RISK MANAGEMENT ANALYSIS AT THE SEWING DEPARTMENT USING THE HOUSE OF RISK (HOR) METHOD
(CASE STUDY: PT. SANDANG ASIA MAJU ABADI)

UNDERGRADUATE THESIS

Submitted to the 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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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in the paper and intellectual property rights, then I am willing to get a bachelor degree that I have received to be withdrawn by the Islamic University of Indonesia.

Yogyakarta, October 11th, 2023

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Demikian surat keterangan ini dibuat untuk dipergunakan semestinya.

Semarang, 15 Juni 2023

PT. SANDANG ASIA MAJU ABADI

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DEDICATION PAGE

Alhamdulillahirabbil'alamin

I dedicate this undergraduate thesis to my father and mother, who have always provided support, love, and prayer. To my sister and brother, thank you for being a support system for me.

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Thank you to my supervisor for all the attention and guidance he gave me while I was writing this undergraduate thesis. Sorry if, during the guidance period, I often make many mistakes, and there are still many shortcomings.
Dr. Taufiq Immawan, S.T., M.M.

MOTTO

“Try always to be grateful for all the favors and gifts Allah has given you today." “Indeed, with hardship will be ease. So when you have finished your duties, then Sand up for worship. And to your Lord direct your longing”.(Q.S. Al Insyirah 6-8)

PREFACE

Assalamu'alaikum Warahamatullahi Wabarakatuh

Alhamdulillah, all praise is due to Allah SWT, the Richest, with all His secrets. Gratitude is endlessly extended to Allah SWT because of His mercy and grace. The writer completed an undergraduate thesis titled **"Risk Management Analysis at Sewing Department Using House of Risk (HOR) Method (Case Study: PT Sandang Asia Maju Abadi)".** The author conveys the true Murabbi of the Prophet Muhammad SAW, who has brought humans from darkness to a realm full of knowledge.

This undergraduate thesis was completed by the author thanks to the help and support both morally and materially from various parties. For that, with all my heart, the author expresses his gratitude and appreciation to:

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The author realizes this undergraduate thesis still has many shortcomings, so the author expects constructive criticism and suggestions from various parties for future improvements. This undergraduate thesis was prepared to fulfill one of the requirements for completing a bachelor's degree in the International Undergraduate Program in Industrial Engineering at the Faculty of IndustrialTechnology, Islamic University of Indonesia.

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Yogyakarta, October 11th, 2023

Rizka Khairika

ABSTRACT

PT Sandang Asia Maju Abadi is one of the companies engaged in the garment and textile sector using a make to order strategy production system manufacturing. PT Sandang Asia Maju Abadi does not yet have a structured risk management to identify and mitigate risks that occur, especially in the supply chain function. PT Sandang Asia Maju Abadi is a large-scale company that involves a lot of processes that occur in the production process of making products. Therefore, there must be some risks that may occur because every business face risks that can pose a threat to its success, thus making the company must be vigilant with the increasing market competition conditions. Things that must be considered in a production process in order to compete are the risks that may occur at PT Sandang Asia Maju Abadi and one way to stay competitive with other companies is to carry out risk management of the supply chain and production. The purpose of this study is to identify the causes of risks that occur and minimize the causes of these risks. The method used in the research is the House of Risk. The results of this study using the HOR model are 10 risk events and 10 risk agents. By using a pareto diagram to determine the priority of risk agents based on the highest value, two dominant risk agents were obtained, namely Workers low performance under expected capacity (A3) and too much tension while sewing the product (A9). Based on these dominant risk agents, 5 mitigation strategies can be implemented.

Keywords: House of Risk, Mitigation, Risk, Risk Management

TABLE OF CONTENTS

AUTHENTICITY STATEMENT ii
CERTIFICATE OF COMPLETION RESEARCH iii
UNDERGRADUATE THESIS APPROVAL OF SUPERVISOR iv
UNDERGRADUATE THESIS APPROVAL OF EXAMINATION COMMITTEE v
DEDICATION PAGE vi
MOTTO vii
PREFACE viii
ABSTRACT x
TABLE OF CONTENTS xi
LIST OF TABLE xiii
LIST OF FIGURES xiv
CHAPTER I INTRODUCTION 1
1.1 Research Background 1
1.2 Problem Formulation 4
1.3 Research Objective 4
1.4 Scope of Research 5
1.5 Research Benefit 5
1.6 Systematic Writing 5
CHAPTER II LITERATURE REVIEW 7
2.1 Inductive Literature 7
2.2 Empirical Study 11
2.2.1 Risk Management 11
2.2.2 House of Risk Method (HOR) 11
2.2.3 Implementation of the House of Risk Method (HOR) in Risk Management 12
2.2.4 Risk Identification in the Sewing Department 14
2.2.5 Risk Analysis Using the House of Risk (HOR) Method 15
2.2.6 Pareto Principle 17
CHAPTER III RESEARCH METHOD 18
3.1 Research subject and object design 18
3.2 Data Collection Method 18
3.3 Research Flow 19
CHAPTER IV DATA COLLECTING AND PROCESSING 22
4.1 Pre-House of Risk Steps 22
4.1.1 Company History 22
4.1.2 Company Logo and Meaning 23
4.1.3 Company Vision and Mission 23
4.1.4 Company Location 23
4.1.5 Company Products 24
4.1.6 Production Process Operation 25
4.2 House of Risk Phase 1 33
4.3 Risk Identification 33
4.3.1 Identification of Risk Events and Risk Agents 33
4.3.2 Risk Event Identification 34
4.3.3 Risk Agent Identification 36

4.3.4 Correlation Identification 37
4.3.5 Aggregate Risk Potentials Calculation 39
4.4 House of Risk Phase 2 45
CHAPTER V DISCUSSION 51
5.1 Risk Identification Analysis at PT. Sandang Asia Maju Abadi 51
5.2 House Of Risk (HOR) Analysis Phase 1 51
5.3 Pareto Diagram Analysis 52
5.4 Fishbone Diagram Analysis 53
5.4.1 Fishbone diagram analysis on risk agent A3 (Workers low performance under expectedcapacity) 53
5.4.2 Fishbone diagram analysis on risk agent A9 (Too much tension while sewing the product) 54
5.5 House Of Risk (HOR) Analysis Phase 2 55
CHAPTER VI CONCLUSION AND SUGGESTIONS 57
6.1 Conclusion 57
6.2 Suggestions 57
REFERENCES 58
ATTACHMENT 61

LIST OF TABLE

Table 4. 1 Scale of Severity 34
Table 4. 2 Risk Event Table 35
Table 4. 3 Scale of Occurrence 36
Table 4. 4 Risk Agent Table 37
Table 4. 5 Correlation Level 37
Table 4. 6 Risk Event and Agent Correlation 38
Table 4. 7 Aggregate Risk Potential Calculation 40
Table 4. 8 House of Risk Phase 1 42
Table 4. 9 Aggregate Risk Potential Rank 43
Table 4. 10 Risk Agent Category 44
Table 4. 11 Risk Agent Dominant 44
Table 4. 12 Level of Risk Maps Determination 45
Table 4. 13 Risk Map 45
Table 4. 14 Preventive Action Table 47
Table 4. 15 Risk Agent and Preventive Action Correlation 47
Table 4. 16 Degree of Difficulty Explanation 48
Table 4. 17 Degree of Difficulty Preventive Action 48
Table 4. 18 House of Risk Phase 2 49
Table 4. 19 Sequence of Mitigation Priorities 50

LIST OF FIGURES

Figure 1. 1 Major Defect Frequency 2
Figure 3. 1 Research Flow..... 19
Figure 4. 1 Company Logo 23
Figure 4. 2 PT. Sandang Maju Abadi Location..... 24
Figure 4. 3 Denim Product of PT. Sandang Asia Maju Abadi..... 25
Figure 4. 4 Basic Pants of PT. Sandang Asia Maju Abadi 25
Figure 4. 5 PT. Sandang Asia Maju Abadi Production Process 26
Figure 4. 6 Pareto Diagram 43
Figure 4. 7 Fishbone Diagram Risk Agent A3 46
Figure 4. 8 Fishbone Diagram Risk Agent A9 46

CHAPTER I

INTRODUCTION

1.1 Research Background

Indonesia is a country that has experienced rapid development in the garment and textile industry sector. The garment and textile industry in Indonesia is currently still considered as a strategic industry for the economy in Indonesia, because the number of Indonesian people reaches morethan 270 million according to the Statistics Indonesia (BPS). In fact, the garment and textile industry is the third largest manufacturing industry with a large number of employment opportunities until 2018. In 2017, exports of Indonesian textiles and textile products reached US$12.4 billion, which exceeded the target of the Indonesian Textile Association (API) of US$11.8 billion. The government is also targeting export growth in 2019 to grow to US$15 billion (Tribunnews, 2020).

Based on the data above, it is identified that the number of market demands is very large and there are considerable opportunities in the textile and garment industry. Thus, this is the reasonwhy there are so many garment and textile industries. According to the Central Statistics Agency (BPS) states that industrial groups are divided into four types, namely large, medium, small and households. Large industry consists of 100 workers or more, then medium industry consists of 20 to 99 people, then small industry consists of 5 to 19 people and home industry consists of 1 to 4 people.

The garment and textile industry in Indonesia is developing over time, starting from garment factories to the garment SME level. The development of the garment industry has drawn much attention, where in Indonesia alone there are more than 200 garment factories with well-known brands. Therefore, the level of competition for manufacturing companies in Indonesia is now increasing. This increase affects business competition, so the right strategy isneeded so that the company survives in running its business. One factor that needs to be considered is the supply chain strategy. Supply chain activities have opportunities for risk to occur. If supply chain activities do not pay attention to the risks that will arise and the impact related to measuring company performance, it will cause sub-optimal results and inconsistent processes (Sari, 2018).

The supply chain in the company is defined as a network owned by the company in which

there are parts such as suppliers, manufacturers, distributors or retailers directly or indirectly who work together in their duties to fulfill customer demands. Each field performs its own function, such as carrying out the process of procuring production raw materials, converting main raw materials into semi-finished materials, and distributing products to end customers (Geraldin, 2007). When carrying out supply chain activities there are many risks that occur such as product defects, delays in raw materials and delays in product delivery to consumers. Therefore, customer risk in the supply chain can be reduced by using a risk management approach, in order to reduce the level of risk and the impact of these risks (Hanafi, 2006).

PT. Sandang Asia Maju Abadi is a company engaged in the garment and textile sector using a make-to-order strategy production system, which means that the buyer (consumers) can custom and choose the desired design or color and also the order quantity. The products produced by PT. Sandang Asia Maju Abadi does not use its brand or trademark, but it is based on orders from buyers (consumers). Therefore, each product has various and different specifications. PT. Sandang Asia Maju Abadi does not have structured risk management to identify and mitigate risks that occur, especially in the supply chain function. PT. Sandang Asia Maju Abadi includes a large-scale company that involved a huge number of processes that occurred in the production process of making the product. Therefore, there must be several risks that might occur because every business face risks that could present threats to its success. Risk is defined as the probability of an event and its consequences. Types of risk can be divided into four categories, such as environment, reputation, assets, and workers. Risks can affect the achievement of objectives either positively or negatively. Risk includes both opportunities and threats, and both should be managed through the risk management process (Geraldin, 2007).

