

**ENTERPRISE RISK MANAGEMENT ON MSMES CREATIVE T-SHIRT
PRODUCTION IN BANTUL AREA, YOGYAKARTA USING HOUSE OF RISK
AND ROOT CAUSE ANALYSIS METHODS**

Thesis

Submitted to International Program
Department of Industrial Engineering
The Requirements for the Degree of
Sarjana Teknik Industri
at
Universitas Islam Indonesia



By
Farhan Muhammad (16522238)

**INTERNATIONAL PROGRAM
DEPARTMENT OF INDUSTRIAL ENGINEERING
UNIVERSITAS ISLAM INDONESIA
YOGYAKARTA
2022**

AUTHENTICITY STATEMENT**AUTHENTICITY STATEMENT**

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in the paper and intellectual property rights, then I am willing to get a diploma that I have received to be withdrawn by the Islamic University of Indonesia.

Yogyakarta, 28th March 2022



(Farhan Muhammad)

**ENTERPRISE RISK MANAGEMENT ON MSMEs CREATIVE T-SHIRT
PRODUCTION IN BANTUL AREA, YOGYAKARTA USING HOUSE OF RISK
AND ROOT CAUSE ANALYSIS METHODS**

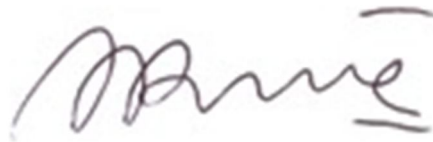
THESIS

By

Name : Farhan Muhammad

Student Number : 16522238

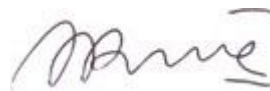
Yogyakarta, March 28th, 2022

A handwritten signature in dark ink, appearing to read 'Elisa', with a horizontal line above and below the main script.

(Dr. Ir. Elisa Kusrini, M.T., CPIM ., CSCP.)

THESIS APPROVAL OF EXAMINATION COMMITTEE**ENTERPRISE RISK MANAGEMENT ON MSMEs CREATIVE T-SHIRT
PRODUCTION IN BANTUL AREA, YOGYAKARTA USING HOUSE OF RISK AND
ROOT CAUSE ANALYSIS METHODS****THESIS****By****Name : Farhan Muhammad****Student Number : 16522238**

**Has been defended in front of the Examination Committee in Partial Fulfillment
of the Requirement for Bachelor Degree of Industrial Engineering Department
Universitas Islam Indonesia**

Examination Committee**Dr. Ir. Elisa Kusrini, M. T., CPIM., CSCP.****Examination Committee Chair****Winda Nur Cahyo, S.T., M. T., Ph. D.****Member I****Bambang Suratno, S.T., M. T., Ph. D.****Member II****Acknowledged by,**

**Head of Undergraduate Program Department of Industrial
Engineering Faculty of Industrial Technology**



(Dr. Fauziq Immawan, ST., MM.)

DEDICATION

This thesis is dedicated to my beloved parent, Mr. Benni Irsan and Mrs. Nike Rachmina Saphira, who always give me affection and prayers that make me able to through all these journeys.

This thesis also would not be possible to be completed without the assistance of my supervisor,

Dr. Ir. Elisa Kusriani, M.T., CPIM., CSCP.

MOTTO

QS. Taha: 25 - 28

رَبِّ اشْرَحْ لِي صَدْرِي، وَيَسِّرْ لِي أَمْرِي، وَاحْلُلْ عُقْدَةً مِنْ لِسَانِي، يَفْقَهُوا قَوْلِي

“My Lord! Uplift my heart for me, and make my task easy, and remove the impediment from my tongue so people may understand my speech”

PREFACE

Assalamu’alaikum Warahmatullahi Wabarakatuh

Al-hamdu lillahi rabbil 'alamin and Gratitude are presented to Allah the Highest, Glory to Allah Unending, The Exalted, Who granted me the primary inspiration and stamina all along to complete this thesis in acquiring the degree of Sarjana Teknik, entitled “Enterprise Risk Management on MSMEs Creative T-shirt Production in Bantul Area, Yogyakarta Using House of Risk and Root Cause Analysis Methods”. Also, by Blessing of His grace, this thesis project in the Creative T- shirt Production MSMEs cluster in Bantul can be completed.

The assistance, guidance, support and lots of help, either directly or indirectly, from some parties involved. Therefore, thank you to those who have constantly been sending supports and motivation to complete of this thesis report. The author would like to thank:

1. Prof. Dr. Ir. Hari Purnomo, M.T. as the Dean of Faculty of Industrial Technology.
2. Muhammad Ridwan Andi Purnomo, S.T., M.Sc., Ph.D. as Head of the Department of Industrial Engineering, Faculty of Industrial Technology, Universitas Islam Indonesia.
3. Dr. Taufiq Immawan, S.T., M.M. as the Head of Undergraduate Program Department of Industrial Engineering Faculty of Industrial Technology Universitas Islam Indonesia.
4. Dr. Ir. Elisa Kusriani, M.T., CPIM. , CSCP. the supervisor who provides me the way in the time of confusions and bestows our knowledge to complete this report.
5. My parents who have prayed and given encouragement and moral and material support during the process of completion.
6. Mrs. Devy, as the International Program administrator who patiently help the IP students, especially the author.
7. Fathul Jannah, Muhammad Kais, Sriningsih, Asmar Hanif, and Nurul Islah as the representative of Saputra Bordir, Kedaton Tailor & Konveksi, Az Zahra Batik, Nine Konveksi, and Ayu Konveksi respectively who have supported and participated in this research.

8. All parties who cannot be mentioned one by one by Author for the assistance in completing this Undergraduate Thesis.

The author realizes that there are still shortcomings as well as weaknesses in this report, so the suggestions and criticisms are fully expected. The author hopes this report would bring advantages for everyone who reads this.

Waasalamu'alaikum Warahmatullahi Wabarakatuh

Yogyakarta, March 28th 2022



FARHAN M

(Farhan Muhammad)

ABSTRACT

The economy in Indonesia cannot be separated from the role of MSMEs. MSMEs have a significant role in the country's economic growth, which is shown by the ability to absorb 97% of the total workforce and collect up to 60.4% of the total investment. Meanwhile, in Yogyakarta, MSMEs contributed 95% to the economic growth of Yogyakarta city. Bantul region, as the largest MSME contributor to Yogyakarta, can rise up by relying on the Creative textile MSME sector, which is growing rapidly in this modern era. However, obstacles in the form of risk are often an obstacle for MSMEs in carrying out the production process on a daily basis. Therefore, this research aims to map any constraints or risks that may occur along the production line and hinder the production process. House of Risk (HOR) method will determine the rank of risk. Then the causes of the risk priority as the House of Risk method output will be identified by using Root Cause Analysis which are why - why analysis and fish bone diagram. The result reveals 7 priority risk agents, and 7 priority handling strategies are generated as the possible solutions.

