices from the factory	A3	Additional costs for purchasing medication
There is ordering error by pharmacy department	A4	Cost of returning the drug to the distributor
Lack of supervision medicine by head of pharmacy department	A5	Shortfall fees for lack of budget
		Daily depreciation loss costs that must be achieved from drug purchases
		Additional costs for purchasing medication
		Sanction fees or fines due to negligence
There is shortage medicine	A6	Shortage costs for purchasing medicines outside routine purchases because the product cannot be provided when there is demand
Lack of socialization by management to doctors regarding the hospital formulary	A7	Sanction costs or fines due to errors in compounding medication or administering a prescription
Lack of communication with the distributors	A8	The cost of losing a drug purchase because the drug stock runs out
Payment arrears by BPJS	A9	Additional fees to cover bills
Negligence from the shipping process	A10	The cost of losing a drug purchase due to out of stock
		Costs of damage to damaged or contaminated medicines
System maintenance	A11	Settlement recapitulation difference costs
Lack of quality control when receiving goods	A12	Loss costs for damaged or expired medicines
Lack of human resources	A13	Costs of adding new employees

Risk Agent	Code	Impact of Losses
The respond of supplier is too long	A14	Cost of lost purchases
Lack of pharmacist knowledge/ human error	A15	Fines or sanctions costs
The medicine purchase invoice is incomplete/ missing	A16	Loss costs due to not being able to make a claim
The medicine return time is too long	A17	Return shipping costs to the distributor

The impact of losses identified from risk agents is known, that there are several risk agents that have the same impact of losses. So, in the following table 4.15 is the impact of losses in rupiah will be identified over the last 3 months, namely from June-August 2023.

Table 0.15 Total Loss Identified

Risk Agent	Impact of Losses	Loss in Rupiah			Total loss
		June	July	August	
Calculation error on annual RAB	Shortfall fees for lack of budget	Rp 150.000.000,00	Rp 90.000.000,00	Rp 180.000.000,00	Rp 420.000.000,00
Forecasting error	Daily depreciation loss costs that must be achieved from drug purchases	Rp -	Rp -	Rp -	Rp -
	Additional costs for purchasing medication	Rp 150.000.000,00	Rp 90.000.000,00	Rp 180.000.000,00	Rp 420.000.000,00
There is increasing in medicine prices from the factory	Additional costs for purchasing medication	Rp 150.000.000,00	Rp 90.000.000,00	Rp 180.000.000,00	Rp 420.000.000,00
There is ordering error by pharmacy department	Cost of returning the drug to the distributor	Rp -	Rp 3.000.000,00	Rp -	Rp 3.000.000,00
Lack of supervision medicine by head of pharmacy department	Shortfall fees for lack of budget	Rp 150.000.000,00	Rp 90.000.000,00	Rp 180.000.000,00	Rp 420.000.000,00
	Daily depreciation loss costs that must be achieved from drug purchases	Rp -	Rp -	Rp -	Rp -
	Sanction fees or fines due to negligence	Rp -	Rp -	Rp -	Rp -

Risk Agent	Impact of Losses	Loss in Rupiah			Total loss
		June	July	August	
There is shortage medicine	Shortage costs for purchasing medicines outside routine purchases because the product cannot be provided when there is demand	Rp 150.000.000,00	Rp 90.000.000,00	Rp 180.000.000,00	Rp 420.000.000,00
Lack of socialization by management to doctors regarding the hospital formulary	Sanction costs or fines due to errors in compounding medication or administering a prescription	Rp -	Rp -	Rp -	Rp -
Lack of communication with the distributors	The cost of losing a drug purchase because the drug stock runs out	Rp 35.000.000,00	Rp 10.000.000,00	Rp 12.000.000,00	Rp 57.000.000,00
Payment arrears by BPJS	Additional fees to cover bills	Rp -	Rp -	Rp -	Rp -
Negligence from the shipping process	The cost of losing a drug purchase due to out of stock	Rp 35.000.000,00	Rp 10.000.000,00	Rp 12.000.000,00	Rp 57.000.000,00
	Costs of damage to damaged or contaminated medicines	Rp -	Rp 2.000.000,00	Rp -	Rp 2.000.000,00
System maintenance	Settlement recapitulation difference costs	Rp -	Rp -	Rp -	Rp -
Lack of quality control when receiving goods	Loss costs for damaged or expired medicines	Rp 5.500.000,00	Rp 3.000.000,00	Rp -	Rp 8.500.000,00
Lack of human resources	Costs of adding new employees	Rp -	Rp -	Rp -	Rp -
The respond of supplier is too long	Cost of lost purchases	Rp -	Rp -	Rp -	Rp -
Lack of pharmacist knowledge/ human error	Fines or sanctions costs	Rp -	Rp -	Rp -	Rp -

Risk Agent	Impact of Losses	Loss in Rupiah			Total loss
		June	July	August	
The medicine purchase invoice is incomplete/ missing	Loss costs due to not being able to make a claim	Rp -	Rp -	Rp -	Rp -
The medicine return time is too long	Return shipping costs to the distributor	Rp -	Rp 3.000.000,00	Rp -	Rp 3.000.000,00

In the table above, statistical risk calculations are carried out using the VaR method. The formula used to calculate risk impact analysis using the Value at Risk method is as follows:

$$VaR = \bar{x} + Z\left(\frac{s}{\sqrt{n}}\right)$$

$$\bar{x} = \frac{\sum_{i=1}^{n} \binom{n}{k} \text{Xi}}{n}$$

Information:

VaR = The largest loss impact arising from the risk source (Rp)

$\bar{x}$ = Average value of loss impact caused by each risk source (Rp)

Xi = Value of the impact of losses caused by each source of risk each period.

Z = Z value taken from the normal distribution table with α = 5%

s = Standard deviation of losses due to risk sources (Rp)

n = Number of work projects for 3 months

To be able to calculate the impact or magnitude of potential losses from risk sources in a certain period, the confidence level used in VaR analysis is first determined, namely 95%. Meanwhile, the remaining 5% is the tolerance or error level. With this level of confidence, the

Z table value is 1.645. The following Table 4.16 are the results of an analysis of the magnitude of the impact of project losses arising from each risk agent on drug supply chain activities at Pandan Arang Regional Hospital.