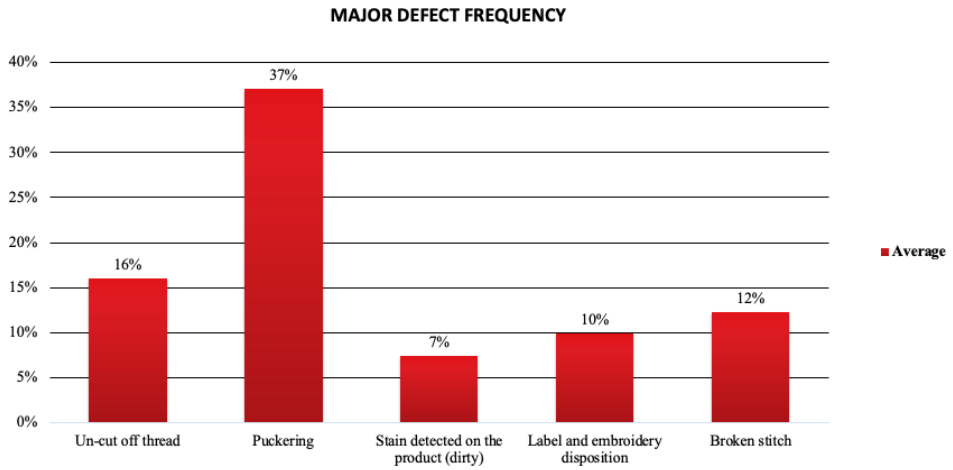

Figure 1. 1 Major Defect Frequency

Based on the graph above, it is illustrated that defective products still do not meet the production requirements of PT. Sandang Asia Maju Abadi production. From the total amount of production for 15 working days of 16070 pcs and there are a total of 1998 pcs of defective products or if there is a percentage of 12% of the number of defective products. From these data, the defects that occur are high, which certainly dramatically affects the level of productivity in PT. Sandang Asia Maju Abadi. The more defective goods, the worse the productivity value will be. However, the company has a standard product defect tolerance of 7%, therefore it is necessary to make countermeasures so that the problem reduces the defects that occur.

In carrying out business processes in a company to achieve its objectives, there are always risks that can occur and affect the company's success in achieving goals. PT. Sandang Asia Maju Abadi as a garment company requires speed and accuracy of work in order to produce products with specifications needed by customers and can be superior to other competitors. PT. Sandang Asia Maju Abadi is a private limited company that produces superior pants products for men and women of all genders and age groups. At PT. Sandang Asia Maju Abadi, there is a Department of Sewing that have the task of gaining the main production, managing, and controlling the production quality standards.

The work carried out by the Sewing Department will face risks that may be affected by disruption of the final activities of the company considering that the quality control is thelast task before the product is distributed. All of these processes have a threat that may occur to disrupt normal activities or stop something that has been planned. Therefore, it is necessaryto overcome the risky activities that cause these risks. In improving the performance of PT. Sandang Asia Maju Abadi, is expected to have strategies and policies that are applied, using the HOR (House of Risk) method. The House of Risk method is useful for analyzing the risk from thecompany because the House of Risk method could minimize risky activities by looking for risk events and the source of the risk. Therefore, the solution will provided by the risk mitigation forthe improvement of risky activities.

According to (Achmadi & Mansur, 2018) *House of Risk* (HOR) is a method that can be used to manage risk. HOR can identify risk events and *risk agents*, besides that using HOR canalso carry out a risk mitigation design, which aims to reduce the probability of occurrence of a*risk agent* from a risk through prevention efforts. HOR focuses on analyzing the causes of riskand the effectiveness of risk mitigation strategies designed to minimize the main causes of a risk event. Several studies that have been conducted related to the use of the *House of Risk* to

mitigate risk include the following: (Tampubolon, et al., 2013) using the *House of Risk* (HOR) to identify *risk events, risk agents* in the *supply chain* and design mitigation strategies risk event based on the value of ARP (*Aggregate Risk Potential*). Furthermore, research conducted by (Adi & Susanto, 2017) uses HOR (*House of Risk*) to identify *risk events*and *risk agents* that cause them to occur, as well as design risk mitigation.

Thus, it is necessary to take action to minimize risks that may arise by identifying risks, analyzing risks, and designing risk strategies to improve the performance of the company by implementing the *House of Risk* (HOR) model. The *House of Risk* (HOR) model was introduced (Pujawan & Geraldin, 2009) which is a combination of the *House of Quality* (HOQ) and *Failure Mode & Effect Analysis* (FMEA), and the *House of Risk* (HOR) method is divided into2 phases, namely the risk identification phase and the risk treatment phase. In the first phase, an*Aggregate Risk Potential* (ARP) calculation will be carried out to find the main risks that mustbe corrected and minimized and in the second phase, a strategy will be designed based on the values implemented in the previous phase.

1.2 Problem Formulation

From the explanation of the research background above, the research problems can be formulated as follows:

1. What kind of risk events exist in the sewing department of PT. Sandang Asia Maju Abadi?
2. What kind of the most suitable action plan to minimize the risk at the sewing department of PT. Sandang Asia Maju Abadi?

1.3 Research Objective

The research objectives related to overcoming the problem formulation above are as follows:

1. To find and explain the risk events that exist at the sewing department of PT. Sandang Asia Maju Abadi.
2. To determine the most suitable action plan to minimize the risk at the sewing department of PT. Sandang Asia Maju Abadi.

1.4 Scope of Research

To limit the space in this internship, the limitations of the problem given are as follows:

1. The research was conducted at PT. Sandang Asia Maju Abadi.
2. The data were taken from March to April.
3. This research focuses on risk identification, risk priority, and risk management strategies that can be implemented to reduce operational risk at PT. Sandang Asia Maju Abadi.
4. This study uses the House of Risk (HOR) method.

1.5 Research Benefit

This research is expected to provide benefits to all parties, including:

1. For researchers to compare knowledge from theory and reality in the field, it is a requirement for the writer to obtain a bachelor's degree in industrial engineering from Universitas Islam Indonesia.
2. For the company, this research is expected to be a reference for making improvements invarious aspects so that the company can contribute to a sustainable production process inaddition to making a profit and company could use the result of this research as a consideration of system changes in the field of risk management. The company can alsofamiliar with risks that may occur in the company.
3. For further researchers, this research can be used as a reference and source of information in conducting research related to these topics, either continuing or complementary.

1.6 Systematic Writing

The systematics in writing this research are as follows:

CHAPTER I INTRODUCTION

This chapter contains a general description of the research conducted, including the background for the undergraduate thesis, the problem formulation, research objectives, the scope of the study, the benefits of research, and systematic writing.

CHAPTER II LITERATURE REVIEW

This chapter contains inductive and deductive studies, in which an inductive study has previous research, which is used as a reference for conducting research. At the same time, the deductive analysis contains the theories supporting the research.

CHAPTER III METHODOLOGY

This chapter contains the research objects to be carried out, the research methods to be carried out, the data collection methods needed for both primary and secondary data, and the flow of research carried out from the beginning of the study to the end.

CHAPTER IV DATA COLLECTION AND PROCESSING

This chapter contains data collection and processing of data obtained by a predetermined method, and then the processed data is analyzed to achieve research objectives.

CHAPTER V DISCUSSION

This chapter contains an explanation of the analysis obtained in detail withthe suitability of the results of the research objectives so that they can provide recommendations for improvements.

CHAPTER VI CONCLUSION AND SUGGESTION

This chapter contains the conclusions from the research that has been carried out and provides recommendations for suggestions for improvements to the results obtained by the formulation of the problem thathas been determined so that it is hoped that it can be studied further in further research.

CHAPTER II

LITERATURE REVIEW

2.1 Inductive Literature

Judi and Jaidin (2021 researched the application of the House of Risk (HOR) method in analyzing risk management in construction projects. This research aims to assist practitioners in the construction industry in identifying, evaluating, and managing the risks associated with their projects. The House of Risk (HOR) method is used as a framework for risk analysis. HOR is an approach that involves identifying the various types of risks that may occur in a construction project, depicting them visually in a "risk house," and analyzing the impact and probability of occurrence of these risks. This research involves case studies of specific construction projects, where risk data is collected and analyzed using the HOR method. The researchers in this study used both quantitative and qualitative approaches to measure the level of risk and its impact on the project. The results of the study show that the House of Risk (HOR) method is effective in assisting project managers in identifying potential risks, evaluating their impact, and taking appropriate mitigation measures. Using House of Risk, project managers can more clearly visualize risks, prioritize actions that need to be taken, and allocate resources more efficiently.

This research makes an important contribution in improving risk management practices in construction projects. By incorporating the House of Risk (HOR) method as an analytical tool, practitioners can optimize their risk management efforts, reduce the likelihood of adverse risks occurring, and increase the overall success of construction projects. However, this research also faced some limitations. For example, this study focuses on only one construction project, so it may be necessary to generalize the research results to other projects with caution. In addition, the use of the House of Risk (HOR) method also relies on accurate and relevant data. Therefore, the accuracy and adequacy of the risk data used is an important factor in risk analysis using this method. Overall, this research provides practical guidance for practitioners in the construction industry in applying the House of Risk (HOR) method to manage risk more effectively. It is hoped that this research will encourage further adoption of this method in risk management practices in construction projects.

Abdurrahman, A., Sutanto, H., & Irawan, S. (2020) reviewed the application of the House of Risk (HOR) method in risk management analysis for the oil and gas industry. This research aims to provide a comprehensive framework for identifying, analyzing, and managing the risks associated with operations in the oil and gas sector. The House of Risk (HOR) method is used as a risk analysis tool in this study. This approach involves identifying the different types of risks that may occur in the oil and gas industry, describing them in terms of "risk houses," and measuring the probability and impact of those risks. This research involves case studies in the oil and gas sector, where risk data is collected and analyzed using the House of Risk method. The data includes risks related to operations such as accidents, equipment breakdowns, reduced oil prices, changes in regulations, and other factors that may affect the success of the company's operations.

The results of the study show that the application of the House of Risk (HOR) method can assist management in identifying critical risks, understanding their impacts, and developing effective mitigation strategies. By visualizing risks in a "risk house," practitioners can easily understand and communicate about the risks faced by companies. In addition, this study emphasizes the importance of using accurate and relevant data in risk analysis. The risk data collected and used in the House of Risk method must be updated regularly to ensure its accuracy and relevance in management decision making. However, this study also recognizes that the implementation of the House of Risk (HOR) method in the oil and gas industry may face challenges. Some of the challenges identified include operational complexity, volatility in oil prices, and rapid regulatory changes. Therefore, it is necessary to adapt and develop the House of Risk method according to the special characteristics of the oil and gas industry. Overall, this research provides a practical guide for companies in the oil and gas sector in applying the House of Risk (HOR) method in their risk management. It is hoped that the results of this research can increase company awareness and ability to manage risk better, so as to increase operational efficiency and sustainability in the oil and gas sector.

Furthermore, Purnamasari, Nurhaeni, and Anggraeni (2020) focused on analyzing risk management in the e-commerce industry using the House of Risk (HOR) method. The purpose of this research is to provide practical guidance in identifying and managing the risks associated with e-commerce operations. The House of Risk (HOR) method is used as a framework in this study. This approach involves identifying risks that are specific to the e-commerce industry, describing them in terms of "risk houses," and analyzing the impact and probability of their

occurrence. This research involves risk analysis on various aspects of e-commerce operations, such as data security, system failure, customer information leaks, regulatory changes, and other risks associated with online transactions. The results of the study show that the application of the House of Risk (HOR) method in the e-commerce industry can help companies identify potential risks and take appropriate mitigation measures. By visualizing risks in a "risk house," practitioners can understand and communicate more effectively about the risks faced by companies. In addition, this research underscores the importance of data security and privacy protection in the e-commerce industry. Risks related to security breaches, data theft and cyberattacks must be managed carefully to maintain customer trust and minimize negative impacts.

However, this research also recognizes that the e-commerce industry faces challenges that are constantly evolving, including technological developments, changes in consumer behavior, and increasingly fierce competition. Therefore, further research and development in the application of the House of Risk (HOR) method in the e-commerce industry is essential to overcome the challenges that arise. Overall, this research provides important insights for practitioners in the e-commerce industry in managing risk more effectively. It is hoped that the results of this research can increase industry awareness of the importance of good risk management in the context of e-commerce and encourage the use of the House of Risk (HOR) method as an effective analytical tool in dealing with emerging risks.

Further research was conducted by Azhar, S., & Kurniawan, F. (2020). This study explores the application of the House of Risk method in analyzing risk management in financial institutions. In research conducted by Azhar dan Kurniawan (2020), the focus is on risk management analysis in financial institutions using the House of Risk (HOR) method. This research aims to provide practical guidance in identifying and managing the risks associated with the operationsof financial institutions. House of Risk method is used as a framework in this study. This approach involves identifying risks that are specific to financial institutions, describing them in terms of "risk houses," and analyzing the impact and probability of occurrence of these risks.