Keywords: Risk, Risk Management, HOR, Why – Why Analysis, Fishbone Diagram

TABLE OF CONTENTS

AUTHENTICITY STATEMENT	ii
DEDICATION	iv
MOTTO	vi
PREFACE	vii
ABSTRACT	ix
TABLE OF CONTENTS	x
LIST OF TABLES	xiii
LIST OF FIGURES	xv
CHAPTER I	1
INTRODUCTION	1
1.1 Background	1
1.2 Problem Formulation	4
1.3 Research Purposes	4
1.4 Research Limitations	4
1.5 Research benefits	5
1.6 Research State of Art	5
1.7 Systematical Writing	6
CHAPTER II	8
LITERATURE REVIEW	8
2.1 Inductive Study	8
2.2 Deductive Study	11
2.2.1 Risk	11
2.2.2 Risk Management	11
2.2.3 Enterprise Risk Management	12
2.2.4 House of Risk (HOR)	12
1. HOR 1 (First Phase)	13
2. HOR 2 (Second Phase)	13
2.2.5 Pareto Chart	14
2.2.6 Root Cause Analysis	14
2.2.7 Why - Why Analysis Method	14
2.2.8 Cause – and – Effect Diagram (Fishbone Diagram)	14
CHAPTER III	16
RESEARCH METHOD	16

3.1	Research Subject	16
3.2	Research Flow	16
3.3	Data Collection Method.....	20
CHAPTER IV		21
DATA COLLECTING AND PROCESSING		21
4.1	Data Collecting.....	21
4.1.1	T – Shirt Production MSMEs Profile.....	21
4.1.2	MSMEs Production Process Mapping	25
4.2	Data Processing (House of Risk Phase 1)	27
4.2.1	Risk Event Identification.....	27
4.2.2	Risk Agent Identification	32
4.2.3	Correlation Level	38
4.2.4	House of Risk Phase 1 Matrix	38
4.2.5	Risk Evaluation	48
4.3	Data Processing (Root Cause Analysis).....	49
4.4	Data Processing (HOR Phase 2).....	58
4.4.1	Mitigation Strategy Design	58
4.4.2	Correlation Identification	60
4.4.3	Degree of Difficulty (D_k) and Total Effectiveness (TE_k).....	61
CHAPTER V		65
DISCUSSION		65
5.1	Business Processes in Textile Creative T-shirts Production MSMEs.....	65
5.2	Risk Event Identification	66
5.3	Risk Agent Identification.....	69
5.4	Risk Event and Risk Agent Correlation.....	71
5.5	House of Risk Phase 1 Analysis.....	72
5.6	Risk Evaluation	72
5.7	Root Cause Analysis.....	73
1.	Standard Operating Procedure (SOP) for workers not going well	73
2.	Human Error.....	73
3.	Inaccuracy in Production Planning.....	73
4.	Miscommunication with The Suppliers	73
5.	Lack of Supervising Towards the Worker	74
6.	Workers Have Less Expertise	75
7.	Machine Maintenance Planning Error	75
5.8	House of Risk Phase 2 Analysis.....	75

5.9	Mitigation Proposal Implementation Design	77
5.9.1	Organize and Complete the Standard Operating Procedures (SOPs) in written form	77
5.9.1.1	Procurement Process	77
5.9.1.2	Warehousing.....	80
5.9.1.3	Early Stage Quality Control	82
5.9.1.4	Patterning and Cutting.....	84
5.9.1.5	Sewing Process (Regular & Over-lock Sewing).....	87
5.9.1.6	Finishing (Over-deck & Chain Sewing).....	90
5.9.1.7	Final Stage Quality Control.....	93
CHAPTER VI		96
CONCLUSION AND RECOMMENDATION.....		96
6.1	Conclusion	96
6.2	Recommendation.....	96
REFERENCES.....		98
APPENDIX.....		102

LIST OF TABLES

Table 4. 1 Saputra Bordir and Ayu Konveksi Production Process Mapping	25
Table 4. 2 Kedaton Tailor & Konveksi, Az Zahra Batik & Modiste and Nine Konveksi Production Process Mapping	26
Table 4. 3 Saputra Bordir Risk Event.....	28
Table 4. 4 Kedaton Tailor & Konveksi Risk Event	29
Table 4. 5 Az Zahra Batik & Modiste Risk Event	30
Table 4. 6 Nine Apparel Risk Event.....	31
Table 4. 7 Ayu Konveksi Risk Event	32
Table 4. 8 Saputra Bordir Risk Agent	33
Table 4. 9 Kedaton Tailor & Konveksi Risk Agent.....	34
Table 4. 10 Az Zahra Batik & Modiste Risk Agent.....	35
Table 4. 11 Nine Apparel Risk Agent	36
Table 4. 12 Ayu Konveksi Agent.....	37
Table 4. 13 Correlation Level Scale.....	38
Table 4. 14 House of Risk Phase 1 of Saputra Bordir.....	40
Table 4. 15 House of Risk Phase 1 of Kedaton Tailor & Konveksi	41
Table 4. 16 House of Risk Phase 1 of Az Zahra Batik & Konveksi.....	42
Table 4. 17 House of Risk Phase 1 of Nine Konveksi	44
Table 4. 18 House of Risk Phase 1 of Ayu Konveksi	45
Table 4. 19 Total Value of ARP Table.....	46
Table 4. 20 Why – Why Analysis table of SOP for workers not worked	49
Table 4. 21 Why – Why Analysis table of Human Error	50
Table 4. 22 Why – Why Analysis table of Inaccuracy in production planning.....	52
Table 4. 23 Why – Why Analysis table of Miscommunication with the suppliers	53
Table 4. 24 Why – Why Analysis table of Lack of supervising towards the worker	54
Table 4. 25 Why – Why Analysis table of Workers have less expertise.....	55
Table 4. 26 Why – Why Analysis table of Machine maintenance planning error.....	56
Table 4. 27 Root Cause recapitulation	57
Table 4. 28 Table of Mitigation Strategy Design.....	59
Table 4. 29 Table of Mitigation Strategy Correlation.....	60
Table 4. 30 Table of House of Risk Phase 2.....	63