Table 0.16 The VaR Calculation

Risk Agent	Total loss	Average	Standar Deviation	Z (5%)	N	N^1/2	VAR
Calculation error on annual RAB	Rp 420.000.000,00	Rp 140.000.000,00	Rp 45.825.756,95				Rp 183.522.609,07
Forecasting error	Rp 420.000.000,00	Rp 140.000.000,00	Rp 45.825.756,95				Rp 183.522.609,07
There is increasing in medicine prices from the factory	Rp 420.000.000,00	Rp 140.000.000,00	Rp 45.825.756,95				Rp 183.522.609,07
There is ordering error by pharmacy department	Rp 3.000.000,00	Rp 1.000.000,00	Rp 1.732.050,81	1,645	3	1,732051	Rp 2.645.000,00
Lack of supervision medicine by head of pharmacy department	Rp 420.000.000,00	Rp 140.000.000,00	Rp 45.825.756,95				Rp 183.522.609,07
There is shortage medicine	Rp 420.000.000,00	Rp 140.000.000,00	Rp 45.825.756,95				Rp 183.522.609,07
Lack of socialization by management to doctors regarding the hospital formulary	Rp -	Rp -	Rp -				Rp -

Risk Agent	Total loss	Average	Standar Deviation	Z (5%)	N	N^1/2	VAR
Lack of communication with the distributors	Rp 57.000.000,00	Rp 19.000.000,00	Rp 13.892.443,99				Rp 32.194.226,33
Payment arrears by BPJS	Rp -	Rp -	Rp -				Rp -
Negligence from the shipping process	Rp 59.000.000,00	Rp 19.666.666,67	Rp 13.279.056,19				Rp 32.278.333,33
System maintenance	Rp -	Rp -	Rp -				Rp -
Lack of quality control when receiving goods	Rp 8.500.000,00	Rp 2.833.333,33	Rp 2.753.785,27				Rp 5.448.716,64
Lack of human resources	Rp -	Rp -	Rp -				Rp -
The respond of supplier is too long	Rp -	Rp -	Rp -				Rp -
Lack of pharmacist knowledge/ human error	Rp -	Rp -	Rp -				Rp -
The medicine purchase invoice is incomplete/ missing	Rp -	Rp -	Rp -				Rp -
The medicine return time is too long	Rp 3.000.000,00	Rp 1.000.000,00	Rp 1.732.050,81				Rp 2.645.000,00

CHAPTER 5
RESULT AND DISCUSSION

5.1 Risk Identification Analysis

Interviews with experts who satisfied the requirements and agreed to participate in the interview process were used to identify the risk events that happened at Pandan Arang Regional Hospital; Placidian Hana Oktaviansari, S.Si, Apt., was the primary expert in this regard.

The SCOR model serves as the foundation for the identification of risk events in this study since it provides a detailed description of the business procedures that take place at Pandan Arang Regional Hospital. There are five components to this business process, which will be identified: plan, source, make, deliver, and return.

The first is a plan. This planning process is related to the planning of the RSUD. After identification, two activities occur at Pandan Arang Regional Hospital based on the planning process, namely production planning and demand estimation. In this production planning, the obstacles experienced by Pandan Arang Regional Hospital are usually the draft annual budget which is not in accordance with needs. The obstacles experienced also affect the number of procurement figures. So, this gives rise to problems such as the presence of medicines that have not yet been sold, there are several medicines whose stock is running low, and the demand for certain medicines that need compounding cannot be met.

The second is the source. This sourcing process is related to the process of searching for supplies and procuring goods or services to meet drug needs at Pandan Arang Regional Hospital. After identification, the activities that occurred at Pandan Arang Regional Hospital were based on the sourcing process, namely, the Distributor could not fulfill the contract with a hospital, the hospital could not pay the bill to the distributor, the lateness of delivering non-BPJS medicine, ordering e-catalog could not be made, fragile medicine, and dent on the wrap.

The third is make. This making process is related to the process of making medicine at Pandan Arang Regional Hospital. After identification, the activities that occur at Pandan Arang Regional Hospital are based on the making process, namely mixing the medicine, and packing the medicine into capsules. The obstacles or risks

faced by these two activities are that it takes too long to pack the medicine and errors in dispensing the medicine due to not being careful in weighing the mixture.

The fourth is the deliver process. The delivery process that occurs at Pandan Arang Regional Hospital is to deliver medicine to patients, both inpatients. The obstacle faced is the delay in administering medication to inpatients. This certainly disturbs the comfort of the families of inpatients.

The fifth is the return process. The return process that occurs at Pandan Arang Regional Hospital is the return of medicinal materials to distributors and medicines to the hospital. The reason for this return process is that there is contamination of the ingredients because they are not packaged properly and there is a lack of checking by the hospital regarding expired medicines. The risks faced due to this negligence are that claims submitted for the return of medicinal/medicinal ingredients cannot be accepted by the distributor, a slow response from the distributor regarding return claims, and patients returning medicines because they have expired.

5.2 Risk Event Analysis

Based on the results of risk identification from the drug supply chain process at Pandan Arang Regional Hospital, according to interviews with the hospital, 17 risk events were found that might occur. At this stage the risk event is categorized into each activity in each process and given a code to facilitate identification.

In the plan process, there are three activities. In the first activity, namely the annual budget planning of medicine procurement, there is one risk event. The risk event is a shortage in the annual budget with code E1. This shortage in the annual budget has an impact of 7. Because a lack of budget will disrupt existing operational processes at the hospital. Because both inpatients and outpatients will need drugs that need to be penetrated. The second activity is the annual planning order of the stock of medicine with identified risk events, some medicines are not used and medicine in pharmacy is out of stock. Certain medications are not used (E2); they are rated 3 with a risk of financial loss up to 0.25 percent of the pharmacy budget costs due to slow-moving medications that can become stagnant and eventually expire. Purchase medications with extreme caution if they are part of slow-moving merchandise. so that the impact can be reduced and the purchase of drugs in this area is not excessive. The pharmacy has an inadequate supply of medication (E3) because of improper planning, which led to a

stockout with a risk rating of 4, as the pharmacy had to place a new order with the distributor, which may be dispatched the same day that the order was placed. Preparing the yearly medication form draft, which includes one risk event—a variety of medications that aren't available in the hospital—is the third task. Requests for medications that do not fit the hospital formula (E4) are assigned a severity level of 3, meaning that there is a possibility of financial loss of up to 0.25 percent of the budget due to certain medications that are constantly stationary.