This research involves risk analysis on various operational aspects of financial institutions, such as credit risk, market risk, liquidity risk, operational risk and other risks related to financial activities. The results of the study show that the application of the House of Risk (HOR) method in financial institutions can assist management in identifying potential risks and taking

appropriate mitigation measures. By visualizing risks in a "risk house," practitioners can understand and communicate more effectively about the risks faced by financial institutions. In addition, this study emphasizes the importance of strong risk management within financial institutions to maintain their stability and sustainability. Financial institutions play an important role in the economy, and the risks associated with their activities can have a significant systemic impact. Therefore, the use of the House of Risk (HOR) method in financial institution risk management is important to ensure sound operational continuity and effective risk mitigation. However, this research also recognizes that financial institutions face complex and varied challenges, such as regulatory changes, market volatility, and technological changes. Therefore, it is necessary to adjust and develop the House of Risk (HOR) method according to the specific characteristics of financial institutions. Overall, this research provides important insights for practitioners in financial institutions to manage risk more effectively. It is hoped that the results of this research can increase industry awareness of the importance of good risk management in the context of financial institutions and encourage the use of the House of Risk (HOR) method as an effective analytical tool in dealing with emerging risks in the financial sector.

Arianingrum, I. R., & Syahputra, R. (2019) focuses on the application of the House of Risk (HOR) method in analyzing risk management in the construction industry. The aim of this research is to provide practical guidance in identifying, analyzing, and managing the risks associated with construction projects. The House of Risk (HOR) method is used as a framework in this study. This approach involves identifying risks that may occur in the construction industry, describing them in a "risk house," and analyzing the impact and probability of occurrence of these risks. This research involves risk analysis on various aspects of construction projects, such as security risks, occupational safety risks, technical risks, environmental risks, and other risks related to construction activities. The results of the study show that the application of the House of Risk (HOR) method in the construction industry can assist practitioners in identifying potential risks and taking appropriate mitigation measures. By visualizing the risks in a "risk house," practitioners can more easily understand and communicate the risks faced in construction projects. Overall, this research provides important insights for practitioners in the construction industry in managing risk more effectively. It is hoped that the results of this research can increase industry awareness of the importance of good risk management in the construction context and encourage the use of the House of Risk (HOR) method as an effective analytical tool in dealing with risks that arise in the construction industry.

2.2 Empirical Study

2.2.1 Risk Management

Peter F. Drucker (2013) suggests risk management must be an integral part of every management decision. Drucker argued that effective management must identify risks, evaluate the probability of occurrence of these risks, and take steps to reduce or overcome these risks. Taleb (2017) is a risk expert known for his theory of the "Black Swan" and the concept of "Antifragility". Taleb argued that many risks are unpredictable and have a significant impact. According to him, risk management must focus on creating resilience to unpredictable risks, not just relying on traditional statistical models and analysis.

Carl L. Pritchard (2014) suggested that risk management must be an integral part of the project life cycle. He emphasized the importance of risk identification, risk analysis, development of risk management strategies, and continuous risk monitoring. Meanwhile, Hubbard (2019) is a statistician who developed a quantitative approach to risk management known as "The Risk Management Framework" (RMF). This approach involves using data and statistical analysis to measure, model and manage risk. Hubbard (2019) argues that risk management must be based on objective analysis and accurate data.

2.2.2 House of Risk Method (HOR)

According to Pujawan & Geraldin (2009), the House of Risk (HOR) is a method that focuses on developing preventive, reduction, and management strategies for risk factors that may lead to more than one risk. This model is different from existing models, where in the HOR a risk agent is selected who has a high Aggregate Risk Potentials (ARP), which means that the risk agent has a high probability of occurrence and causes many risk events with severe impacts. Then, mitigation measures for selected risk agents are prepared based on the total effectiveness ratio for the level of difficulty and which mitigation measures can reduce many risk agents with high ARP values.

The House of Risk (HOR) method is an approach used to identify, categorize, and analyze risks within an organization or project. This method was developed by Karlene Agardh and Anders Westerberg (2009) and has become one of the most widely used methods in risk management.

In the House of Risk method, risk is represented as a "house" consisting of several components or "rooms". Each room in the house represents a different type of risk, and risks

are identified and grouped based on their characteristics. This method aims to provide a structured framework for identifying risks and analyzing their impacts.

Agardh and Westerberg (2019), explained that the house in this method provides an intuitive and systematic way to describe risk in an organization or project. The house consists of several rooms, such as “focus room”, “special attention room”, and “support room”, which represent different types of risks and their level of importance. Ochieng (2014) argues that the House of Risk method provides an advantage in describing risk in a way that is easier to understand and more structured. This approach helps in identifying risks related to organizational goals and allows management to allocate resources more effectively.

Holmberg (2013) criticized the House of Risk method for its reliance on a qualitative approach. He stated that this method tends to ignore more in-depth quantitative analysis and relies on the perceptions and subjective judgments of the experts involved in the process. Jouanjean (2017) highlighted the usefulness of the House of Risk method in project risk management. He argues that this approach helps in identifying key risks that can have a significant impact on project success and enables better decision-making in risk management.

In general, the House of Risk (HOR) method has been widely accepted as a useful framework in risk management. This method helps organizations or projects to identify and analyze risks in a more structured manner, enabling better decision making and more effective risk management.

2.2.3 Implementation of the House of Risk Method (HOR) in Risk Management

Implementation of the HOR (House of Risk) Method in risk management is an approach that can assist organizations in identifying, analyzing and managing existing risks. The HoR method is based on the concept of building a house with floors that are connected and connected to each other. Each floor represents a different aspect of risk management, and the whole building represents a comprehensive effort to manage risk (Flanagan, 2013). The following is the implementation of the House of Risk Method in risk management according to Hillson (2017):

1. Risk Identification

   The House of Risk method assists organizations in identifying risks by connecting various aspects within the organization. For example, the first floor represents risk identification from an operational perspective, the second floor from a financial perspective, the third floor from a reputational perspective, and so on. With

this approach, organizations can take a holistic view of existing risks and identify risks thatare relevant in each aspect.

2. Risk Analysis

   Once risks are identified, the House of Risk Method allows organizations to analyze risks in detail. Each floor in the House of Risk represents a different level of analysis. For example, the first floor might represent a simple qualitative analysis, while the second floor represents a more in-depth quantitative analysis. Thus, the organization can choose the level of analysis according to the complexity of the risks it faces.

3. Risk Evaluation

   The House of Risk method facilitates risk evaluation by linking risk aspects with the level of impact and probability. For example, the first floor could describe the impact of risk on operations, the second floor could describe the impact on finances, and so on. Then, the level of risk probability can be related to the appropriate floor. This assists the organization in comprehensively evaluating risks and identifying the most significant risks.

4. Managing Risk

   This method provides a clear framework for managing risk. Organizations can identifyrisk management strategies on each floor, including options to accept, reduce, transferor avoid risk. This approach allows the organization to develop an action planaccording to the risks faced and systematically monitor its implementation.

5. Communication and Risk Reporting

   House of Risk method also pays attention to aspects of risk communication and reporting. Each floor within the House of Risk may represent a different stakeholder, such as executive management, the board of directors or regulators. With this approach, organizations can convey relevant risk information to different stakeholdersand gain a clear understanding of the risks faced and the steps taken to manage them. The method also enables organizations to prepare structured and comprehensive risk reports, making it easier for stakeholders to understand and make decisions based on the risk information presented.

6. Integration of Risk Management

   The implementation of the House of Risk Method in risk management assists organizations in integrating the risk approach into the entire organizational

structure. Each floor in the House of Risk can represent a different unit or department within theorganization. Thus, risk can be seen as part of the business process and integrated intoday-to-day decision-making. This allows the organization to adopt a strong andproactive risk culture.

7. Continuity and Improvement

   The HOR method also encourages organizations to pay attention to aspects of continuity and improvement in risk management. The building of the house consistingof interconnected floors reflects a sustainable and sustainable approach to risk management. The organization can continuously monitor and evaluate the effectiveness of the implemented risk management strategy, make improvements if necessary, and update risk information regularly.

Overall, the implementation of the House of Risk Method in risk management providesa structured and holistic approach to managing risk. This approach enables organizations to identify, analyze and manage risk in an integrated way, and strengthens communication and understanding of risk at all levels within the organization. Thus, organizations can make better decisions, reduce potential losses, and improve their performance and long-term sustainability.

2.2.4 Risk Identification in the Sewing Department

The sewing department in the textile and clothing industry has an important role in the production process. However, like other departments, there are risks that need to be identified and managed to ensure the smooth operation and safety of workers (Smith, 2019). Following are some common risks that may be encountered in the sewing department according to Johnson (2020) as follows:

1. Work Injuries and Accidents

   The biggest risks in the sewing department are work injuries and accidents. This can happen due to equipment used such as sharp sewing machines, needles, scissors, or due to lack of attention when working with potentially hazardous materials.

2. Health Risk

   In addition to physical injuries, the sewing department is also at risk for health problems. Some of the health risks that may be faced are chemical poisoning, exposure to fiber dust, and musculoskeletal disorders due to non-ergonomic body positions.

3. Production delays and discrepancies

   Another risk that may occur is production delays or non-compliance with the set quality standards. This can be caused by problems such as limited worker skills, broken machines, or unavailability of raw materials.

4. Fire Risk

   The sewing department has a significant fire risk due to the use of machines that run on electricity or gas and the presence of flammable materials such as fabrics and threads.

5. Product Quality Risk

   One of the risks that need to be identified in the sewing department is the risk related to the quality of the products produced. Imperfect seams, material defects, or excessive shrinkage can reduce the quality of the final product.

6. Risk of Production Interruption

   Production disruptions, such as power outages, sewing machine breakdowns, or raw material shortages, can hinder the efficiency and productivity of a sewing department.

7. Risk of Workload Imbalance

   The risk of workload imbalance can arise if there is too much work for some team members and too little for others. This can lead to burnout, reduced quality of work, and potential errors.

2.2.5 Risk Analysis Using the House of Risk (HOR) Method

Below the risk analysis using the house of risk method:

1. Building a House of Risk

   The House of Risk (HOR) method is an approach used to analyze and manage risk in a project or organization. The first step in the House of Risk method is the creation of the House of Risk itself. House of Risk is a visual representationconsisting of several floors or levels, each of which represents a different level of risk (Aven, 2010).

   On the first floor or the lowest level, there are usually risks that have the lowest impact and the highest probability of occurrence. Then, getting to the topfloor, the risk of having a higher level of impact but a lower probability of occurrence. This

structure reflects the risk rating from the lowest to the highest (Hillson, 2017).

2. Risk Assessment

   After the House of Risk is created, the next step is to carry out a risk assessment.Risk assessment involves identifying potential risks that may occur in a project or organization, as well as assessing the level of impact and likelihood of these risks occurring (Hubbard, 2009). In risk assessment, each risk is given an assessment based on a predetermined scale of impact and likelihood. The impactscale can be a number or a category that describes the level of impact of a risk on a project or organizational objectives. The scale of possibility can also be in theform of numbers or categories that describe the level of possibility of a risk occurring.

3. Impact and Likelihood Analysis

   After the risk assessment has been carried out, the next step is to carry out an impact and likelihood analysis. At this stage, each risk is assessed separately based on the impact and likelihood that has been determined. The impact of riskreflects the level of consequences that can occur if the risk materializes (Leitch,2019). Impacts can be in the form of financial losses, reputation damage, projectdelays, or other things that can disrupt the smooth running of projects ororganizational operations. The likelihood of risk reflects the level of opportunityfor the risk to occur. The likelihood of a risk can be assessed based on factors such as a history of similar events, the success of existing control measures, or other factors that may influence the occurrence of the risk.

4. Determination of Risk Priority

   After conducting an impact and likelihood analysis, the last step in the HOR method is to determine risk priorities (Pinto, 2016). Risk priority is determined based on the results of the impact and likelihood analysis that has been carried out previously. Risks with high impact and likelihood will be the top priority, while risks with low impact and likelihood will be a lower priority. This risk priority will assist in determining control and mitigation measures to be taken toreduce the impact of the risk.