Table 4. 31 Table of Mitigation Priority Rank	64
Table 5. 1 Procurement Process Procedure Description.....	77
Table 5. 2 Procurement Process Disposition Table.....	79
Table 5. 3 Warehousing Procedure Description	80
Table 5. 4 Warehousing Disposition Table	82
Table 5. 5 Early Stage Quality Control Procedure Description.....	83
Table 5. 6 Early Stage Quality Control Disposition Table.....	84
Table 5. 7 Patterning and Cutting Procedure Description	85
Table 5. 8 Patterning and Cutting Disposition Table	86
Table 5. 9 Sewing Process Procedure Description.....	87
Table 5. 10 Sewing Process Disposition Table.....	89
Table 5. 11 Finishing Process Procedure Description.....	90
Table 5. 12 Finishing Process Disposition Table.....	92
Table 5. 13 Final Stage Quality Control Procedure Description	93
Table 5. 14 Final Stage Quality Disposition Table	95

LIST OF FIGURES

Figure 1. 1 Data of Micro, Medium and Small Enterprises (MSMEs) in Indonesia	2
Figure 1. 2 Data of Micro, Medium and Small Enterprises (MSMEs) in Yogyakarta	2
Figure 3. 1 Research Flow.....	17
Figure 4. 1 Saputra Bordir Location.....	22
Figure 4. 2 Kedaton Tailor & Konveksi Location	22
Figure 4. 3 Az Zahra Batik & Modiste Location	23
Figure 4. 4 Nine Apparel Location.....	24
Figure 4. 5 Ayu Konveksi Location.....	24
Figure 4. 6 The example of Fishbone Diagram of Risk Agent Process Plan	33
Figure 4. 7 Pareto Chart of Risk Evaluation.....	48
Figure 4. 8 Fishbone Diagram of SOP not worked.....	50
Figure 4. 9 Fishbone Diagram of Human Error.....	51
Figure 4. 10 Fishbone Diagram of Inaccuracy in production planning.....	52
Figure 4. 11 Fishbone Diagram of Miscommunication with the suppliers	54
Figure 4. 12 Fishbone Diagram of Lack of supervising towards the worker	55
Figure 4. 13 Fishbone Diagram of Worker have less expertise.....	56
Figure 4. 14 Fishbone Diagram of Machine maintenance planning error.....	57
Figure 4. 15 Example of Fishbone Diagram of Mitigation strategy	59
Figure 5. 1 Procurement Process Flowchart.....	79
Figure 5. 2 Warehousing Flowchart	82
Figure 5. 3 Early Stage Quality Control Flowchart	84
Figure 5. 4 Patterning and Cutting Flowchart.....	86
Figure 5. 5 Sewing Process Flowchart	89
Figure 5. 6 Finishing Process Flowchart	92
Figure 5. 7 Final Stage Quality Control Flowchart.....	95

CHAPTER I

INTRODUCTION

1.1 Background

The economy in Indonesia cannot be separated from the role of MSMEs. MSMEs are part of the national economy that is self-reliant and has great potential to improve people's welfare. MSMEs have a significant role in the country's economic growth. The importance level of MSME in Indonesia is closely related to the fact that Indonesia is a developing country with 271 million people of overall populations (Worldometers, 2019). With the presence of a large population and large natural resources, those facts make Indonesians compete to take advantage of the essence of the wealth outcomes to build their own jobs rather than searching for work because Indonesian society is aware of the competition in looking for a job has become global-scale competition, which means a wider and more stringent scope since the establishment of the ASEAN Economic Community (AEC) (Hartono, 2015). Following this background, a major community emerged that created Micro Small Medium Enterprise (MSME) which in turn makes a significant contribution to the Indonesian economy.

Based on data from the Ministry of Cooperatives and SMEs, the number of MSMEs currently reaches 64.19 million, contributing to a GDP of 61.97% or worth 8,573.89 trillion rupiahs. The contribution of MSMEs to the Indonesian economy includes the ability to absorb 97% of the total workforce and collect up to 60.4% of the total investment (BKPM, 2020). Meanwhile in Yogyakarta there are 289,238 MSME in the Special Region of Yogyakarta which recorded by *Dinas Koperasi dan UMKM Yogyakarta* (Dinas Koperasi dan UMKM Yogyakarta, 2018). In terms of influence, MSMEs in Yogyakarta are very significant in helping the government to improve the economic quality of Yogyakarta. In 2016, MSMEs in Yogyakarta contributed 95% to the economic growth of Yogyakarta City with the amount of Micro 55%, Small 25%,

Medium 15%, and Big 5%. The number of MSMEs in Indonesia and Yogyakarta is shown in figure 1.1 and figure 1.2, respectively.

NO	INDIKATOR	SATUAN	TAHUN 2017 ^{*)}		TAHUN 2018 ^{**)}	
			JUMLAH	PANGSA (%)	JUMLAH	PANGSA (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	UNIT USAHA (A+B)	(Unit)	62.928.077		64.199.606	
	A. Usaha Mikro, Kecil dan Menengah (UMKM)	(Unit)	62.922.617	99,99	64.194.057	99,99
	- Usaha Mikro (UMi)	(Unit)	62.106.900	98,70	63.350.222	98,68
	- Usaha Kecil (UK)	(Unit)	757.090	1,20	783.132	1,22
	- Usaha Menengah (UM)	(Unit)	58.627	0,09	60.702	0,09
	B. Usaha Besar (UB)	(Unit)	5.460	0,01	5.550	0,01

Figure 1. 1 Data of Micro, Medium and Small Enterprises (MSMEs) in Indonesia

289238 Mitra UMKM	2574 Mitra Koperasi	1765 UMKM marketHUB	4243 Produk marketHUB
-----------------------------	-------------------------------	-------------------------------	---------------------------------

Figure 1. 2 Data of Micro, Medium and Small Enterprises (MSMEs) in Yogyakarta

Kementerian Koperasi dan UKM Republik Indonesia also stated through the presentation results of the Yogyakarta national coordination meeting regarding the development of MSMEs in the Special Region of Yogyakarta that Bantul area is the central location of the distribution of MSMEs in the Special Region of Yogyakarta by having up to 26% of the total population of DIY MSMEs, which is major compare to any other regions in DIY. Bantul region itself is an area that relies heavily on MSMEs as a source of the regional economy, Budi Wibowo as the temporary executor of the Bantul regional regent, reported by the *Pemerintah Kabupaten Bantul* (2020), stated that saving the MSME business sector, especially the creative industry sector, is very important considering that the sector is growing rapidly and contributes up to 98% of the Bantul economy. This statement is corroborated by Sri Mulyani's statement as the finance minister, as reported by *Tempo* (2020), that the government is trying to encourage the economic sector that "profits" from the current state of the modern economy the example of that is the creative textile industry. The two previous statements show that the creative textile industry MSMEs in Bantul have the potential to improve and maximize the

economic opportunities that exist in this modern era. However, obstacles in the form of risk often happen in MSMEs carrying out day-to-day production process.