In the sourcing process, there are 2 activities, namely choosing the medicine's distributor and procuring the medicine from the distributor. Two risk events were found during the distribution of the medication action. The distributor's inability to complete the contract as stipulated by the hospital represents the first risk event. The distributor's failure to meet the requirements of pharmacy installation and the disruption of services resulting from late medicine delivery are the reasons for the hospital's rating of 4 (E5) due to the distributor's inability to execute the contract. The second risk event, which is rated 5 because it might disrupt hospital services for more than a week due to BPJS's late payment, is the hospital's inability to pay the distributor for the drug bill (E6). This is because the hospital would not be able to cover its charges from the distributor. In the second activity, 5 risk events were identified. The first risk event is Delivery lateness of medicine non-BPJS (E7) it is rated 3 because it could disrupt the services for up to 8 hours because you should wait for reshipment by the distributor. This can be minimized by taking stock from the nearest distributor location so that the impact can be minimized. The second risk event, drug delivery tardiness (BPJS; E8), was given a 5 since it has the potential to disrupt pharmacy services for longer than a week. Around the end of the year, there is typically a one- to two-month delay in the supply of BPJS medicine, which forces pharmacy installations to forgo ordering BPJS medicine due to stock shortages and substitute more costly patent medicine. Ordering e-catalog could not be handled (E9) is the third risk event. It is rated 4 because the pharmacy installation should have been postponed until the system was fixed to prevent service disruptions through reordering. The fourth risk event, "Defect/broken" (E10), was given a 3 out of 10 because it has the potential to disrupt service for up to 8 hours while the defective or broken medicine is being reshipped, and it might result in a budget loss of up to 0.25 percent of the pharmacy's yearly budget. The fifth risk event is a dent on the wrap

(E11), which is rated 1 because it represents less than 0.1% of the pharmacy's yearly budget and is still usable despite the little damage.

There are two activities included in the making process. There is one risk event for the first activity, which is pacing the medication. An instance of danger is taking too long to pack. The packing time (E12) is very lengthy; it receives a 2 because, depending on the length of the medical service line, it may disrupt service for anywhere from 30 to 8 hours. Making a mixture of medicine is the second activity, and it carries one risk event. An error made when distributing medication is one such risk occurrence. Compounding medicine error (E13) is graded 3 because it can impact the level of customer effect, potentially increasing the patient's resistance to a particular dosage of medication or causing specific side effects.

There is only one task involved in the delivery procedure, and that is giving patients' and pharmacies' medications. It was determined that there was a risk event in this activity, which was the patient medication delivery delays. The inpatient's (E14) medication delivery tardiness is graded at three since it can result in side effects like dyspnea, convulsions, and vomiting.

In the return process in the drug supply chain at Pandan Arang Regional Hospital, it is known that there are two activities. These activities are Returning the damaged medicine, expired and excess to the supplier with two risk events and returning the damaged medicine, expired and excess to a patient with one risk event. The first risk event, which was graded 4 because it resulted in pharmaceutical budget losses of more than 0.75 percent, was the claim that the distributor (E16) was unable to approve. The second risk event is the distributor's lengthy response to the return claim (E17), which is rated 3 since it resulted in pharmaceutical budget losses of more than 0.25 percent and prevented the approval of some claims. The risk event for the second activity, returning medicine by the Patient, is graded 3 because it raises the possibility of rumors and lowers patient trust in the hospital due to the patient's medication use issues (E18).

5.3 Risk Agent Analysis

A risk agent is anything that has the potential to trigger risk events. Multiple risk events can be caused by one risk agent, while multiple risk agents can cause one risk event (Anindyanari & Puspitasari, 2021). The risk agent evaluates the likelihood of an event

occurring or its occurrence. The risk agent has a higher possibility of occurring on a scale of 1 to 10, with a higher number denoting an increased likelihood.

1. Calculation error on RAB (A1) has the possibility of occurring seldom, namely once in 1-3 years since the RAB is created once a year. Planning and procurement of medicines is an important factor that influences the quality of hospital pharmacy. The hope of hospital management is none other than to meet the need for medicines in the hospital so that from the start, it is hoped that the planning and procurement of medicines must be effective and efficient (Satibi, 2014). The effectiveness of drug planning is based on guidelines taking into consideration the budget, remaining drugs, previous period data, drug priorities, waiting times, and development plans.
2. Forecasting error (A2) has the possibility of occurring sometimes, namely once in six months since the forecasting for procurement is carried out in a short period. Because Medicine capsules prepared by pharmacies expire 8 weeks after they are prepared, external medicines (lotion, shampoo, liquid soap) expire 6 months after the first opening of the packaging, eye drops/nose drops/ear drops (bottle packaging) expire 28 days after the packaging was opened for the first time (dr. Dina Fauzia, 2023).
3. There is an increase in medicine prices from the factory (A3) that has the possibility of occurring sometimes, namely once in six months since the price of the medicine is affected by inflation. The contributing factor is that domestic drug production is still very dependent on imported raw materials. According to sources quoted from farmalkes.kemkes.go.id, around 90% of medicinal raw materials circulating in Indonesia still come from imports. The country that supplies the most imported raw materials is from China up to 75%, then India 20%, and the rest from European countries (Farmalkes & Yanwardhana, 2023).
4. There is an ordering error by the pharmacy department (A4) that has the possibility of occurring rarely, namely once in more than 3 years. Since the procurement division already knows the quantity and the expiration.
5. Lack of supervision of medicine by the head of the pharmacy department (A5) has the possibility of occurring seldom, namely once in 1-3 years. This incident is included in the seldom category because the position of head of the

pharmaceutical division is changed every few years. So that errors can be minimized.

6. There is a shortage of medicine (A6) that has the possibility of occurring often, namely once a month. Shortage of medicine is something that often happens in regional hospitals, so it needs immediate improvement.
7. Lack of socialization by management to doctors regarding the hospital formulary (A7) has the possibility of occurring seldom, namely once in 1-3 years. Almost all doctors understand the hospital formulary. The hospital also provides a forum for learning so that doctors are updated with the hospital formulary.
8. Lack of communication with the distributors (A8) has the possibility of occurring seldom, namely once in 1-3 years. This lack of communication with distributors is a big catalyst for supply chain constraints in the procurement of medicines and medicinal materials in hospitals. Very disruptive to existing operations.
9. Payment arrears by BPJS (A9) have the possibility of occurring sometimes, namely once in six months. This is because the payments or terms of BPJS payments made by the government are usually divided into 2 terms a year.
10. Negligence from the shipping process (A10) has the possibility of occurring seldom, namely once in 1-3 years. Negligence from the shipping process is very rare because the distributor is bound by a contract with RSUD. If there is negligence committed by the distributor, the RSUD has the right to file a claim.
11. System maintenance (A11) has the possibility of occurring seldom, namely once in 1-3 years. The maintenance system implemented in the hospital is carried out during unproductive hours such as midnight and the hospital has provided information so that it can minimize disruption caused by the maintenance system.
12. Lack of quality control when receiving goods (A12) has the possibility of occurring seldom, namely once in 1-3 years. The hospital should re-check medicines and drug ingredients to ensure that the items received are still sealed and have not been damaged/contaminated.