2.2.6 Pareto Principle

A Pareto chart is a bar chart that shows problems based on the order in which they occur. Each problem is represented by a bar chart. The problem with the most occurrences will be the tallest bar chart, while the fewest problems will be represented by the lowest bar chart. (Tisnowati et al., 2008). The principle of Pareto itself is 80:20 where 20% of a problem has 80% of the impact of the problem. Thus, 20% of identified problems can result in 80% of damage or errors.

CHAPTER III

RESEARCH METHOD

3.1 Research subject and object design

According to the Big Indonesian Dictionary, objects are objects, things, and so on that are targeted for research, and attention. in this study, the company that became the research object wasthe sewing department at PT. Sandang Asia Maju Abadi, which was located on Jl. Industrial Monument I No.8, Randu Garut Village, Tugu District, Semarang, Central Java, 50153, Indonesia. While the subject according to KBBI is the subject of discussion or subject matter and the subject of this research is the risk of activities at the sewing department and focuses on risk management.

3.2 Data Collection Method

The following are the two types of data used in this research.

1. Primary Data

   Primary data is obtained from sources through direct field observations and interviews. According to Smith (2020), primary data is data collected directly by the researcher using methods such as surveys, interviews, and experiments, as opposed to data that has previously been published or collected by others. In this research, primary data were obtained through Interviews. The interview was conducted directly to sewing department to collect the production failures (risk events and risk agents) data.

2. Secondary Data

   Secondary data is data that is not directly involved in data processing in this study. Secondary data is obtained indirectly from the object but through other sources, both orally and in writing.This data is obtained from the literature study in the form of references and relevant literature,likewise with materials related to quality control from journals or books.

3.3 Research Flow

Below is the research flow:

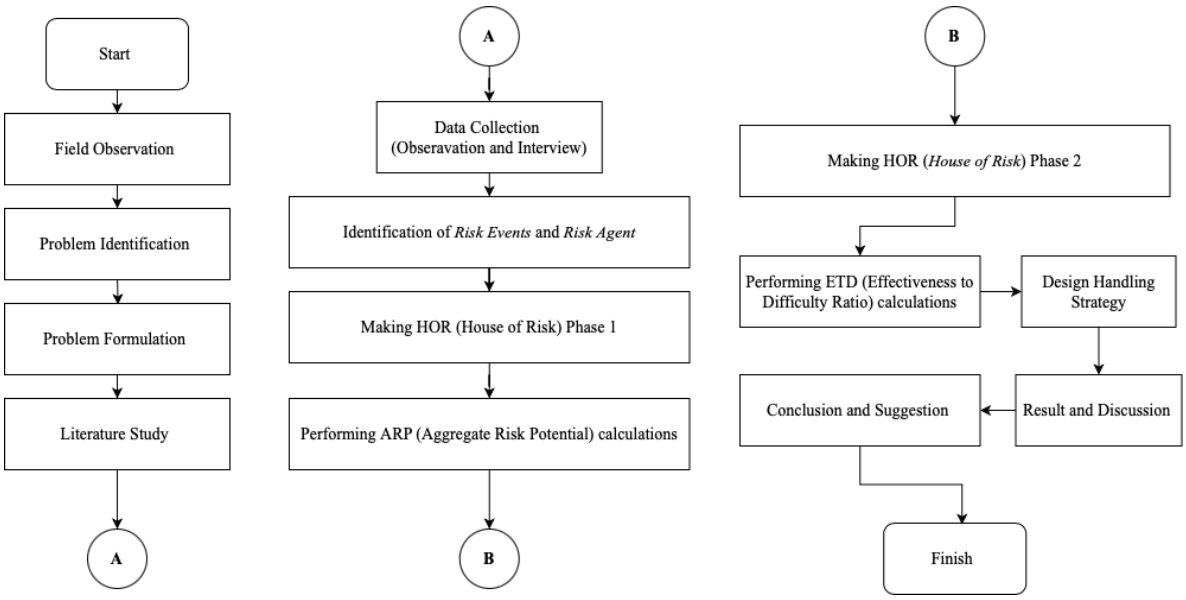

Figure 3. 1 Research Flow

The following is an explanation of the research flow in Figure 3.1 above.

1. Field Study

   At this stage, the research made direct observations in the field to find out the real condition ofthe object to be observed, namely the sewing department of PT. Sandang Asia Maju Abadi.

2. Problem Identification

   At this stage the author identify the problems that exist, then the authors make the formulationof the problem and the limits of the problem to be investigated. Based on the results of a field study at PT. Sandang Asia Maju Abadi, the problem found was the risk in the sewingdepartment which could have an impact on disrupting the company's final activities consideringthat quality control is the last task before products are distributed.

3. Problem Formulation

   The formulation of the problem is the details of the problem that has been identified and aims to determine the direction of the discussion. Where the formulation of the problem contains questions that will be answered in research. Thus, a formulation of the problem is obtained which aims to reduce the risk to the sewing department.

4. Literature Study

   The next stage is a literature review, namely by studying previous research related to this

research to be used as a reference. The literature review used is in the form of local and international journals. A literature review is a step taken to investigate data processing methods.This study's literature review will be limited to Risk Management, House of Risk, Failure Mode and Effect Analysis, and Pareto Diagrams.

5. Data Collection

   The data collected is related to the observed problems. The data collected is later used for inputin HOR processing, such as activities that occur in the sewing department, risk events, risk agents (risk causes), severity assessment, occurrence assessment, and HOR correlation assessment stage 1 and stage 2. The data collection techniques used in this study are as follows:

   a. Observation

      Observations were made with field supervisors related to production conditions at the sewing department of PT. Sandang Asia Maju Abadi.

   b. Interview

      Interviews were conducted with Mr. Jiman as Human Resources Department companies to identify risks to the production department's performance, the correlation between risk events and risk agents, and the probability of a risk map.

   c. Questionnaire

      The use of this questionnaire was given to research subjects to determine risk events and risk agents, and impact (severity) and likelihood (occurrence).

   d. Literature Review

      The literature review is a search for information about the methods and problems needed by researchers by citing theories that have existed in previous studies that can support researchers in conducting research.

6. Data Processing

   After obtaining the results of the interviews and distribution of questionnaires, data processingis performed, which includes risk events, risk event causes, the frequency of events that cause risk, the impact if the risk occurs, and the correlation between risk causes and risk events. Afterthe data is complete, it can be processed using the House of Risk method phase 1 to obtain priority risk events, which will then be given risk mitigation recommendations based on the Pareto diagram that was formed.

   At this point, the obtained priority risk event data will be included in the House of Risk

phase 2 calculation of what mitigation will be carried out to be given to risk events based on the actualfield conditions that occur. Following the determination of risk mitigation options, these optionswill be re-processed to obtain priority mitigation actions by taking into account how difficult itwill be to realize these mitigations in the future. Furthermore, in the final stages of the House of Risk phases 1 and 2, decision-making is done using Pareto diagrams.

7. Result and Discussion

   At this stage, the results that have been obtained will be analyzed and elaborated to determine which mitigation actions are suitable for the sewing department at PT. Sandang Asia Maju Abadi.

8. Conclusion and Suggestion

   The conclusion is the final stage in this study, in which the conclusions obtained are related to theresearch objectives. And suggestions are needed as input for PT. Sandang Asia Maju Abadi or other researchers who are conducting similar research. The provision of suggestions and recommendations is expected to be used as input or consideration for the company.

CHAPTER IV

DATA COLLECTING AND PROCESSING

4.1 Pre-House of Risk Steps

4.1.1 Company History

PT. Sandang Asia Maju Abadi is a private limited company established in 1997 based in Semarang, Central Java, Indonesia. The company was established with a Limited Liability Company deed by Notary H.M. Afdal Ghazali, S.H. No. 546 dated September 25, 1997, based on Decision No. C-165858.HT.01.04.TH.99 and granted approval by the Ministry of Justice of the Republic of Indonesia, Directorate General of Law, and Legislation. The company is located at Tugu Wijaya Kusuma Industrial Estate, Jalan Tugu Industri I/8 Randugarut Village, Tugu District, Semarang, Central Java, Indonesia. PT. Sandang Asia Maju Abadi is an apparel industry company with export-scale products to five continents in the world.

PT. Sandang Asia Maju Abadi is maintained by a strong management consisting team of local and foreign professionals in the apparel manufacturing industry who have extensive experience at various stages of the manufacturing process. This competence enables the companies to qualify for analyzing and forecasting potential problems, planning ahead, controlling, and resolving them. A reliable workforce is able to produce promising achievements, especially by upholding the company's commitment to serving prestigious clients.

This company has modern facilities that can produce high quality products from international class brands. The products of this company are not limited to gender and age group. Therefore, the company produces superior denim products for men and women of all genders and age groups. Supported by around 2,425 skilled workers, PT. Sandang Asia Maju Abadi is able to produce an average of around 400,000 garments in a month. The process of making products itself starts from the design process and the development of sampling for printing, cutting, sewing, embroidery, sanding, laundry washing, as well as packaging and quality analysis audit.

4.1.2 Company Logo and Meaning

Figure 4. 1 Company Logo

Founder of PT. Sandang Asia Maju Abadi created a logo used to describe the company'sidentity which gives the meaning of the light blue parallelogram symbol which means reliable, trustworthy, and responsible. While the parallelogram symbol is dark blue which means professionalism. Likewise in the writings of PT. Asia Maju Abadi clothing is also dark blue which means professionalism.

4.1.3 Company Vision and Mission

The company's vision and mission are the main basis and direction so that the company continues to develop and innovate over time. The vision and mission are:

a. Vision

   "To supply the best quality apparel at the most competitive price supported by an unrivaled professional service or merchandising, tight quality control, quick turnaround, product design and online information. To always hold customer satisfaction through quality as vital."

b. Mission:

   "Supply our customers a "Full Package" program for the apparel production at the highest level of quality, service, and value."

4.1.4 Company Location

For the company location, PT. Sandang Asia Maju Abadi is located on Tugu WijayaKusuma Industrial Estate, Jl. Tugu Industri I No.8, Randu Garut Village, Tugu District, Semarang, Central Java, 50153, Indonesia. The detail location of PT. Sandang Asia Maju Abadiwill be described in a figure as shown below:

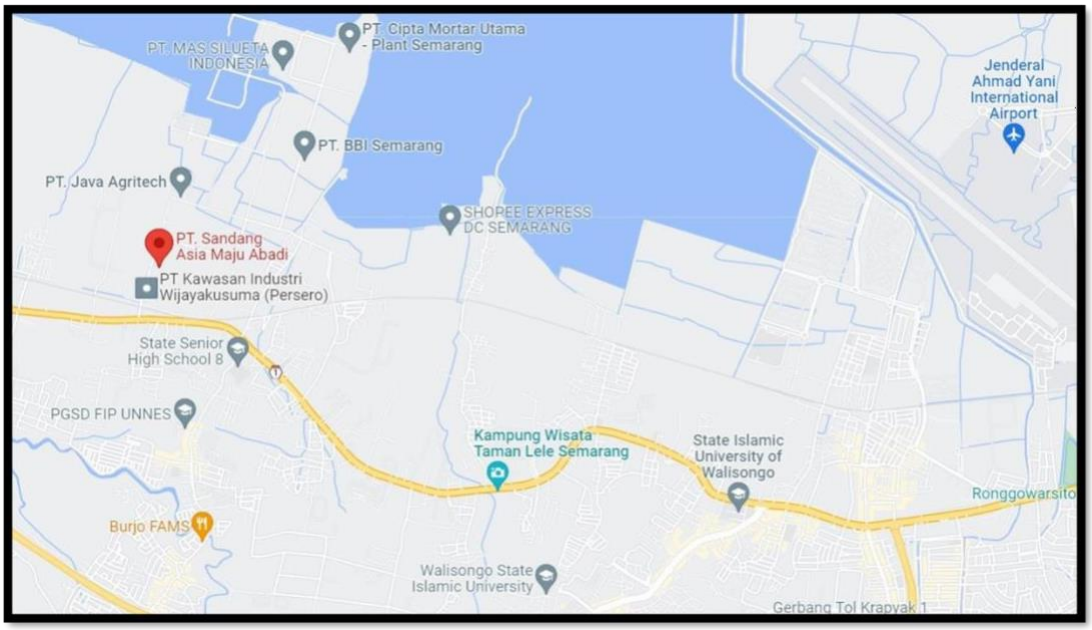

Figure 4. 2 PT. Sandang Maju Abadi Location

4.1.5 Company Products

In producing garments, a production strategy that is used by PT. Sandang Asia Maju Abadi is make to order strategy, which means that the buyer (consumers) could custom and choose the desired design or color and also the order quantity. The products produced by PT. SandangAsia Maju Abadi does not use its own brand or trademark, but it is based on orders from the buyers (consumers). Therefore, each product has its various and different specifications. The products that produced by PT. Sandang Asia Maju Abadi will be described as shown below**:**

1. Denim Pants

   Denim pants is the main product that are produced by PT. Sandang Asia Maju Abadi. This product is produced based on the consumers specification due to the size, color, article, and denim material types.