Risks are always encountered due to the unpredicted uncertainty, which leads to some losses that must be accepted by business actors. Likewise, for MSMEs where the capital background is not so strong, causing risks that result in operational disruptions and financial losses and even bankruptcy. In this case, several forms of risk control are needed to anticipate potential risks and become an advantage for MSMEs. Gradual, sustainable, and comprehensive risk management is essential to anticipate the occurrence of risks that are harmful to the business process (Ulfah et al., 2016).

Enterprise risk management, or ERM, as a tool, enables organizations to consider the potential impact of all types of risks on their processes, products, services, activities, and stakeholders (Conrad & Yau, 2010). Pujawan and Geraldin (2009) developed a risk management model known as the House of Risk (HOR) approach. The overall step of HOR method approach aims to identify risks and design treatment strategies to reduce the probability of emergence of risk agents by providing preventive measures. Risk agents or risk causes are factors that drive risk. Therefore reducing the risk agent means reducing the incidence of several risk events. As a first step, HOR step 1 will analyze the score of each potential risk that might happen. Furthermore, Root Cause Analysis uses 5 why analysis and fishbone diagram (Ishikawa Diagram) to describe the problem until the simplest cause or root of the problem is found. Then the results from the RCA will be used as a possible solution formulation through the HOR method step 2.

As a conclusion, this study will analyze the potential risks that may occur, the causal relationship that allows the risk to occur and also the possible risk mitigation in the production flow of creative T-shirt production MSMEs located in D. I. Yogyakarta. This research will use the House of Risk (HOR) method, which will determine the rank of risk, later the causes of the risk priority as the House of Risk method output will be identified by using Root Cause Analysis which is aided by 5 why analysis and fishbone diagram. In the end, a combination of potential risks and causes of risk that often arise from various creative T-shirt MSME production in Bantul, Yogyakarta can be produced, which can be used to formulate collective mitigation proposals as possible solutions to potential risks in the creative T-shirt production MSME community in Bantul, Yogyakarta.

1.2 Problem Formulation

Based on various problems in the background, the problem formulations in this study are

1. What are the priority risks on every production flow of creative T – shirt production MSMEs in Bantul, Yogyakarta?
2. What are the mitigations for the majority risk which appear from every production flow of creative T – shirt production MSMEs in Bantul, Yogyakarta?

1.3 Research Purposes

The purposes of this research are to:

1. Determine the priority risks on every production flow of creative T – shirt production MSMEs in Bantul, Yogyakarta
2. Determine what are the mitigations for the majority risk which appear from every production flow of creative T – shirt production MSMEs supply chain in Bantul, Yogyakarta

1.4 Research Limitations

The limitations of the problem specified in this study are

1. This study only examines every creative T – shirt production MSMEs in the area of Bantul, Yogyakarta
2. The scope of research only focuses on enterprise production flow in creative T - shirt MSMEs, specifically from the planning process of raw materials to finished products
3. The creative t-shirt production MSME cluster as the object in this research is assumed to face both challenges in the same market conditions and geographical conditions

1.5 Research benefits

The research benefits obtained from this study are as follows

1. For Researcher

The results of this study are useful for maturing researchers' minds in solving problems in society. This research is used to implement the application of the theories that have been previously obtained during lecture activities to fulfill the graduation requirements for a bachelor's degree in the Islamic University of Indonesia Yogyakarta.

2. For knowledge

This study contributes to the awareness of the urgency of the quality of the internet service provider industry based on customer perceptions as a reference for other companies and potential customers and for further research and development.

3. For the Micro Small Medium Enterprises (MSMEs)

This study contributes to determining improvement proposals that can be applied by the MSMEs so that the so that MSMEs can be helped in terms of improving the quality of the overall business process

1.6 Research State of Art

This research was carried out in several MSMEs producing creative t-shirts in the Bantul area of Yogyakarta so as to form clusters with the aim that the research results can be applied as a whole. The cluster will be analyzed for risk management in the enterprise production flow with the aim of finding the overall dominant risk that occurs in the enterprise production flow of each cluster member and formulating solutions to resolve the problems that occur. In addition to combine the methods and objectives of several existing studies, this research was also carried out in several enterprises in the form of MSMEs so that it became a research that differentiated it from other research. This research will use the core method in the form of the House of Risk Method, which is used to identify possible risk agents based on the ARP (Aggregate Risk Potential) value and the priority of implementing mitigation measures based on the ETD (Effectiveness to Hardy) value. To determine a better mitigation proposal, the fishbone diagram method

was used to analyze the source of each risk agent. However, the causes of certain aspects will be determined using a Pareto diagram to identify which causes should be prioritized.

1.7 Systematical Writing

In order to make this writing and compiling thesis is easy to understand, writing thesis uses the following writing system:

1. CHAPTER I INTRODUCTION

This chapter contains a preliminary description of the research which consists of the background of the problem, formulation of the problem, the objective to be achieved, the benefits of the research, and systematic writing.

2. CHAPTER II LITERATURE REVIEW

This chapter contains the basic concepts and principles needed to solve research problems. In addition, it also contains a description of the results of previous research conducted by other researchers that are related to the research conducted.

3. CHAPTER III RESEARCH METHODOLOGY

This chapter describes the research flowchart and framework, the technique carried out, the model used, the development and development of the model, materials or materials, tools, research procedures. Data to be studied, and the analysis method that will be used.

4. CHAPTER IV DATA COLLECTING AND PROCESSING

This section contains the data obtained during the research and how to analyze the data. The results of data processing are displayed both in the form of tables and graphics. What is meant by data processing also includes analysis carried out on the results obtained. This sub-chapter is a reference for discussing the results that will be written in sub-chapter V, namely the results of the discussion.

5. CHAPTER V DISCUSSION

Discuss the results obtained in the research and the suitability of the results with the research objectives to produce a recommendation.

6. CHAPTER VI CONCLUSION AND SUGGESTION

Contains conclusions on the analysis made and recommendations or suggestions for the results achieved and the problems found during the research, so that recommendations are needed to be studied in further research.