13. Lack of human resources (A13) has the possibility of occurring sometimes, namely once in six months. The turnover that occurs in hospitals is very low, so the lack of human resources only happens sometimes.
14. The response of the supplier is too long (A14) having the possibility of occurring often, namely once a month. The existing communication with distributors is still poor so following up orders or other requests from hospitals is difficult.
15. Lack of pharmacist knowledge/ human error (A15) has the possibility of occurring rarely, namely once in more than 3 years. Before being recruited by the hospital, all pharmacists have gone through a long stage and the hospital also often invites pharmacists to take part in workshops and training to update their knowledge.
16. The medicine purchase invoice is incomplete/ missing (A16) and has the possibility of occurring seldom, namely once in 1-3 years. Hospitals have realized the importance of databases so that administrative files are more organized than before. Because even in hospitals there are audits so the need for complete files is very important.
17. The medicine return time is too long (A17) and has the possibility of occurring rarely, namely once in more than 3 years. If the hospital realizes that there are medicines or ingredients for medicinal preparations that have expired or are damaged or even contaminated, the hospital will immediately act by sending a receipt back to the distributor. The hospital always ensures that the medicines given to inpatients and outpatients are in accordance with the prescription.

5.4 House of Risk Phase 1 Analysis

House of Risk phase 1 is used to determine the dominant risk agent that will be treated. Aggregate Risk Potential (ARP) computations are used to determine which risk agents are prioritized. The factors employed in these calculations are the severity, occurrence, and correlation scores for each risk agent. Out of a total of 18 risk agents, two were identified as dominant risk agents based on the ARP value: the higher the ARP value, the more influential the risk agent. These findings were derived from the ARP processing results.

The 80:20 rule, which states that you can reduce 80% of the other risk agents by managing 20% of the dominant risk agent, was used in this study using a Pareto diagram. The phase 1 HOR table was used to produce the Pareto diagram that is shown below:

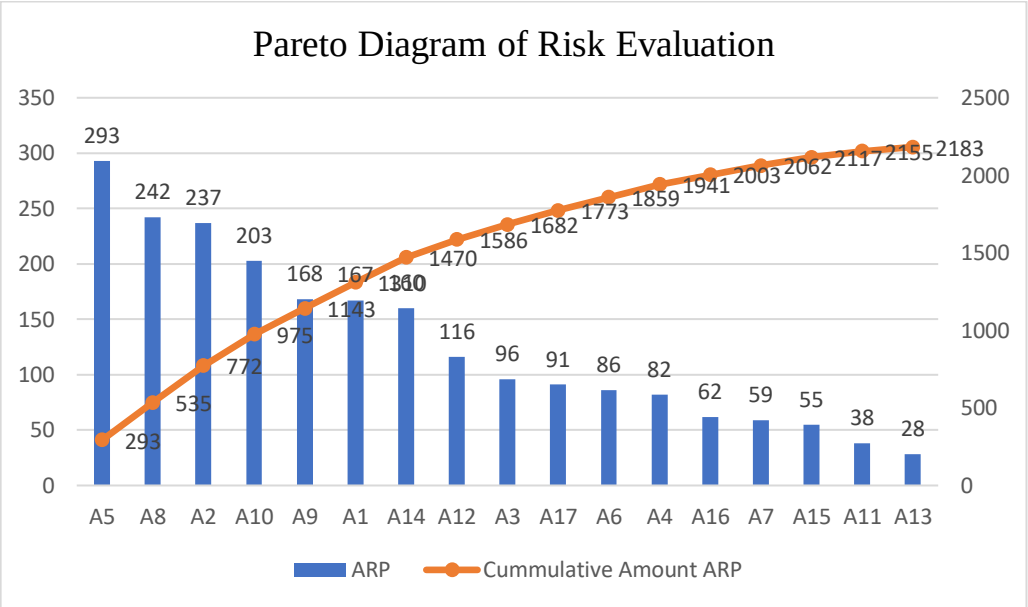

Figure 0.1 Pareto Diagram of Risk Evaluation

As seen in Figure 5.1, several prominent risk agents are manageable. Two primary risk agents are shown in the above Pareto diagram, and these risk agents can be taken into consideration while developing a risk mitigation strategy. According to the Pareto principle, if 24.5% of risk agents are the main cause, then 75.5% of other risk agents should also be reduced. Here is the detail for the two primary risks of the medicine supply chain in RSUD Pandan Arang:

1. Code A5, "Lack of supervision of medicine by the head of the pharmacy department," was shown to have a very high-risk level and a very low incidence rate with an ARP score of 293. Given that this risk is depicted on the map of extreme risk, action must be taken. It was not possible to take this risk lightly; board reviews, treatment, and director discussions are necessary.

   At the primary level of management, supervisors are tasked with creating and overseeing work groups within businesses (Noe, 2008). They perform a crucial function as a mediator between management and operational staff (Azman, Sieng, Ajis, Dollah, & Boerhannoeddin, 2009). Supervisors frequently collaborate with their employers to create, carry out, and oversee organizational policies, procedures, and strategies, including training initiatives, since they are

skilled leaders, problem solvers, and role models for the group (Ellinger & Ellinger, 2005). Because it is an integral part of an organization, if there is a lack of supervision from the head of the pharmacy department it can disrupt the operations of the entire department and even impact other departments. Because it concerns treatment for outpatients and inpatients. So, the impact is included in the very high category.

2. Code A8, "Lack of communication with the distributors," is linked to a high risk and a low incidence with an ARP score of 248. Given that this risk is depicted on the map of extreme risk, action must be taken. It was not possible to take this risk lightly; board reviews, treatment, and director discussions are necessary.

Customer communication is the most crucial aspect of every organization. Customers are essential to a business's survival, thus i the organization must understand how to effectively connect with them, listen to their concerns, handle customer relationships (CRM), and draw in and fulfill their wants (Florea & Duica, 2017). Building trusting connections with clients via hiring and training top talent is essential to meeting their demands more quickly, more affordably, and more effectively (Florea & Tanasescu, 2016). Since in here, RSUD Pandan Arang is the business customer, the distributor needs to ensure clear and strong B2B communication. In addition to ensuring that tasks are completed correctly and on time, effective communication also lowers errors, minimizes disruptions, and maximizes workflow. Establish communication that allows feedback and recommendations, promoting open communication and ongoing development.