Figure 4. 3 Denim Product of PT. Sandang Asia Maju Abadi

2. Cotton Pants

   Cotton pants is a one of product that produced by PT. Sandang Asia Maju Abadi. This product is produced using 100% cotton materials and made based on the consumer's specification and request.

Figure 4. 4 Basic Pants of PT. Sandang Asia Maju Abadi

4.1.6 Production Process Operation

The production department at PT. Sandang Asia Maju Abadi has several departments, namely: Warehouse Department, Sample and Pattern Department, Cutting Department, Sewing

Department, Laundry Department, Finishing Department, and Quality Control Department. The process of production stages at PT. Sandang Asia Maju Abadi is illustrated by flowchar below:

Figure 4. 5 PT. Sandang Asia Maju Abadi Production Process

Based on the flow above, the details of every department and production process of PT. Sandang Asia Maju Abadi will be described as shown below:

1. Warehouse Department

   Warehouse department of PT. Sandang Asia Maju Abadi has a function to store all raw materialinventory until the production process is carried out. When the raw materials in the form of basic fabric and other materials that are needed in the production process that will be transferred to the production department, an inspection will be carried out beforehand. The inspection refersto a visual inspection or review of raw materials (such as fabric, sewing thread, accessories, etc.), and all production equipment such as fabrics must be strictly in accordance with several standards. The main purpose of the inspection is to detect defects as early as

possible in the production process. Therefore, the time and money are not wasted later on and bring the negative impacts to the company. If it occurs, it will waste the sense of a high number ofdamaged or defective garments.

2. Sample and Pattern Department

   The sample and pattern department is the initial stage before carrying out the mass production. Thisdepartment aims to ensure the process of making samples to patterns according to the requirements that given by the buyer (consumer). The scope of this department includes patternmaking and sample making to the pattern process. The input of this department is information onbuyer order specifications, while the output in this department is the pattern of each model for mass production reference, and samples on the request that submitted by the buyers. The following are the stages of making samples and patterns divided into 3 stages that will be described as shown below:

   a. Pattern and Sample Approval Arrangement

      The detail step of pattern and sample approval arrangement will be described as follows:

      1) The Sample department accepts the Sample Arrangement Approval Letter from the sales department.
      2) Sample department accepts the original pattern of the product design based onthe size specification from the buyer through the sales department sing the accepting pattern book of garment.
      3) Sample department arranges the soft copy pattern and will be re-checked by quality control department.
      4) Sample department prints out the pattern through cutter board machine based onthe work instruction.
      5) Every pattern that approved will be attached the identity regarding the article, size, thread direction, components name, the number of components, approval stamp, and will be recorded in the pattern validation book.
      6) Sample department will cooperate with industrial engineering, trainer, and the mechanic to make an approval sample based on the instruction of pre-production sample to make an agreement to the buyer.
      7) Sample department will take a documentation through every process and

changeat the pattern based on the buyer request on the form of revised pattern book.Sample department will analyze the risk from the garment result that was madethat will be used as reference at pilot project mass production meeting.

b. Pattern and Pre-Production Sample Internal Arrangement

The detail step of pattern and pre-production sample internal arrangement will be described as shown below:

1) Sample department arranges the pattern grading in soft copy after the sample is approved by the buyer and also the quality control department.
2) Sample department prints out the pattern used the cutter board machine based onthe operational instruction.
3) Every pattern that already approved will be noted by the identity using the size,article, thread direction, components name, amount of the components, and approval stamp.
4) Sample department prepares the pre-production sample internal based on the operational instruction.
5) Sample department will send the soft copy, full size carton pattern, and sample approval from the sample department.

c. Pattern Process

The detail step of pattern process will be described as shown below:

1) The pattern department accepts the soft copy pattern, full size carton pattern, andsample approval from the sample department.
2) The Pattern department will process the soft copy to be identified based on thepattern or garment sample.
3) The Pattern department prints out the pattern at the pattern paper to be re-checked with the carton pattern.
4) The Pattern department reports the pattern result to the cutting and sales departmentusing the report pattern form.

3. Cutting Department

Cutting department also called as the preparatory process because cutting department works onthe process cutting fabric and cutting parts of each clothing model. The

scope of this department is to accept the arrival of the fabric, produce the parts that ready to be proceed to the sewing department. The stages of the cutting department in detail will be described as shown below:

1) Based on the sample department, the pattern that already accepted by sales department could be forwarded to the computer pattern using pattern reservation form by cutting department.
2) The pattern reservation refers to the weekly cutting plan operation.
3) If the pattern process finished, the pattern result will be accepted by cutting department to be processed further.
4) Cutting department accept the report pattern from the computer pattern as basic evidence to take the material to the warehouse used the delivery order form.
5) Cutting department do the cutting process of the material based on the operational instruction of auto-cutter and spreading machine operation.
6) Cutting department check the panel condition of every machine component and thematerial that already cut-off. The result of the cutting will be noted in check panel report.
7) The order that used embroidery will be check using metal detector and the result willbe monitored in embroidery metal detector report form.
8) All components of the material are arranged based on the size, article, amount, color, serial, and the other additional identity and will be forwarded to sewing department.

4. Sewing Department

Sewing department is a department that has a major role in the production process. Sewing department has its various units that includes Unit 1A, Unit 1B, Unit 2A, Unit 2B, Unit 2C, Unit 3A, Unit 3B, and Unit 3C. Each unit works on different product and specification becausemost product orders are grouped according to the buyer (consumer). The division of the types of orders that are carried out by each unit will be described as shown below:

1) Unit 1A, proceed on Levi’s Straus
2) Unit 1B, proceed on S Oliver
3) Unit 2A, proceed on J Crew

4) Unit 2B, proceed on Macy's
5) Unit 2C, proceed on Tommy Hilfiger
6) Unit 3A, proceed on Dockers
7) Unit 3B, proceed on Duluth
8) Unit 3C, proceed on American Eagle

The company will be grouping and proceeding with the order based on the grouping of the consumer because every consumer has its own characteristics that are different from each other. At the sewing department, there will be several stages that will be conducted that will be described asshown below:

a. Sewing Process Planning

   Based on sewing weekly planning and the realization order from the sales department, the sewing department will review the order through the pilot project meeting that will analyze the buyer specification and also the quality inspection from the quality control department.

b. Sewing Process Operation

   The detailed step of the sewing process operation will be described as shown below:

   1) The sewing department will make the delivery order to get the supporting materials for the style that will be processed based on the bundle listing.
   2) The head of sewing department will explain to each supervisor and operator before doing the die-cut process and supporting materials submission based on the operational instructions of the sewing process.
   3) The sewing operation will be conducted using the advanced sewing machine based on the buyer's product specification and operational instructions.
   4) The output of the sewing department per hour and per line will be noted at the sewing output form and will be recorded in the sewing output monitor form.The next step is the output from the sewing department will be forwarded to the laundry department.

5. Laundry Department

   Laundry department at PT. Sandang Asia Maju Abadi has a function to wash the products that are already produced by the sewing department with the technical

aspect to fade the unstable texture and color on the garment products. Therefore, the fabric will be softened. After the product goes through the laundry step, the product color will be the same quality as before entered the laundry department. After the product laundry process is finished, the next step is to forward the product to the finishing department.

6. Finishing Department

The finishing department is the final stage in the production process which will handle folding clothes and packing the clothes according to the request of buyers. The finishing department will have severalsteps that will be described as follows:

a. Finishing Process Planning

The detailed step of finishing process planning will be described as shown below:

1) Based on weekly finishing planning and the realization order from the sales department the finishing department will review the order that will be done.
2) The finishing department will make sure the bulk component card and standard visual of the product are available before proceeding.

b. Finishing Process Operation

The detailed step of finishing the process operation will be described as shown below:

1) Finishing department arrange the delivery order to take the supporting materials.
2) The head of the finishing department will give an explanation to the supervisor and operator.
3) Each process that uses supporting materials is conducting metal.Therefore, the checking process will use the metal detector.
4) The head of the finishing department will divide a task on each garment product that will use a metal detector before proceeding to the swipe process.
5) The output from the finishing department was recorded on the output finishingreport and will be inputted to the production result form.
6) Garment that was submitted to the packing warehouse will be inputtedto logistic form data.

c. Cutting, Sewing, and Finishing Inspection

The detailed step of cutting, sewing, and finishing inspection will be described

shown below:

1) The inspection at cutting, sewing, and finishing process refers to the inspection of product quality assessment instruction.
2) If there any mistakes or defects at the product, every process stage willbe evaluated based on standard operational procedure.

7. Quality Control Department

At the quality control department, PT. Sandang Asia Maju Abadi uses the Total Quality Control (TQC) and Quality Control Circle (QCC) methods. TQC is a dynamic management system thatengages all members of the organization with the application of quality control concepts and techniques to achieve customer satisfaction and those who work on it. Besides, the QCC method is a team of employees who voluntarily meet together periodically to find, recognize, and solve problems that arise in their respective fields of work. The quality controls that exist at PT. Sandang Asia Maju Abadi will be described as shown below:

1) Quality Control of Raw Materials

   The first step to producing fabrics that are in accordance with company standards is to control raw materials that are desired because the quality of the fabric is largely determined by the fabric supplier. Control of the quality of raw materials will beginby determining fabric quality standards. After going through determining fabric quality standards, the fabric will be distributed to the production process.

2) Process Control

   After going through the stage of determining fabric quality standards, the next process is the production process which is carried out at each stage until the raw material of the fabric becomes a finished product in the form of garment products based on the buyer's specification.

3) Quality Control of Finished Products

   After finished fabric products, quality control of finished products will be carried out. This is done to assess fabric quality in accordance with the standards. Quality control of finished products is determined by the process of inspecting, repairing,and grading. If in the process of quality control of finished products, it is found many defective products, it is necessary to

check the production process. Next, rework is done if the defective product is possible to be repaired. The results of the quality control of the fabric will be evaluated for the next production process. The entire quality of PT. Sandang Asia Maju Abadi products could be sold, the only differencebeing in the price of the product. The better the quality of the product, the more expensive the price of the product.

4.2 House of Risk Phase 1

House of Risk Phase 1 is the initial stage where identification of all risks that could potentially occur in the sewing department of PT. Sandang Asia Maju Abadi is carried out. The data needed in phase 1 is the identification of risk events, assessment of severity, identification of risk agents, assessment of occurrence, and assessment of correlation. These data were obtained through filling out questionnaires and interviews with Mr. Jiman in the Human Resources Department. Then these data will be used as a calculation of the Aggregate Risk Potential (ARP) value so that later you can find out the risk events that must be given priority for preventive action.

4.3 Risk Identification

4.3.1 Identification of Risk Events and Risk Agents

From the results of interviews and filling out questionnaires with company experts, 10 risk events and 10 risk agents were obtained in the production process carried out at the Sewing Department.

The following are 10 risk events that appear in the Sewing Department:

1. Wrong material selection.
2. Work accident.
3. The production target was not achieved.
4. Un-cut off thread.
5. Label and embroidery disposition.
6. Broken stitch.
7. Stain detected on the product (dirty).
8. Runoff stitching.
9. Puckering.