REFERENCES**APPENDIX**

CHAPTER II

LITERATURE REVIEW

2.1 Inductive Study

Inductive studies are information or knowledge obtained from evidence, facts, or any scientific results related to this study that have been and have not been published. The following are several other research linked as follows:

Ahmed, et al (2013) performed research investigating the quality improvement of a garment enterprise in Bangladesh using the Pareto Analysis and Cause-Effect Diagram. The following research aimed to minimize the defects in order to reduce the rework activity and rejection rate. The research findings proved that 78.56% of defects occur in identified top 6 defect positions out of 50 overall positions. Furthermore, there are identified 115 concerning areas that significantly influence 71.40% of defects in total. In the end, some suggestions are provided formulated using a Cause – Effect Diagram as a potential solution to minimize the tendency to have previous defects.

Ahmed & Ahmad (2011) performed research conducted in an electric lamp manufacturing industry with several important raw materials such as Lead in Wire, filament, and cap. The research purposes were to identify defects for corresponding raw materials as a response based on data from 2010 that the company faced a high amount of rejection from raw materials, which was beyond the budget rejection rate of raw materials. Pareto diagram and Cause – and – Effect diagram are used to identify and evaluate various defects and their responsible causes for materials rejection. The analysis found that there are 4 defects responsible for 82.27% of the total defects that lead to raw materials rejection. The analysis of the Cause – and – Effect Diagram then formulated the

final recommendation as a corrective action for the detected appearance of abnormalities based on the root cause of the problem.

Kristanto & Hariastuti (2014) performed the research in PT. Karyamitra Budisentosa which has a supply chain background in leather processing raw materials. The research aims to analyze the potential risks and formulate the possible mitigations for solving the risks. The House of Risk (HOR) model is performed in 2 phases to determine the priority in handling strategy. The first phase will identify the risks and risk agents, followed by measuring the severity and occurrence level for aggregate risk priority (ARP) value. The first phase output is then continued by the second phase, which are the handling risks process. Those processes resulted in 27 identified risks and 52 agents of risks. In order to handle based on research findings, 6 mitigation actions are formulated as the potential solutions for the supply chain potential risks.

Nurlela & Suprpto (2014) conducted research on HOR to identify risk management in multi-storey building infrastructure development projects. The purpose of this study is to identify risks and risk-causing agents in a multi-storey building infrastructure development project and to provide recommendations for handling the most influential risk agents using the House of risk (HOR) method. There were 18 risk events and 12 agents or causes of risk identified. From the calculation results, the most influential risk agent is the resource procurement process has stopped and has not been rescheduled. Mitigation actions that are at the top of the risk response are creating a realistic schedule and establishing a monitoring and sanction system.

Hekmatpanah (2011) performed research which implemented the Cause – and – Effect Diagram in the oil industry in Iran. The main purpose of the research is to implement the Cause – and – Effect Diagram as an instrument for determining the quality management and also to identify the root causes of quality problems. The expected output will be the enhanced quality level of the oil industry compared by before the implementation of the method. In Sepahan Oil Company, a Cause–and–Effect diagram shows how to link possible triggers of a major presenting issue. The company's four-liter production line

was chosen for investigation for this reason. According to the results, using a Cause-and-Effect diagram lowered scraps from 50000 to 5000 ppm, resulting in a 0.92 percent reduction in oil waste.

Magdalena & Vannie (2019) conducted research to determine the potential risk and formulated any potential mitigation in PT. Tatalogam Lestari supply chain. PT. Tatalogam Lestari is a company engaged in the manufacture of roof tiles, mild steel, as well as other roofing accessories. Research carried out over operational activities at the company's L8 Plant with the type of operational risk. The study found 21 risk events and 20 risk agents. On HOR 1 is, measuring the severity of risk events, the occurrence of risk agents, and relationships between risk events and risk agents; and yields an Aggregate Risk Potential value, where found 8 risk agents, which accounted for 80% of the problems in operational activities based on Pareto Diagram. HOR 2 identifies 8 preventive actions and calculates mitigation priorities for anything that a company should do based on the value of the ratio between effectiveness and difficulty implementation of preventive actions.

Nicolae et al. (2015) conducted research on a manufacturing process of a drill with CMS interchangeable plates in order to improve the product quality either for monitoring or measurement of the manufacturing process. A Pareto chart is used to highlight the most common types of defects, as well as the most common causes of defects and customer complaints. The study and execution of corrective and mitigation steps were used to prioritize analyzed defects. It will use the Pareto Analysis to increase the consistency of industrial materials, which helps to keep errors under control and improve production processes. The cutting regime's parameters are adjusted, and operators are trained regularly. Finally, it can be seen that the initial stage defect percentage of 39 percent has been reduced to 31 percent.

Wibowo, et al (2018) conducted research on a construction project of a district office in Solo Regency with the purpose to analyze and evaluate root causes and waste construction material costs. Root Cause Analysis (RCA) is used to identify the root cause of a problem,

meanwhile, Fault Tree Analysis (FTA) method is used as well to determine how much influence each intermediate events cause the top event in percent and be calculated with fault tree analysis's formula. The results are iron and ceramic element become the biggest waste in cost percent, about 12.40 % - 14.50 %. The final solution was to decrease the cost of waste material which was executed best by instruction to the workers and choose the most efficient worker for the truss job.

Benjamin and Murugaiah (2015) conducted a research study that used the lean manufacturing 5-whys analysis technique to reduce or eliminate speed loss in a lean manufacturing setting. The location was found XYZ is based in Malaysia and is part of a multinational corporation headquartered in Europe. The use of the 5-whys analysis technique in the manufacturing business (XYZ Corporation) totally eradicated top speed loss, resulting in a value savings of USD 32,811.5 per year, which has been primarily recognized to improve OEE's quality loss and changeover loss has been demonstrated to be an effective technique to also addressing speed loss; a loss which has been regarded as the most dominating loss among all forms of OEE's losses and the most difficult to eliminate.

2.2 Deductive Study

The deductive study will discuss the theories related to the research. The theories included in the deductive study are risk, risk management, Cause – and – Effect diagram (Fishbone diagram / Ishikawa diagram), the House of Risk (HOR), and Pareto Chart.

2.2.1 Risk

Risk is a possibility that causes deviations or something that is not expected to happen because it can cause losses to the company. Kasidi (2010) believed that "risk is the possibility of deviations from expectations that can cause losses". Hanggraeni (2010) also explains that "risk is an event/event that has the potential to occur that may cause harm to a company". Risk is also defined as the possibility of deviations that can cause losses. This is because risk events can arise at any time. In other words, it cannot be predicted for their occurrences.