5.5 House of Risk Phase 2 Analysis

The suggested treatment is administered once a dominant risk agent has been identified to reduce the risk. The House of Risk Phase 2 is used to obtain this risk mitigation strategy. In this phase, the mitigation strategies are sorted from highest to lowest ETD value using the variables of degree of difficulty and correlation between risk agents to assess treatment effectiveness.

Following the establishment of the priority order for the suggested mitigation strategies, the Pareto diagram was employed in this study to identify the primary

mitigation strategies using the Pareto 60:40 concept. This implies that by choosing 40% of the mitigation strategies, it is anticipated that 60% of the strategies will be successful. A Pareto diagram of the suggested mitigation technique is shown below in Figure 5.2:

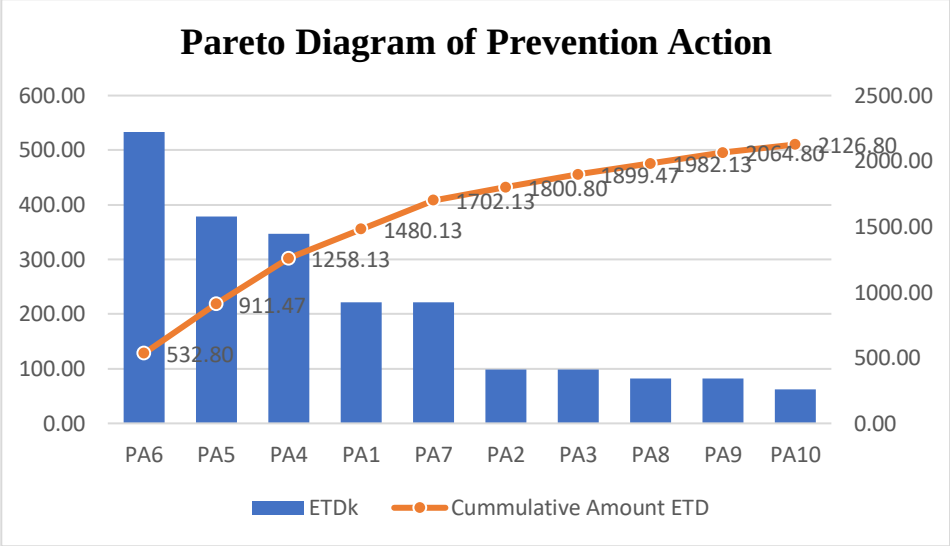

Figure 0.2 Pareto Diagram of Prevention Action

Three mitigation techniques were ranked according to how well they executed the strategies, as shown in Figure 5.2 above. As a result, 59.2% of the total cumulative ETD value was effective. As a result, the three main mitigating strategies that are applicable are as follows:

1. Establishing an information technology system that helps integrate the complete drug/medicine service process to assist everyone operate more effectively and efficiently, facilitates decision-making, and makes it easier to obtain data in real-time is the first strategy, with an ETD value of 532.8. Supply chain management (SCM) is impacted by information systems (IS) at various levels, from tactical operations to organizational strategy. These activities include planning, sourcing, and delivering. Information and communication technology (ICT) has been essential to the development of supply chain management (SCM) as a means of conducting transactions, facilitating communication, gaining managerial insight, and sharing data (Buyukozhan & Gocer, 2018). Researchers acknowledge cutting-edge IT-enabled supply chain tracking and control to solve supply chain visibility. Furthermore, research that has been published addresses the application of BI&A tools and how they help analyze data from the supply chain, which

enhances the accuracy of demand forecasting and the standard of planning (Kakhki & Gargeya, 2019).

2. Conducting reviews of each finished project to gauge team performance, examine the project's impact and efficacy, and identify areas in need of improvement represents the second strategy, with an ETD value of 378.6667. The evaluation of projects can be used to separate the future from the past, legitimize certain behaviors or courses of action, impart status or stigma, or justify huge or risky initiatives (Haas & Guzman, 2019). By evaluating each project, here what is meant is procurement, there will be corrective action thereby reducing obstacles that previously occurred due to continuous improvement.
3. The third strategy, which has an ETD value of 346,6667, involves organizing frequent meetings to address challenges and advancements to enhance teamwork and cooperation. Meetings are a regular organizational activity and a vital tool for efficient management. Decision-making, communication, motivation, building interpersonal relationships, and resolving disputes are all facilitated by meetings. Team meetings constitute an essential situation (Kauffeld & Lehmann-Willenbrock, 2012). Meetings ought to be interactive and a representation of an organization's teamwork (Bagire, Byarugaba, & Kyogabiirwe, 2015). However, meetings need to be handled well to accomplish these goals.

5.6 Value at Risk Analysis

The VaR technique determines the biggest loss that is projected with a given degree of confidence and could happen within a given time frame. One way to apply this strategy is to examine past historical data. Events that reduce the hospital's profitability, such as work failures or delays, are deemed harmful. Here is the result of the VaR calculation on each risk agent that has been identified in the previous chapter:

Table 0.1 The VaR Score on Risk Agents

Risk Agent	VAR
Calculation error on annual RAB	Rp 183.522.609,07

Risk Agent	VAR
Forecasting error	Rp 183.522.609,07
There is increasing in medicine prices from the factory	Rp 183.522.609,07
There is ordering error by pharmacy department	Rp 2.645.000,00
Lack of supervision medicine by head of pharmacy department	Rp 183.522.609,07
There is shortage medicine	Rp 183.522.609,07
Lack of socialization by management to doctors regarding the hospital formulary	Rp -
Lack of communication with the distributors	Rp 32.194.226,33
Payment arrears by BPJS	Rp -
Negligence from the shipping process	Rp 32.278.333,33
System maintenance	Rp -
Lack of quality control when receiving goods	Rp 5.448.716,64
Lack of human resources	Rp -
The respond of supplier is too long	Rp -
Lack of pharmacist knowledge/ human error	Rp -
The medicine purchase invoice is incomplete/ missing	Rp -
The medicine return time is too long	Rp 2.645.000,00

From the results of calculating the VaR value above, it can be analyzed that:

1. The risk impact caused by incorrect RAB calculations is Rp 183.522.609,07. This failure is certainly detrimental to the hospital because it creates a shortfall in fees due to a lack of budget.