10. Inconsistent SPI (Stitch per inch).

The following are the 10 Risk Agents that appear in the Sewing Department:

1. Inaccuracy communication from warehouse department.
2. Worker negligence in implementing K3 (OSH).
3. Workers low performance under expected capacity.
4. Workers are not careful in checking uncut off threads.
5. Lack of maintain the label and embroidery stamp.
6. Poor thread quality.
7. Inconsistency in the operation of the sewing machine.
8. Workers too early released the fabric from the machine.
9. Too much tension of the sewing machine while sewing the product.
10. The performance of the needle tip on the sewing machine is not maximal.

4.3.2 Risk Event Identification

A risk event is an event that has a disruptive impact on ongoing supply chain activities. The risk event is denoted as Ei. Risk events (Ei) are all that result in loss of time, energy, and finances tothe company which can be measured using a severity scale. Severity is the first step to analyzing risk, namely calculating how much the impact or intensity of an event affects operational processes. The severity assessment is carried out by giving a score of one to ten based on the assessment criteria, where the greater the score given, the greater the impact caused by the occurrence of a risk event. The following are the severity assessment criteria:

Table 4. 1 Scale of Severity

Rank	Severity	Description	Criteria
1	No	No effect	Failure forms no effect on the product
2	Very Slight	The risk of causing very little disruption	This form of failure has a very small effect on the product but the effect is not readily apparent
3	Slight	Slight risk of causing slight disruption	The failure form has little effect but can be reworked and is still acceptable

Rank	Severity	Description	Criteria
4	Minor	The risk of causing minor disruption	Very low form of failure, products need to be reworked slightly
5	Moderate	Moderate risk of causing disruption	Low form of failure, products can be reworked
6	Significant	The risk of causing major disruption	Medium form of failure, product needs to be reworked
7	Major	The risk of causing enormous disruption	High form of failure, resulting in products needing major repairs
8	Extreme	The risk of causing very severe disruption	The failure rate is very high, resulting in the product needing very large repairs
9	Serious	The risk of causing serious disruption	Hazardous failure forms, resulting in unworkable products
10	Hazardous	The risk of causing disruptiondangerous	This form of failure is very dangerous, resulting in a highly unworkable product

Based on the above criteria, the following is a risk event table and severity scale obtained from the sewing department of PT. Sandang Asia Maju Abadi:

Table 4. 2 Risk Event Table

Code	Risk Event	Severity
E1	Wrong material selection	7
E2	Work accident	8
E3	Production target did not achieve	7
E4	Un-cut off thread	4
E5	Label and embroidery disposition	6
E6	Broken stitch	5
E7	Stain detected on the product (dirty)	4
E8	Run off stitching	5

Code	Risk Event	Severity
E9	Puckering	6
E10	Inconsistent SPI (Stitch per inch)	7

4.3.3 Risk Agent Identification

At this stage, identification of the causes of risks that occur in the supply flow of the sewing department at PT. Sandang Asia Maju Abadi will be carried out. This assessment is also carried out by giving a score of one to ten. The following are the occurrence assessment criteria:

Table 4. 3 Scale of Occurrence

Rank	Occurrence	Description	Criteria
1	Almost Never	The occurrence of risk causes is almost non-existent	Occurs < 5 times in 6 months
2	Remote	The occurrence of risk causes is almost non-existent	Occurs 5-10 times in 6 months
3	Very Slight	The occurrence of risk causes is very little	Occurs 10-15 times in 6 months
4	Slight	The occurrence of risk causes is few	Occurs 15-20 times in 6 months
5	Low	The occurrence of low-risk causes	Occurs 20-25 times in 6 months
6	Medium	The occurrence of risk causes is moderate	Occurs 25-30 times in 6 months
7	Moderately High	The occurrence of causes of risk is quite high	Occurs 30-35 times in 6 months
8	High	The occurrence of high-risk causes	Occurs 35-40 times in 6 months
9	Very High	The occurrence of risk causes of very high	Occurs 40-45 times in 6 months
10	Almost Certain	The occurrence of a risk cause is almost always happened	Occurs >45 times in 6 months

Based on the criteria in the table above, the following is a table of risk agents and occurrence scale obtained from the sewing department of PT. Sandang Asia Maju Abadi:

Table 4. 4 Risk Agent Table

Code	Risk Agent	Occurrence
A1	Inaccuracy communication from warehouse department	3
A2	Worker negligence in implementing K3 (OSH)	5
A3	Workers low performance under expected capacity	7
A4	Workers are not careful in checking uncut off threads	8
A5	Lack of maintain the label and embroidery stamp	6
A6	Poor thread quality	4
A7	Inconsistency in the operation of the sewing machine	4
A8	Workers too early released the fabric from the machine	5
A9	Too much tension of sewing machine while sewing the product	7
A10	The performance of the needle tip on the sewing machine is not maximal	5

4.3.4 Correlation Identification

The next assessment is to identify the correlation between the risk event and the risk agent.The relationship between risk agents and other risk events is identified and given a value of 0,1, 3 or 9 as a sign of each relationship/combination that is obtained from experts. The correlationlevels table will be described as follows:

Table 4. 5 Correlation Level

Weight	Criteria
0	No Correlation
1	Low Correlation
3	Moderate Correlation
9	High Correlation

The following table delivers the results of identifying the correlation level of 1each risk event and risk agent at sewing department of PT. Sandang Asia Maju Abadi:

Table 4. 6 Risk Event and Agent Correlation

Risk Event	Correlation	Risk Agent
E1	0	
	1	A7, A9
	3	A1, A3
	9	A6
E2	0	
	1	A4, A8, A9, 10
	3	A2
	9	A3
E3	0	
	1	A1, A6
	3	A7
	9	A2, A3, A9
E4	0	
	1	A6, A9
	3	A3
	9	A4, A5, A10
E5	0	
	1	
	3	A3, A8, A9, A10
	9	
E6	0	
	1	
	3	A4, A8
	9	A3, A6, A9, A10

Risk Event	Correlation	Risk Agent
E7	0	
	1	
	3	A3, A7
	9	
E8	0	
	1	A4
	3	A9, A10
	9	A3, A8
E9	0	
	1	A3, A8
	3	A9, A10
	9	
E10	0	
	1	A3
	3	A9, A10
	9	

4.3.5 Aggregate Risk Potentials Calculation

After assessing severity, occurrence, and also the correlation between risk events and risk agents, the next step is to calculate the Aggregate Risk Potentials (ARP) values. Calculation of aggregate risk potential which aims to find out the priority risks that will be given treatment or mitigation. The formula for determining the aggregate risk potential (ARP) value is as follows:

$$ARP_j = O_j \Sigma S_i R_{ij} \quad (4.1)$$

Description:

ARP_j = Aggregate Risk Potential

O_j = Possibility of occurrence of risk agent

S_i = Severity of influence if risk event

R_{ij} = Correlation between risk agent and risk events

Therefore, this is Aggregate Risk Potentials calculation as follows:

Table 4. 7 Aggregate Risk Potential Calculation

Aggregate Risk Potential	Calculation Result
	= O1 (Σ Si Ri1)
ARP_1	= 3 x [(7x3)+ (7x1)]
	= **84**
	= O2 (Σ Si Ri2)
ARP_2	= 5 x [(8x3)+(7x9)]
	= **435**
	= O3 (Σ Si Ri3)
ARP_3	= 7 x [(7x3)+(8x9)+(7x9)+(4x3)+(6x3)+(5x9)+(4x3)+(5x9)+(6x3)+(7x1)]
	= **2191**
	= O4 (Σ Si Ri4)
ARP_4	= 8 x [(8x1)+(4x9)+(5x3)+(5x1)]
	= **512**
	= O5 (Σ Si Ri5)
ARP_5	= 6 x [(4x9)]
	= **216**
	= O6 (Σ Si Ri6)
ARP_6	= 4 x [(7x9)+(7x1)+((4x1)+(5x9)]
	= **476**
	= O7 (Σ Si Ri7)
ARP_7	= 4 x [(7x1)+(7x3)+(4x3)]
	= **160**
	= O8 (Σ Si Ri8)
ARP_8	= 5 x [(8x1)+(6x3)+(5x3)+(5x9)+(6x3)]
	= **520**
ARP_9	= O9 (Σ Si Ri9)
	= 7 x [(7x1)+(8x1)+(7x9)+(4x1)+(6x3)+(5x9)+(5x3)+(6x9)+(7x3)]
	= **1642**
	= O10 (Σ Si Ri10)
ARP_{10}	= 5 x [(8x1)+(4x9)+(6x3)+(5x9)+(5x3)+(6x9)+(7x3)]
	= **985**

In this House of Risk phase 1, there is a table containing ARP calculations which is the final stage in identifying risks. This table contains the severity value of the risk event, the occurrence value of the risk agent, and the correlation between the risk agent and the risk event obtained from the results of interviews with the production department experts. In addition, there is a ranking of risk agents that will be prioritized to be given a mitigation strategy for this risk.

The following table HOR phase 1 performs calculations to obtain risk agent priority based on the highest to lowest value of the aggregate risk potential:

Table 4. 8 House of Risk Phase 1

Risk Event (E_i)	Risk Agent (A_j)										Risk Event Severity (S_i)
	A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**	**A10**	
E1	3	0	3	0	0	9	1	0	1	0	7
E2	0	3	9	1	0	0	0	1	1	1	8
E3	1	9	9	0	0	1	3	0	9	0	7
E4	0	0	3	9	9	1	0	0	1	9	4
E5	0	0	3	0	0	0	0	3	3	3	6
E6	0	0	9	3	0	9	0	3	9	9	5
E7	0	0	3	0	0	0	3	0	0	0	4
E8	0	0	9	1	0	0	0	9	3	3	5
E9	0	0	3	0	0	0	0	3	9	9	6
E10	0	0	1	0	0	0	0	0	3	3	7
Agent J Occurrence (O_j)	3	5	7	8	6	4	4	5	7	5	
Aggregate Potential j	84	435	2191	512	216	476	160	520	1645	985	
Agent Priority Rank	10	7	1	5	8	6	9	4	2	3	

Based on the table above, the following is the sequence of results from the Aggregate Risk Potential calculation:

Table 4. 9 Aggregate Risk Potential Rank

Rank	Risk Agent Code	ARP
1	A3	2191
2	A9	1645
3	A10	985
4	A8	520
5	A4	512
6	A6	476
7	A2	435
8	A5	216
9	A7	160
10	A1	84

4.3.6 Risk Evaluation Prioritizing using the Pareto Diagram

This risk evaluation aims to determine the dominant risk agent to be handled based on the aggregate risk potential value that has been previously processed. This risk evaluation will be carried out using a Pareto diagram. In the Pareto diagram, a data classification will be sorted from left to right based on the highest order to the lowest. According to Caesaron & Tandianto (2014), a Pareto diagram is created using the cumulative percentage of each ARP from the risk agent. With the 80:20 concept, it is expected that by improving 20% of the dominant risk sources, it can minimize 80% of other risk sources. The following is a Pareto diagram showing the most dominant risk agents:

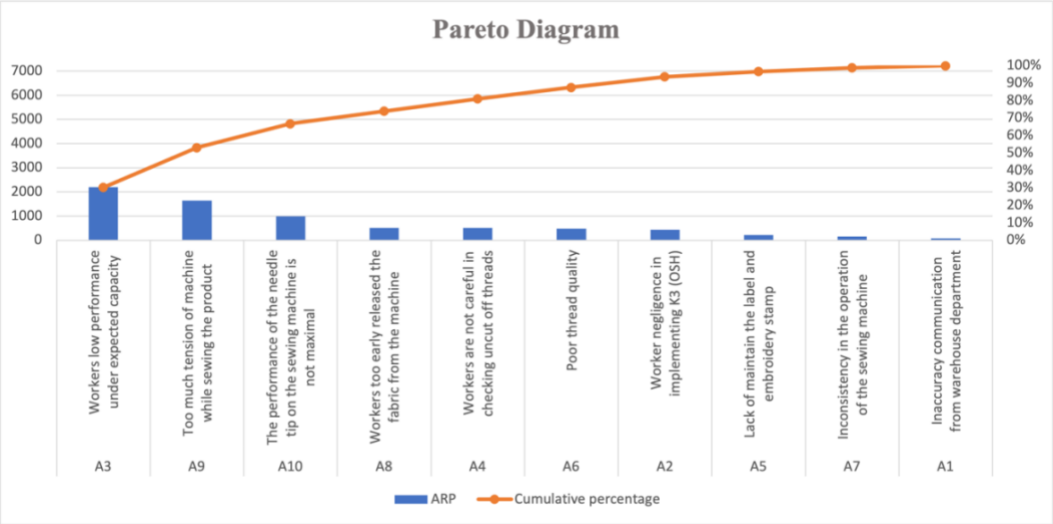

Figure 4. 6 Pareto Diagram

Table 4. 10 Risk Agent Category

Risk Agent Code	ARP	Percentage ARP	Percentage Cumulative	Category
A3	2191	30%	30%	Priority
A9	1645	23%	53%	
A10	985	14%	67%	Non - Priority
A8	520	7%	74%	
A4	512	7%	81%	
A6	476	7%	88%	
A2	435	6%	94%	
A5	216	3%	97%	
A7	160	2%	99%	
A1	84	1%	100%	

It can be seen from the figure above, that of the 10 risk agents that cause the risk of occurrence at PT. Sandang Asia Maju Abadi are Workers low performance under expected capacity (A3) and too much tension of sewing machine while sewing the product (A9), which has a percentage of 30% and 53% out of 100%. This risk agent will then become the focus of research to identify the cause of the problem. It is revealed based on the principle that 80% of consequences come from 20% of causes. The essence of Pareto is that a small number of causes can have a large effect. Therefore, in this study, the types of potential hazards with a percentage of 30% and 53% will be the focus of improvement in this study. The two risk agents can be seen in thetable below along with their occurrence and severity values.