2.2.2 Risk Management

According to Siahaan (2009), risk management is a systematic process to manage risk. Regardless of whether the risk is pure or speculation, which can affect the company's ability to achieve its strategic goals. Kot & Dragon (2015) stated that skilled risk management is based on the fact that companies also develop risk management strategies during strategy development. When developing a strategy, the company must indicate risk management objectives, identify risks, take measurements, propose risk mitigation tools, monitor and control risks and create a homogeneous risk management system. In short, risk management is not company-wide oriented, but effectively and efficiently supports the implementation of the developed strategy and captures signals indicating the need to modify assumptions, financial flows, programs, and results. Risk management is applied to reduce, avoid, and accommodate risk through several sequential activities, risk identification, risk measurement, and risk control (Darmawi, 2014).

2.2.3 Enterprise Risk Management

Pranatha, et al (2018) explains that ERM is a systematic and continuous process designed and carried out by management to provide adequate assurance that all risks that have the potential to have a negative impact have been managed in such a way according to the level of risk the company is willing to take. The definition of ERM according to COSO is as a process influenced by company management, which is implemented in every company strategy and designed to provide adequate assurance in order to achieve company goals. Application risk management also aims to identify the company's risk in each activity and measure and overcome it at a certain tolerance level. Definition of Enterprise Risk Management (ERM) is a process that is influenced by the board of directors, and other personnel of an organization applied in a strategic setting and covers the organization as a whole, designed to identify potential events affecting an organization, to provide reasonable assurance regarding the achievement of organizational goals (COSO ERP, 2004).

2.2.4 House of Risk (HOR)

The House of Risk method is focused on the idea that constructive Supply Chain Risk Management should try to concentrate on proactive measures. It is important to classify the risk events as well as the risk agents that are associated with them. HOR model requires assigning the probability to the risk agent and the severity to the risk event. This

model is being used because it differs from other models, which selects high-risk Aggregate Risk Potentials means the risk agent has a high likelihood of occurrence and induces a large number of risk events with serious consequences. Then, based on the ratio of overall effectiveness to level of complexity, mitigation steps for selected risk agents are devised, with the goal of reducing the number of risk agents with high ARP values. Pujawan & Geraldin (2009) stated that HOR is basically divided into two phases:

1. HOR 1 (First Phase)

In the first phase the identification of risk events (E_i) and risk agents (A_j) are being held in order to calculate the severity and occurrence of those variables. The next step of severity and occurrence calculations, a correlation matrix of E_i and A_j is constructed with a specific coefficient which are 0: no correlation, 1: weak correlation, 3: moderate correlation and 9: strong correlation. Furthermore the ARP_j value will be calculated to rate each of A_j value by the using formula:

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

Then a Pareto Diagram of A_j value will be formulated to figure out the priority value of A_j to be selected

2. HOR 2 (Second Phase)

The output value of the first phase will be used as a source to formulate mitigation or preventive action PAk . The PAk value and A_j value then will be correlated by the provisions of 0, 1, 3, and 9. The value of the total effectiveness from each PAk is then calculated with the formula:

$$TEk = \sum (ARP_j \cdot E_{jk})$$

The difficulty degree of application PAk will be measured with a scale of 3: Low, 4: Medium, and 5: High. After that the Effectiveness to difficulty ratio calculation is held by using the formula:

$$ETDk = TEkDk$$

In the end the value of *ETDk* will be used as the based value of *PAk* Priority ranking.

2.2.5 Pareto Chart

The Pareto diagram is a data histogram sorted from greatest frequency to the smallest (Evan & Lindsay, 2007: 87-89), as well also calculated the cumulative. This diagram is helpful for management quickly identifies the most critical areas that need special and prompt attention. A Pareto chart is used to highlight the most common types of defects, as well as the most common causes of defects and customer complaints. The Pareto principle is depicted graphically in the Pareto chart. When analysing events, it is common to find that approximately 80% of the events are caused by 20% of the potential causes (Franch, et al., 2015).

2.2.6 Root Cause Analysis

This study uses the Root Cause Analysis (RCA) method with the help of fishbone diagram tools and 5 why analysis. RCA is a method used to solve problems or discrepancies with the aim of finding the root cause of a problem. The application of the RCA method uses common sense techniques that can produce a systematic, measurable and documented approach to the identification of understanding and resolution of the underlying causes (Vorley, 2008). There are six main points in the RCA method, including: identify the problem, define the problem, understand the problem, identify the root cause, corrective action, and monitor the system.

2.2.7 Why - Why Analysis Method

It is a structured approach where asking why questions repeatedly to understand the cause of a problem, generate effective corrective actions to reduce an incident and prevent an accident from happening. The results obtained at this stage will be processed on a fishbone diagram.

2.2.8 Cause and Effect Diagram (Fishbone Diagram)

Fishbone diagram (also called Ishikawa diagrams or cause-and-effect diagrams) is a graphical technique to show the several causes of a specific event or phenomenon. In

particular, a fishbone diagram (the shape is similar to a fish skeleton) is a common tool used for a cause and effect analysis to identify a complex interplay of causes for a specific problem or event (Coccia, 2017). In reality, this Cause and Effect Analysis was created as a quality management method to identify possible factors causing an overall effect, such as product design and quality defect prevention. . Each cause contributes to the variance of the phenomenon under investigation. Is it also designated to classify the overall sources of variation that contribute to a key impact, causes are normally grouped into major categories. In general, the Fishbone diagram can be used as an appropriate visual representation of phenomena that involve the investigation of multiple cause-and-effect factors and how they inter-relate (Ayverdia et al., 2014).

CHAPTER III

RESEARCH METHOD

3.1 Research Subject

The main study of this research is the potential risks that occur in the production flow of MSMEs producing creative t-shirts. The object of the research is a cluster of creative t-shirt production MSMEs located in Bantul Regency, DIY. Members of the cluster include Saputra Bordir, Kedaton Tailor & Konveksi, Az Zahra Batik & Modiste, Nine Apparel, and Ayu Konveksi.