2. The risk impact caused by forecasting error is Rp 183.522.609,07. This failure is certainly detrimental to the hospital because it creates additional costs for purchasing medication and daily depreciation loss costs that must be achieved from drug purchases.
3. The risk impact caused by the increase in medicine prices from the factory is Rp 183.522.609,07. This failure is certainly detrimental to the hospital because it creates additional costs for purchasing medication.
4. The risk impact caused by ordering errors by the pharmacy department is Rp 2.645.000,00. This failure is certainly detrimental to the hospital because it creates the cost of returning the drug to the distributor.
5. The risk impact caused by the lack of supervision of medicine by the head of the pharmacy department is Rp 183.522.609,07. This failure is certainly detrimental to the hospital because it creates shortfall fees for lack of budget, daily depreciation loss costs that must be achieved from drug purchases, and sanction fees or fines due to negligence.
6. The risk impact caused by the shortage of medicine is Rp 183.522.609,07. This failure is certainly detrimental to the hospital because it creates a shortage of costs for purchasing medicines outside routine purchases. After all, the product cannot be provided when there is demand.
7. The risk impact caused by the lack of communication with the distributors is Rp 32.194.226,33. This failure is certainly detrimental to the hospital because it creates the cost of losing a drug purchase. After all, the drug stock runs out.
8. The risk impact caused by negligence in the shipping process is Rp 32.278.333,33. This failure is certainly detrimental to the hospital because it creates the cost of losing a drug purchase because the drug stock runs out and costs of damage to damaged or contaminated medicines.
9. The risk impact caused by lack of quality control when receiving goods is Rp 5.448.716,64. This failure is certainly detrimental to the hospital because it creates loss costs for damaged or expired medicines.
10. The risk impact caused by the medicine return time is too long Rp 2.645.000,00. This failure is certainly detrimental to the hospital because it creates return shipping costs to the distributor.

5.7 The limitation of this research

During the research in the installation of RSUD Pandan Arang the weaknesses are found because the data that used is only from qualitative according to the experts. There is a possibility that the result that slightly different according to the different experts. Besides, this research with this method is limited to the plan process, source, make, deliver, return while another process can be explored more such as marketing

.

CHAPTER 6
CONCLUSION AND SUGGESTION

6.1 Conclusion

Based on the research that did in RSUD Pandan Arang, it can be conclude that:

1. From the house of risk calculation, it could be known that there are 17 risk events and 17 risk agents. From the Pareto diagram on the house of risk stage 1 2 primary risk agents namely Code A5 "Lack of supervision of medicine by the head of the pharmacy department," were shown to have a very high-risk level and a very high incidence rate with ARP score 293, and Code A8 "Lack of communication with the distributors," is linked to a high risk and a high incidence with ARP score 248.
2. The VaR technique determines the biggest loss that is projected with a given degree of confidence and could happen within a given time frame. One way to apply this strategy is to examine past historical data. After calculating using value at risk method with a period of 3 months (July 2023 – September 2023), it was obtained with confidence level of 95% loss possibility is Rp 183.522.609,07 to the risk impact caused by incorrect RAB calculations, the risk impact caused by forecasting error is Rp 183.522.609,07, the risk impact caused by the increasing in medicine prices from the factory is Rp 183.522.609,07, the risk impact caused by ordering error by pharmacy department is Rp 2.645.000,00, the risk impact caused by lack of supervision medicine by head of pharmacy department is Rp 183.522.609,07, the risk impact caused by shortage medicine is Rp 183.522.609,07, the risk impact caused by lack of communication with the distributors is Rp 32.194.226,33, the risk impact caused by negligence from the shipping process is Rp 32.278.333,33, the risk impact caused by lack of quality control when receiving goods is Rp 5.448.716,64, and the risk impact caused by the medicine return time is too long Rp 2.645.000,00.

6.2 Suggestion

Based on the analysis and discussion, the following suggestions can be given:

1. For RSUD Pandan Arang

   The advice given to RSUD Pandan Arang is the research result should be considered in determining risk mitigation strategies at the pharmacy installation of RSUD Pandan Arang based on existing risk sources to reduce the impact of risk.

2. For further research

   Suggestions are given to further risk management that can be carried out in the other parts of the process within the company and the entire business process in the company.

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ATTACHMENT

KUISIONER
(Studi Kasus: RSUD Pandan Arang)
JURUSAN TEKNIK INDUSTRI
FAKULTAS TEKNOLOGI INDUSTRI
UNIVERSITAS ISLAM INDONESIA

Assalamualaikum Wr. Wb.

Saya Nur Imamah Al Karimah mahasiswa jurusan Teknik Industri Universitas Islam Indonesia, saat ini saya sedang melakukan penelitian tugas akhir tentang manajemen risiko pada rantai pasok obat di RSUD Pandan Arang.

A. Data Diri

Nama:
Jabatan:
Lama Bekerja:

B. Aktivitas Rantai Pasok Obat di RSUD Pandan Arang

Berikut merupakan penjelasan dari kuisioner dibawah:

1. Risk Event: risk event merupakan kemungkinan kejadian risiko yang dapat menyebabkan potensi kerugian bagi perusahaan baik berupa Sumber daya, financial, reputasi, dll.
2. Risk Agent: risk agent merupakan kejadian yang dapat menimbulkan risiko
3. Plan: merupakan kegiatan perencanaan dalam penyediaan obat/ bahan baku didalamnya termasuk perencanaan pemesanan, dll
4. Source: merupakan kegiatan yang berkaitan dengan jadwal pengiriman obat, menilai kinerja supplier, pemesanan dan penerimaan obat, quality control, dll
5. Make: merupakan kegiatan yang berkaitan dalam proses produksi termasuk didalamnya pengemasan dan pembuatan resep.
6. Deliver: merupakan proses penyampaian barang berkaitan dengan pemrosesan pesanan pelanggan, invoicing customer, manajemen penggudangan mulai dari penerimaan produk sampai pengiriman produk.

Return: berkaitan dengan pengembalian produk karena kesalahan pengiriman atas jumlah maupun jenis barang, adanya kecacatan pada produk, terjadi kerusakan produk dalam jangka waktu garansi yang terjadi bukan karena kesalahan pengguna. Kegiatan return ini meliputi pemeriksaan kondisi produk, meminta/memberi hak pengembalian produk.