Table 4. 11 Risk Agent Dominant

Rank	Code	Risk Agent	ARP	O_j	S_i
1	A3	Workers low performance under expected capacity	2191	7	7
2	A9	Too much tension of machine while sewing the product	1645	7	6

After obtaining a list of selected dominant risk sources (risk agents), the next step is to create a risk map based on the level of risk assessment of the selected risk sources. The level of risk assessment can be seen in the table above. The following is a table of risk assessment levels showing very low to very high levels along with their severity and occurrence values:

Table 4. 12 Level of Risk Maps Determination

Risk Assessment Level		
Level	**Severity**	**Occurrence**
Rare	1-4	1-4
Unlikely	5	5
Possible	6	6
Likely	7-8	7-8
Almost Certain	9-10	9-10

Based on the occurrence and severity values of the selected risk sources, the risk level can be assessed based on conditions before handling the selected risk sources. Table 4.9 below shows the position of the risk source (risk agent) selected from the operational process prior to risk handling. The following is a risk map of the dominant risk agent:

Table 4. 13 Risk Map

Severity	**Occurance**				
	Rare	**Unlikely**	**Possible**	**Likely**	**Almost Certain**
Catastrophic					
Major					
Moderate			**A9**	**A3**	
Minor					
Insignificant					

Based on the risk map in the table above, it can be seen that A9 is in the orange zone with a significant level of risk, which means immediate corrective action must be taken and A3 is in the red zone with a high-risk level, which means immediate action must be taken.

4.4 House of Risk Phase 2

After carrying out the house of risk phase 1, the next stage is the house of risk phase 2. In the house of risk phase 2, the required input is in the form of interviews and discussions with experts. The handling strategy is obtained from the fishbone diagram for each risk source. The figure below is an example of a handling strategy fishbone diagram for risk agents A3 and A9:

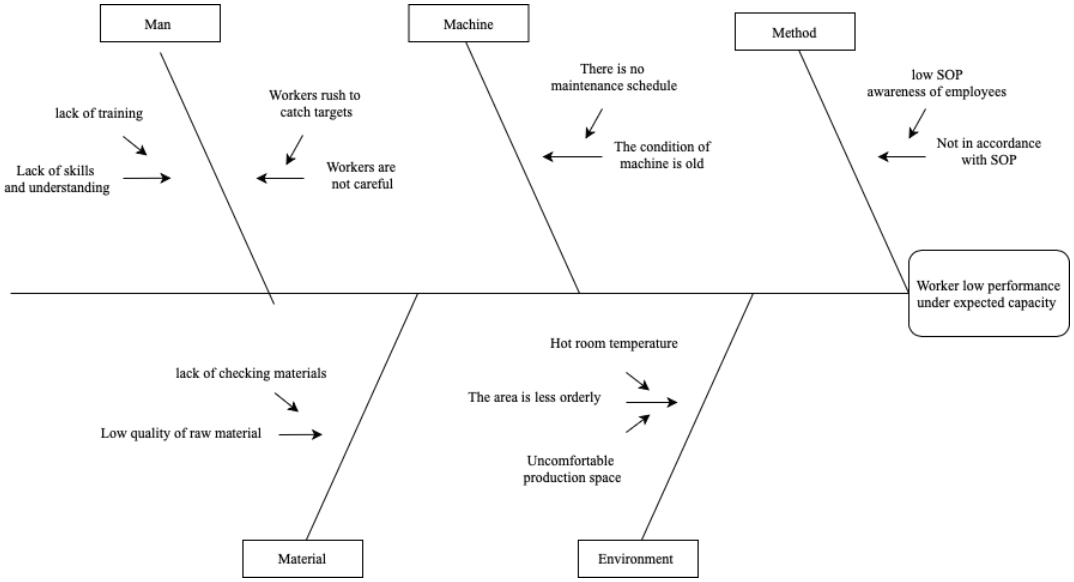

Figure 4. 7 Fishbone Diagram Risk Agent A3

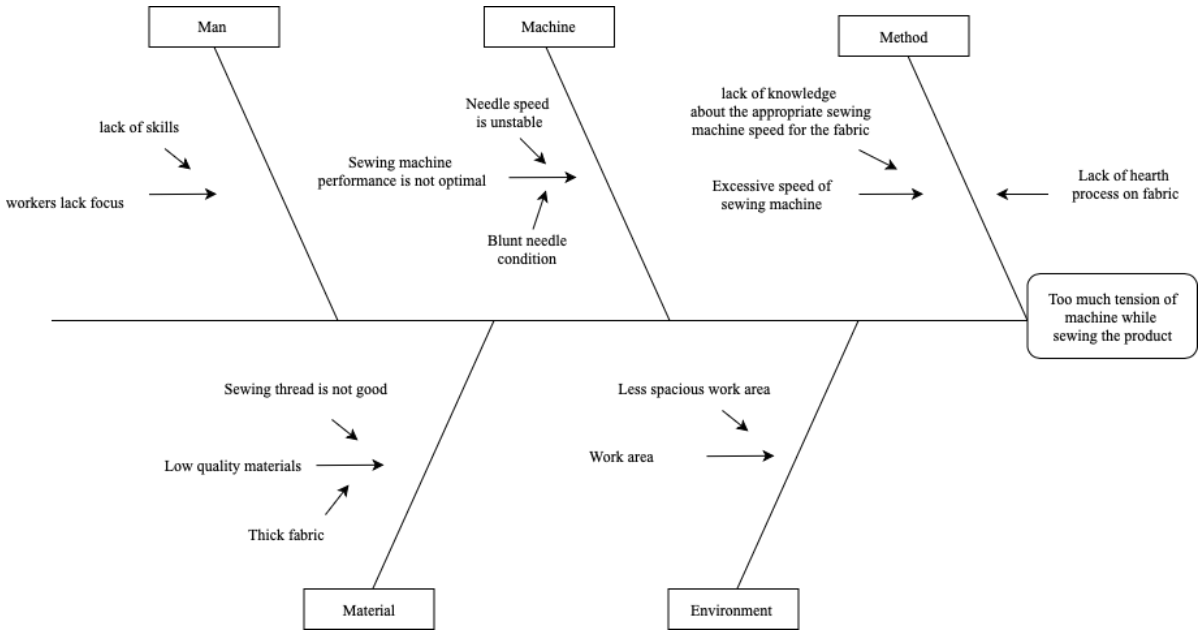

Figure 4. 8 Fishbone Diagram Risk Agent A9

The second stage of the House of Risk is used to determine the most effective risk mitigation to minimize the possibility of risk events based on risk agents. In the previous stage, based on the pareto diagram above, there are two dominant risk agents that will be handled and search for handling strategies using the fishbone diagram. Based on these two risk agents, 5 mitigation actions were obtained. The following is a table of proposed risk mitigation strategies:

Table 4. 14 Preventive Action Table

Preventive Action	Preventive Action Code
Standard Operational Procedure creation	PA1
Worker's skills training and evaluation	PA2
Construct the safety and comfort work environment	PA3
Conduct quality control strictly, effectively and efficiently	PA3
Sewing machine maintenance	PA5

After determining the preventive action table, the next step is determining the correlation betweenthe risk agent that has the priority with the preventive action agent. The correlation will be described in the table as shown below:

Table 4. 15 Risk Agent and Preventive Action Correlation

Risk Agent	Correlation	Preventive Action Code
A3	0	
	1	
	3	PA1, PA2, PA5
	9	PA3, PA4
A9	0	
	1	PA1
	3	PA4, PA5
	9	

The next step that must be carried out is to measure the correlation value between the mitigation strategy and the selected risk agent. The following is a table of degrees of difficulty along with

weighting values and descriptions of mitigation actions that will be applied, both easy, somewhat easy and difficult:

Table 4. 16 Degree of Difficulty Explanation

Quality	Explanation
3	The action of mitigation is easy to be applied
4	The action of mitigation is quite difficult to be applied
5	The action of mitigation is difficult to be applied

The following table lists the treatment strategies obtained according to the priority of the risk agent determined from the aggregate risk potential value:

Table 4. 17 Degree of Difficulty Preventive Action

Preventive Action	Preventive Action Code	Degree of Difficulty (Dk)
Standard Operational Procedure creation	PA1	3
Worker's skills training and evaluation	PA2	4
Construct the safety and comfort work environment	PA3	5
Conduct quality control strictly, effectively, and efficiently	PA4	4
Sewing machine maintenance	PA5	4

After determining the treatment strategy and assessing the degree of difficulty (Dk), the next step is to find a strong relationship between the treatment strategy and the existing sources of risk. After the strong value of the relationship is obtained, the next step is to calculate the Total Effectiveness (TEk) value, namely how effective the handling strategy is applied. After that, calculate the Efficiency to Difficulty (ETDk) ratio by dividing the results of Total Effectiveness (TEk) by the Degree of Difficulty (Dk). Once the Effectiveness to Difficulty (ETDk) value is known, the priority ranking of the existing treatment strategies can be identified. The following is the formula used to determine the total effectiveness value:

$$TE_k = \Sigma\, ARP_j \cdot E_{jk} \quad (4.2)$$

$$ETD_k = TE_k \,/\, D_k \quad (4.3)$$

Description:

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

D_k = Degree of Difficulty

The following is an example of calculating TE_k (total effectiveness) and ETD_k (effectiveness to difficulty). For complete results can be seen in the table.

$TE_k = \Sigma\, ARP_j \cdot E_{jk}$

TE_1 = (2191 x 3) + (1645 x 1)

= 8218

$ETD_k = TE_k \,/\, D_k$

ETD_k = 8218 / 3

= 2739,3

Phase 2 HOR calculations of sewing department at PT. Sandang Asia Maju Abadi can be seen in the table below.

Table 4. 18 House of Risk Phase 2

Risk Agent (Ei)	**Preventive Action (PA)**					**ARP**
	PA1	**PA2**	**PA3**	**PA4**	**PA5**	
A3	3	3	9	9	3	2191
A9	1	0	0	3	3	1645
Total Effectiveness of Action k	8218	6573	19719	24654	11508	
Degree of Difficulty Preventive Action	3	4	5	4	4	
Effectiveness of Difficulty Ratio	2739,3	1643,3	3943,8	6163,5	2877	
Rank of Priority	4	5	2	1	3	

After arranging the House of Risk Phase 2 Table, we could determine the rank of mitigation from the preventive action to be prioritize as shown below:

Table 4. 19 Sequence of Mitigation Priorities

Code	Preventive Action	ETD_k	Rank of Priority
PA4	Conduct quality control strictly, effectively and efficiently	6163,5	1
PA3	Construct the safety and comfort work environment	3943,8	2
PA5	Sewing machine maintenance	2877	3
PA1	Standard Operational Procedure creation	2739,3	4
PA2	Worker's skills training and evaluation	1643,3	5

Based on table above, we could get the result that from 5 mitigation strategies that will be applied, it can be obtained that conduct quality control strictly, effectively, and efficiently as the highest score of ETD 6163,5, followed by construct the safety and comfort work environment with ETD 3943,8, then sewing machine with ETD 2877, standard operational procedure creation with ETD 2739,333, and the last is workers skills training and evaluation with the lowest value of ETD, which is 1643,25.