3.2 Research Flow

The flow of this research is as follows:

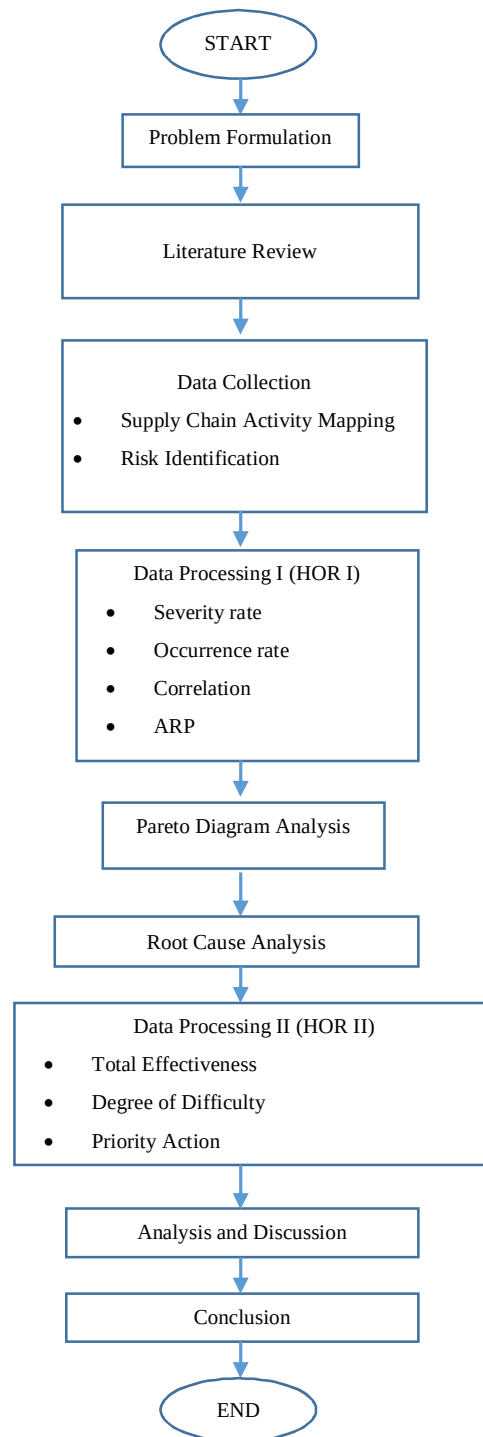


Figure 3. 1 Research Flow

This research was conducted with various systematic work steps in order to achieve optimal results. The research work step itself is a set of procedures and steps for conducting systematic and directed research in order to meet the primary objectives of the research. The explanation of the research flow in Figure 3.0.1 will be explained below:

1. Problem Formulation

The problem formulation process is the stage in looking for possible problems that will be the core discussion of this research. The problem formulated in the MSME cluster of creative t-shirt production in Bantul district will be a reference for the purpose of this research so that it can solve the problems that occur in the MSMEs in Bantul area.

2. Literature Review

Literature Review was conducted to find out the basics and position of the research to be carried out. Literature Review was carried out according to the problem and also the purpose of the research. Basically, literature studies are divided into two types, which are:

- The inductive study, which provides information or knowledge obtained from evidence, facts, or any scientific results related to this study that have been and have not been published
- The deductive study, which explains the theories or knowledge related to the research

3. Data Collection

The data collection process consists of two processes, which are production flow mapping and risk identification. Production flow mapping process starts from a brief description of the company profile as a brief identifier of the research location until the detailed breakdown of production activities in the production flow. Mapping of activities in the production process will give a simple picture of the complete flow of production that occurs every day in the MSME cluster of creative t-shirt production. After the output of the mapping has been completed, it will continue to the risk identification process by interviewing representatives from MSMEs with the help of a questionnaire caused by the current COVID-19 pandemic constraints.

4. Data Processing I (HOR I)

The risks that have been identified are then assessed for the level of severity, level of occurrence, and level of correlation. The risk assessment is based on the real conditions that exist in the UMKM cluster of creative t-shirt production so that the output of this study is in accordance with the initial objectives of the study. In addition, at this stage, the risk selection that gets priority is also carried out to design a handling strategy. Risk selection is based on the ARP value of each risk.

5. Pareto Diagram Analysis

The next stage is to analyze the Pareto diagram, which is an image that sorts the classification of data with the aim of giving the highest to lowest ranking from left to right data based on an 80/20 ratio which means that about 80% of the effect is the result of 20% of the causes. It can help to find the problem that must be resolved immediately, from the highest-ranking to problems that do not have to be resolved immediately or the lowest ranking.

6. Root Cause Analysis

At this stage, the risks that have been identified using the previous method are then searched for the root cause of the risk by asking why questions several times in a row to ascertain the root of the problem using the why - why analysis method. After knowing the root cause of the risk agent, then it is visualized using a fishbone diagram

7. Data Processing II (HOR II)

This stage performs the design of mitigation actions based on the priority of risk agents obtained from the previous process. The mitigation actions are then correlated and ranked to determine which mitigation actions should be prioritized.

8. Analysis and Discussion

Analysis and discussion were conducted to compare the findings in the field with the scientific theory of the problem. It is done as a validation process of the findings in the field.

9. Conclusion

The conclusion-making stage aims to draw a conclusion in answering the research objectives. The provision of suggestions and recommendations is expected to be used as input/consideration related to the research that has been carried out and improvements for further research.

3.3 Data Collection Method

The data taken supports the preparation of this research. In the data collection process, there are several types and methods used including:

1. Primary Data

Primary data is data obtained from direct observation of the object to be studied or studied. In this study, primary data was collected by interview method by means of question and answer or face to face with trusted sources to obtain data. However, due to the pandemic conditions that made direct interviews impossible, the interview data collection process was translated in the form of a questionnaire containing interview questions that would be asked to resource persons as experts.

2. Secondary Data

Secondary data is data obtained indirectly as a support in the preparation of this research. In this study, sources from the Literature Study were used by obtaining theories that would support researchers in conducting this research.

CHAPTER IV

DATA COLLECTING AND PROCESSING

In data collection, several topics will be discussed including a brief profile of research object MSMEs and also the mapping of the production process for research object MSME. Meanwhile, in data processing, several methods will be used such as HOR 1, HOR 2 and Root Cause Analysis. Data collection was carried out by making observations about the production process that runs every day at MSMEs in T-shirt production located in Bantul, Yogyakarta. Due to the Covid-19 pandemic, data collection was modified by using a tool in the form of a questionnaire which was distributed to resource persons who are experts in MSMEs producing T-shirts in Bantul, Yogyakarta. There are 5 MSMEs which are the object of data collection in the study, namely Saputra Bordir, Kedaton Tailor & Konveksi, Az Zahra Batik & Konveksi, Nine Konveksi and Ayu Konveksi.

4.1 Data Collecting

4.1.1 T – Shirt Production MSMEs Profile

a. Saputra Bordir

Saputra Bordir is located in Kauman, Tamanan, Banguntapan, Bantul, Yogyakarta. This MSME focuses on the production of batik clothing and also custom t-shirts. As a raw material for the production of Saputra Bordir, it supplies 250 m per month with the purchase of 3 suppliers of raw materials who have become subscriptions to the MSME.