Process	Activity	Code	Risk Event	Code	Risk Agent
Plan					

Source					
Make					
Delivery					
Return					

Dengan demikian, kami ucapkan terimakasih kepada responden yang telah mengisi kuisonertugas akhir yang saya lakukan.

Wassalamualaikum wr wb

KUISIONER
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JURUSAN TEKNIK INDUSTRI
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UNIVERSITAS ISLAM INDONESIA

Assalamu'alaikum Warahmatullahi Wa barakatuh

Sehubungan dengan tugas akhir yang sedang kami teliti. Untuk itu, kami meminta kesediaan bapak/ibu untuk mengisi kuisoner ini. Kuisoner ini merupakan kelanjutan dari tahapan kuisoner sebelumnya. Dalam kuesioner ini, bapak/ibu diminta untuk mengisikan:

a. Nilai *severity* dari risk event (besarnya dampak dari kejadian risiko terhadap perusahaan).
b. Nilai *occurance* dari *risk agent* (tingkat keseringan risiko terjadi pada penyebab risiko).
c. Nilai korelasi antara *Severity* dan *Occurance*

Data yang diberikan hanya digunakan untuk kepentingan penelitian Petunjuk Pengisian Isilah kuisoner berikut sesuai dengan situasi dan kondisi didalam perusahaan saat ini. Adapun kriteria penilaian akan dijelaskan pada lembar penilaian.

A. Data Diri

Nama:
Jabatan:
Lama Bekerja:

B. Tabel Penilaian Occurance dan Severity

1. Occurance

Occurance digunakan untuk menilai frekuensi terjadinya suatu risiko. Berikutmerupakan kriteria untuk penilaian *occurance*

Rating	Probabilitas	Deskripsi
1	Jarang terjadi	Sekali dalam lebih dari 3 tahun
2	Sedikit	Sekali dalam 1-3 tahun
3	Sedang	Sekali dalam enam bulan
4	Sering	Sekali dalam sebulan
5	Sangat sering	> 4 kali dalam seminggu

Dalam pengisian tabel *occurance* dapat menggunakan symbol angka.

Agen Risiko (*Risk Agent)*	Kode	*Occurance*
kesalahan perhitungan RAB tahunan	A1	2
kesalahan perencanaan/forecasting	A2	3
Adanya kenaikan harga obat dari pabrik	A3	3
kesalahan pemesanan oleh bagian farmasi	A4	1

kurangnya pengawasan obat oleh kepala farmasi	A5	2
Adanya kelangkaan obat-obatan	A6	4
kurangnya sosialisasi pihak manajemen kepada dokter terkait formularium rumah sakit	A7	2
Kurangnya komunikasi dengan distributor	A8	2
Tunggakan pembayaran oleh BPJS	A9	3
Kelalaian dari proses pengiriman	A10	2
Adanya pemeliharaan system	A11	2
Kurangnya quality control saat penerimaan barang	A12	2
Kurangnya SDM	A13	3
Respon supllier yang terlalu lama	A14	4
Kurangnya pengetahuan SDM/ human eror	A15	1
Faktur pembelian obat tidak lengkap/ hilang	A16	2
Waktu pengembalian obat sudah terlalu lama	A17	1

2. Severity

Severity digunakan untuk menilai dampak risiko. Berikut merupakan kriteria untuk penilaian *Severity*

Rank	*Effect of Severity*	*Customer Effect*	Pelayanan	*Financial loss*	Reputasi
1	*No Effect*	Tidak ada efek yang ditimbulkan	Terhentinya pelayanan <30 menit	Kerugian sangat kecil	Rumor
2	*Minor*	Dapat ditolong dengan pertolongan pertama	Terhentinya pelayanan 30 menit - 8 jam	Kerugian >0,1% dari anggaran	Berdampak kecil dari kepercayaan masyarakat
3	*Moderate*	Berkurangnya fungsi motoric dan sensorik sementara waktu	Terhentinya pelayanan > 8 jam	Kerugian > 0,25% dari anggaran	Berdampak besar terhadap kepercayaan masyarakat
4	*Major*	Cacat permanen	Terhentinya pelayanan > 1 hari	Kerugian >0,75% dari anggaran	Adanya pemberitaan serius di media

5	*Catastrophic*	kematian	Terhentinya pelayanan > 1 minggu	Kerugian >1,5% dari anggaran	Adanya pemberhentian operasional dari pemerintah

Dalam pengisian tabel *severity* dapat menggunakan symbol angka.

Aktivitas	**Kejadian Risiko (*Risk Event*)**	**Kode**	***Severity***
Plan	Kekurangan anggaran biaya tahunan	E1	3
	Adanya beberapa jenis obat yang tidak terpakai	E2	2
	Farmasi mengalami kekurangan jumlah stock obat	E3	3
	Permintaan jenis obat diluar formularium rumah sakit	E4	2
Source	Distributor tidak memenuhi kontrak dengan rumah sakit	E5	3
	Rumah sakit tidak dapat membayar tagihan obat kepada distributor	E6	1
	Keterlambatan pengiriman obat non BPJS	E7	2
	Keterlambatan pengiriman obat BPJS akhir tahun	E8	3
	Pemesanan e-katalog tidak dapat dilakukan	E9	3
	Adanya obat pecah/ hancur	E10	3
	Adanya bungkus obat yang penyok	E11	2
Make	Waktu pembuatan berkas pengiriman terlalu lama	E12	1
	Waktu pembuatan faktur pajak terlalu lama	E13	1
Deliver	Keterlambatan pengiriman obat ke pasien rawat inap	E14	3
Return	Claim tidak diterima oleh distributor	E15	3

	Respon claim pengembalian distributor telalu lama	E16	3
	Pengembalian obat oleh pasien karena obat rusak/ expired	E17	4

C. Tabel Nilai Korelasi Antara *Severity* dan *Occurance*

Kuisioner berikutnya merupakan tabel korelasi yang menggambarkan besarnya hubungan antara *Risk Agent* (penyebab risiko) dengan *Risk Event* (kejadian risiko). Dimana hubungan tersebut digambarkan dengan skala sebagai berikut:

Skala Corelation	Keterangan
0	Tidak ada korelasi
1	Sedikit korelasi
3	Korelasi sedang
9	Korelasi tinggi