CHAPTER V

DISCUSSION

5.1 Risk Identification Analysis at PT. Sandang Asia Maju Abadi

At PT. Sandang Asia Maju Abadi there are 7 departments, namely the warehouse department, sample and pattern department, cutting department, sewing department, laundry department, finishing department, and quality control department. The production process begins with the fabric being cut according to the pattern that has been made by the sample and pattern department. This stage is carried out by the cutting department. After the fabric is cut according to the pattern, the fabric is sewn by all sewing department employees following the existing pattern and sample. At the end of the sewing section there is a quality control section that will decide and check whether the stitching results can follow the next stage or not, if feasible then a sanding process is carried out to smooth the stitches. Furthermore, the stitches will go through the washing process with a rinsing machine by adding soap, softening agent, and others.After leaving the rinsing machine, a draining process is carried out to wait for the water contained in the fabric to be removed by the drying machine. Once dry, the next step is packaging by ironing and attaching buttons while checking the quality again. Once it has passedthe quality test, the product will be packaged by the packaging department and the production process will be declared complete. After observing, it was found that the sewing department was the core of all activities in the company. If the company is not serious about paying attentionto this department, the company cannot sell goods and get income from sales.

5.2 House Of Risk (HOR) Analysis Phase 1

The risk identification process at PT. Sandang Asia Maju Abadi was carried out from March to April through observations, interviews and discussions with experts. Based on this, it is found that there are 10 risk agents and 10 risk events. In House of Risk phase 1, the input obtained is event risk and severity values, risk agent and occurrence values, and correlation values. Then the output obtained is the rank of the risk agent which is obtained from the largest to smallest aggregate risk potential (ARP) value. then the assessment of risk sources with ARP is evaluated using the Pareto diagram. The principle of the Pareto diagram for prioritizing risk sources is to

use a ratio of 80:20, which means that 80% of risk events come from 20% of risk agents. Based on this, it was found that 2 dominant risk agents were selected to handle risks. Priority risk agents who need to handle risks are as follows:

1. Workers' low performance under expected capacity (A3)

   The aggregate risk potential (ARP) value for workers with low performance under expected capacity (A3) is 2191. Workers with low performance under expected capacity are related to the risk of events such as causing production targets not to be achieved which can later cause losses to the company because it can reduce revenue. company and will also have an impact on all fields. Employee performance is an important building block of a company. then it is also related to the risk of work accidents due to physical and mental fatigue, it can cause difficulty concentrating when working and can reduce worker productivity which in turn can lead to inappropriate products and loss of production time which has the effect of adding to company costs.

2. Too much tension on sewing machine while sewing the product (A9)

   The aggregate risk potential (ARP) value for Too much tension while sewing the product (A9) is 1645. Too much tension while sewing the product is related to the risk of damaged stitches or wrinkles which can make the sewing results less than optimal and can cause the thread to break. Therefore, you must pay attention to the sewing machine gear settings and the thickness of the material used. Another effect of too much tension can also cause work accidents due to needle pricks during the sewing process.

5.3 Pareto Diagram Analysis

Based on the Pareto diagram, it is found that the risk agent type of defect with the highest percentage is workers low performance under expected capacity by 30% with an aggregate risk potential of 2191, then too much tension of the machine while sewing the product by 23% with an aggregate risk potential of 1645. Followed by the performance of the needle tip on the sewing machine is not maximal and has a percentage of 14% with an aggregate risk potential of 985. Thenworkers too early released the fabric from the machine has a percentage of 7% with an aggregaterisk potential of 520. then workers are not careful in checking uncut off threads has a percentageof 7% with an aggregate risk potential of 512. Furthermore, poor thread quality has a percentage of 7% with an aggregate risk potential of 476. For worker negligence in implementing K3 (OSH) has a percentage of 6% with an aggregate risk potential of 435,

then the lack of maintaining the label and embroidery stamp has a percentage of 3% with an aggregate risk potential of 216. The risk agent inconsistency in the operation of the sewing machine is 2% with an aggregate risk potential of 160, and finally the inaccuracy of communication fromthe warehouse department is 1% with an aggregate risk potential of 84.

5.4 Fishbone Diagram Analysis

After identifying the percentage of the pareto diagram, the root cause of the problem obtained isanalyzed using a fishbone diagram. It can be seen that the risk agent priority is Workers low performance under expected capacity (A3) and too much tension of sewing machine while sewing the product (A9). There are 5 factors affecting these defects, namely human factors, machine factors, environmental factors, method factors, and material factors. The following are the factors that cause work accidents that occur at PT. Sandang Asia Maju Abadi with the discussion of the fishbone diagram, as follows:

5.4.1 Fishbone diagram analysis on risk agent A3 (Workers low performance under expected capacity)

- Man

  Man is a workforce involved in making sugar at PT. Sandang Asia Maju Abadi. The man factor dramatically influences the quality of the product that will be produced because the crew is the operator who carries out all activities related to the production process. The influencing factors are lack of skill and understanding and workers are less careful in doing their work because they are in a hurry to meet the target. Therefore, it can organize training for workers in order to improve skills.

- Machine

  A machine is a production tool that can make work easier. The influencing factor is the condition of the old sewing machine, which makes workers ineffective because in the process of work this factor is caused by the lack of maintenance of the sewing machine. Then the solution that can be applied is to carry out routine maintenance.

- Method

  The method is a work instruction or order that must be followed in the production process at PT. Sandang Asia Maju Abadi. The root of the problem with this method is that the SOP is not running properly where employees work according to the directions. However, sometimes the directions are not well observed, so the work done is not

maximized. So, the solution is to involve employees in making SOPs and can also evaluate and improve every few months.

- Environment

  The environment is the situation around the company that directly or indirectly affects the company in general and can affect the production process at PT. Sandang Asia Maju Abadi. At PT. Sandang Asia Maju Abadi, the influence of the environment on product rejects is the temperature which is too high for the standard working environment temperature in Indonesia, which is 22-26 ° C, the temperature is too high making the operator sweat too much and affecting focus at work. In an uncomfortable environment, workers will be distracted causing many errors in carrying out the production process. A hot environment can also affect worker productivity. What the company can do to overcome this is to put fans/air conditioners at certain points in order to reduce the existing temperature.

- Material

  Material is everything that the Company uses as an ingredient to be used in the production process at PT. Sandang Asia Maju Abadi. Factors that can affect the quality of raw materials are low. Therefore, the selection of quality raw materials greatly affects the final product. The type of raw material that is not good and the type of yarn that is fragile will greatly affect the final product.

5.4.2 Fishbone diagram analysis on risk agent A9 (Too much tension while sewing the product)

- Man

  Factors that can affect sewing operators are less thorough in the sewing process due to their lack of skill in sewing.

- Machine

  Factors that can affect sewing machine performance are not optimal due to blunt needle and inconsistent needle speed. Therefore, maintenance can be carried out on sewing machines on a routine basis.

- Method

  Factors that can affect excessive speed of sewing machine due to lack of knowledge about the appropriate sewing machine speed for the fabric and lack of hearth process on fabric before sewing process so that the fabric does not wrinkle when sewn.

- Environment

  Factors that can affect less spacious work cause disruption of workers' activities to move so that the work is not maximized.

- Material

  Factors that can influence are low quality materials, namely fragile and not strong stitching threads which result in damage to the stitches on the pants. In addition, the fabric that is too thick also causes the stitching thread to break and is more difficult in the sewing process.

5.5 House Of Risk (HOR) Analysis Phase 2

House of Risk Phase 2 is a continuation of House of Risk Phase 1. In the second phase of House of risk, a handling strategy is created for each dominant risk agent. The output from the second phase of the house of risk is a sequence of risk management strategies. These handling strategies were obtained through interviews and discussions with experts. This risk-handling strategy aims to handle 2 priority risk agents. Based on the house of risk phase 2 data processing, 5 preventive actions or risk management were obtained with codes PA1 – PA5. The following are the priority handling strategies for each selected risk agent:

1. Conduct quality control strictly, effectively, and efficiently (PA4)

   Conduct quality control strictly, effectively, and efficiently aims to produce final products that meet quality standards and are in accordance with consumer expectations and needs and reduce damage or loss to production results based on the cause of the damage. This PA4 handling strategy has a difficulty level of 4 which indicates a medium level of difficulty.

2. Construct a safety and comfortable work environment (PA3)

   Construct a safe and comfortable work environment to support and encourage work because it aims to increase efficiency and productivity in carrying out work. This PA3 handling strategy has a difficulty level of 5 indicating a high level of difficulty.

3. Sewing machine maintenance (PA5)

   Sewing machine maintenance aims to ensure that the sewing machine is always in good condition and avoids unplanned damage. This PA5 handling strategy has a difficulty level of 4 indicating a medium level of difficulty.

4. Standard Operational Procedure Creation (PA1)

Standard Operational Procedure creation aims to standardize the way employees complete work, reduce errors and omissions, and function as a guide to anticipate unexpected situations or circumstances as well as a reference for carrying out work. This PA1 handling strategy has a difficulty level of 3 which indicates a low level of difficulty.

5. Worker's skills training and evaluation (PA2)

   Worker's skill training and evaluation aims to see how successful workers are in carrying out their work activities and assess how well employees carry out their tasks. This PA2handling strategy has a difficulty level of 4 indicating a medium level of difficulty.Worker's skills training aims to improve worker performance. This PA2 handling strategy has a difficulty level of 4 which indicates a medium level of difficulty.

The following is the priority ranking of the 5 handling strategies, namely in order from the highest to the lowest treatment priority ranking as follows:

1. PA4, with an *Effectiveness difficulty performing action* (ETD) value of 6163.5.
2. PA3, with an *Effectiveness difficulty performing action* (ETD) value of 3943.8.
3. PA5, with an *Effectiveness difficulty performing action* (ETD) value of 2877.
4. PA1, with an *Effectiveness difficulty performing action* (ETD) value of 2739.3.
5. PA2, with an *Effectiveness difficulty performing action* (ETD) value of 1643.3.

CHAPTER VI

CONCLUSION AND SUGGESTIONS

6.1 Conclusion

Based on the results of analysis and data processing performed, the following conclusions are obtained:

1. There are 10 risk events and 10 risk agents that have been identified in the sewing department at PT. Sandang Asia Maju Abadi. Where from the 10 risk agents there is a dominant t2 risk agent. The two dominant risk agents are Workers with low performance under expected capacity (A3) and too much tension the in sewing machine while sewing the product (A9).
2. Risk mitigation strategies that can be implemented by PT. Sandang Asia Maju Abadi are based on 2 dominant risk agents with 5 mitigation actions. The five mitigation actions are to Conduct quality control strictly, effectively, and efficiently (PA4), Construct a safe and comfortable work environment (PA3), Sewing machine maintenance (PA5), Standard Operational Procedure creation (PA1), and Worker's skills training and evaluation (PA2).

6.2 Suggestions

The suggestions that can be given for further research and for PT. Sandang Asia Maju Abadi are as follows:

1. The suggestion for the company, it can implement and consider the proposed mitigation strategy provided and can pay attention and make careful improvements to therisks that may occur to avoid losses and minimize the occurrence of risks.
2. Suggestions for future researchers, it is recommended to conduct research on each business process as a whole and linked to each process and the impact of environmental aspect risks.
3. There was only one company expert interviewed for this study. In order to achieve results that more accurate to the current situation, future research is anticipated to use an increase in the number of respondents.

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ATTACHMENT