Kejadian Risiko (*Risk Event*)	**Kode**	***Risk Agent***	**Kode**
Kekurangan anggaran biaya tahunan	E1	kesalahan perhitungan RAB tahunan	A1
Adanya beberapa jenis obat yang tidak terpakai	E2	kesalahan perencanaan/forecasting	A2
Farmasi mengalami kekurangan jumlah stock obat	E3	Adanya kenaikan harga obat dari pabrik	A3
Permintaan jenis obat diluar formularium rumah sakit	E4	kesalahan pemesanan oleh bagian farmasi	A4
Distributor tidak memenuhi kontrak dengan rumah sakit	E5	kurangnya pengawasan obat oleh kepala farmasi	A5
Rumah sakit tidak dapat membayar tagihan obat kepada distributor	E6	Adanya kelangkaan obat-obatan	A6
Keterlambatan pengiriman obat non BPJS	E7	kurangnya sosialisasi pihak manajemen kepada dokter terkait formularium rumah sakit	A7
Keterlambatan pengiriman obat BPJS akhir tahun	E8	Kurangnya komunikasi dengan distributor	A8
Pemesanan e-katalog tidak dapat dilakukan	E9	Tunggakan pembayaran oleh BPJS	A9
Adanya obat pecah/ hancur	E10	Kelalaian dari proses pengiriman	A10
Adanya bungkus obat yang penyok	E11	Adanya pemeliharaan system	A11
Waktu pembuatan berkas pengiriman terlalu lama	E12	Kurangnya quality control saat penerimaan barang	A12

Waktu pembuatan faktur pajak terlalu lama	E13	Kurangnya SDM	A13
Keterlambatan pengiriman obat ke pasien rawat inap	E14	Kurangnya pengetahuan SDM/ human eror	A14
Claim tidak diterima oleh distributor	E15	Respon supplier yang terlalu lama	A15
Respon claim pengembalian distributor lama	E16	Faktur pembelian obat tidak lengkap/ hilang	A16
Pengembalian obat oleh pasien karena obat rusak/ expired	E17	Waktu pengembalian obat sudah terlalu lama	A17

Kejadian resiko (Ej)	Agen resiko (Aj)																	
	A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**	**A11**	**A12**	**A13**	**A14**	**A15**	**A16**	**A17**	**Severity**
E1																		3
E2																		2
E3																		3
E4																		2
E5																		3
E6																		1
E7																		2
E8																		3
E9																		3
E10																		3
E11																		2
E12																		1
E13																		1
E14																		3
E15																		3
E16																		3
E17																		4

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Nilai *severity* dari risk event (besarnya dampak dari kejadian risiko terhadap perusahaan).

Nilai *occurance* dari *risk agent* (tingkat keseringan risiko terjadi pada penyebab risiko).

Data yang diberikan hanya digunakan untuk kepentingan penelitian Petunjuk Pengisian Isilah kuisoner berikut sesuai dengan situasi dan kondisi didalam perusahaan saat ini. Adapun kriteria penilaian akan dijelaskan pada lembar penilaian

Tabel Penilaian Occurance dan Severity

Occurance

Occurance digunakan untuk menilai frekuensi terjadinya suatu risiko. Berikut merupakankriteria untuk penilaian *occurance* dan *Severity*

Rating	Occurance	Severity
1	Jarang terjadi	Tidak ada dampak
2	Sedikit terjadi	Sedikit dampak
3	Kadang terjadi	Dampak sedang
4	Sering terjadi	Dampak serius
5	Sangat sering terjadi	Sangat serius

Berikut merupakan tabel kuisioner *severity* dan *occurance:*

No	*Risk Agent*	*Code*	*Occurance*	*Severity*
1	Adanya kelangkaan obat-obatan	A6		
2	Kelalaian dari proses pengiriman	A 10		
3	Kurangnya pengetahuan apoteker/ human eror	A16		
4	Kurangnya SDM	A13		
5	Kesalahan peramalan	A2		
6	Tunggakan pembayaran oleh BPJS	A9		
7	Kelalaian dari proses pengiriman	A 10		
8	Kurangnya pengetahuan apoteker/ human eror	A16		
9	Kurangnya SDM	A13		
10	Kesalahan peramalan	A2		
11	Tunggakan pembayaran oleh BPJS	A9		

Tabel Nilai Korelasi Antara *Severity* dan *Occurance*

Kuisioner berikutnya merupakan tabel korelasi yang menggambarkan besarnya hubungan antara *Risk Agent* (penyebab risiko) dengan *preventive action*. Dimana hubungan tersebut digambarkan dengan skala sebagai berikut:

Skala Corelation	Keterangan
0	Tidak ada korelasi
1	Sedikit korelasi
3	Korelasi sedang
9	Korelasi tinggi

Risk Agent	**PAi**	**Tindakan pencegahan**
Adanya kelangkaan obat-obatan	PA1	Mencari alternative obat dengan fungsi serupa
	PA2	Membangun system informasi obat yang terintregasi
	PA3	Melakukan perencanaan obat tahunan secara akurat
	PA4	meningkatkan komunikasi dengan distributor

	PA5	Memberikan training rutin kepada apoteker dan pertukaran informasi dengan apoteker lain untuk meningkatkan kemampuan dan pengetahuan
Kelalaian proses pengiriman	PA4	meningkatkan komunikasi dengan distributor
Kurangnya pengetahuan apoteker/ human eror	PA6	Memberikan reward, punishment dan motivasi kerja
	PA5	Memberikan training rutin kepada apoteker dan pertukaran informasi dengan apoteker lain untuk meningkatkan kemampuan dan pengetahuan
	PA7	Menciptakan lingkungan kerja yang nyaman
Kurangnya SDM	PA8	Memaksimalkan komunikasi antara perawat, bagian farmasi, dan dokter
	PA5	Memberikan training rutin kepada apoteker dan pertukaran informasi dengan apoteker lain untuk meningkatkan kemampuan dan pengetahuan
Tunggakan pembayaran oleh BPJS	PA9	Melakukan efisiensi biaya
	PA3	Melakukan perencanaan obat tahunan secara akurat
	PA1	Mencari alternative obat dengan fungsi serupa
Kesalahan peramalan	PA3	Melakukan perencanaan obat tahunan secara akurat

	PA4	meningkatkan komunikasi dengan distributor
	PA5	Memberikan training rutin kepada apoteker dan pertukaran informasi dengan apoteker lain untuk meningkatkan kemampuan dan pengetahuan
	PA9	Melakukan efisiensi biaya

Tabel korelasi

Risk agent (Ei)	**Preventive action (PAi)**								
	PA1	**PA2**	**PA3**	**PA4**	**PA5**	**PA6**	**PA7**	**PA8**	**PA9**
A6									
A 10									
A16									
A13									
A2									
A9									