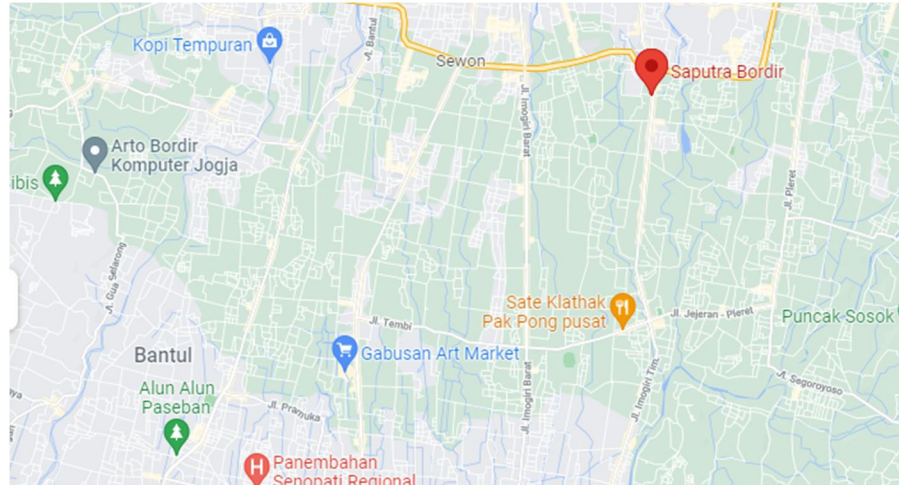


Figure 4. 1 Saputra Bordir Location

b. Kedaton Tailor & Konveksi

Kedaton Tailor & Konveksi is an MSME which located in kedaton RT.01, Kedaton, Pleret, Bantul Regency, Special Region of Yogyakarta 55791. This MSME is capable of custom T-shirts production, custom shirts, custom uniforms, etc. As a raw material for the production of Kedaton Tailor & Konveksi, it supplies depend on the followed demand from customers. They have collaborated with 5 suppliers of raw materials who contribute to this MSME's production



Figure 4. 2 Kedaton Tailor & Konveksi Location

c. Az Zahra Batik & Modiste

Az Zahra Batik & Modiste located in piringan rt 02, Cepit, Pendowoharjo, Kec. Sewon, Bantul. This MSME is capable of custom T-shirts production and custom shirts associated with batik. As a raw material for the production of Az Zahra Batik & Modiste, the supplies depend on the demand from customers. They already have 5 suppliers of raw materials who have become who contribute to this MSME's production



Figure 4. 3 Az Zahra Batik & Modiste Location

d. Nine Apparel

Nine Apparel is an MSME located in Jl. Imogiri Barat, Ngentak, Timbulharjo, Kec. Sewon, Bantul, Daerah Istimewa Yogyakarta. This MSME is capable of producing custom T-shirts which is associated with sports apparel. As a raw material for the production of Nine Apparel, its supplies depend on the followed demand from customers. They already have 7 raw material suppliers who contribute to the MSME's production.

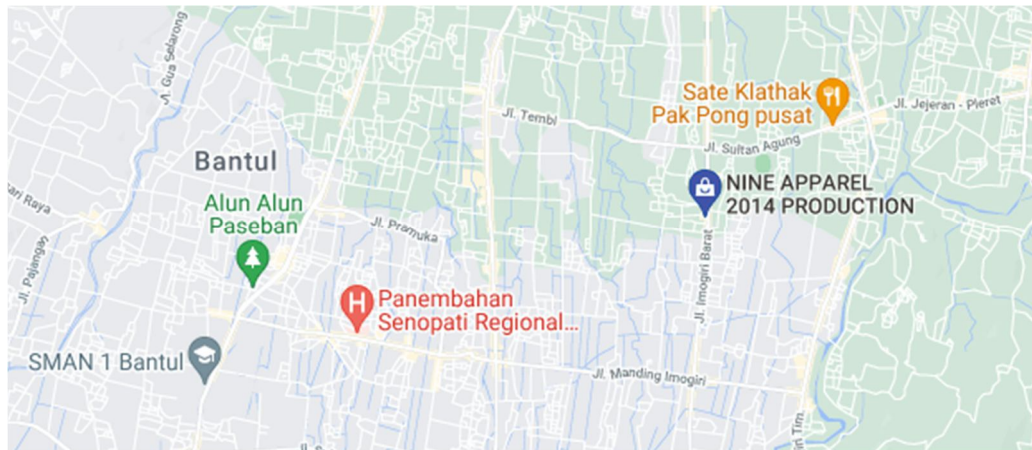


Figure 4. 4 Nine Apparel Location

e. Ayu Konveksi

3. Ayu Konveksi is an MSME which located in Jl. East Imogiri KM. 10, RW.6, Wonokromo I, Wonokromo, Pleret Regency, Bantul. This MSME is capable of custom T-shirts production and custom shirts. As a raw material for the production of Ayu Konveksi, they regularly stocked 3 – 5 rolls of raw material in the warehouse. They already have 3 suppliers who contribute to the MSME's production.



Figure 4. 5 Ayu Konveksi Location

4.1.2 MSMEs Production Process Mapping

Based on the actual conditions, five T-shirt production MSMEs have almost identical production process mappings as a result of identical types of businesses. The particular differentiation only happens by the warehouse system's existence. In Saputra Bordir and Ayu Konveksi the warehousing systems are existed. At the same time, the quality check process of raw materials is held before the materials are processed or stored in the warehouse.

The remaining MSMEs, Kedaton Tailor & Konveksi, Az Zahra Batik & Modiste, and Nine Apparel had not used the warehousing system and relied more on the amount of demand from the customer instead.

a. Saputra Bordir and Ayu Konveksi

Table 4. 1 Saputra Bordir and Ayu Konveksi Production Process Mapping

No	Production Process	Sub Process
1	Procurement Process	Plan order quantity, Purchase raw material from supplier
2	Warehousing	Unused raw materials are stored in warehouses as production reserves
3	Early Stage Quality Control	checking the quality of raw materials before the materials are processed or stored in the warehouse
4	Patterning	early pattern formation process
5	Cutting	the process of cutting the material according to the pattern before sewing

6	Sewing	The sewing process is divided by 2, namely ordinary sewing and overlock sewing
7	Finishing	semi-finished products then go to the overdeck sewing process and chain sewing as the final step in t-shirt production
8	Final Stage Quality Control	Quality checking process include checking the quality of yarn, stitching and overall proportion of the shirt

Table 4. 2 Kedaton Tailor & Konveksi, Az Zahra Batik & Modiste and Nine Konveksi
Production Process Mapping

No	Production Process	Sub Process
1	Procurement Process	Plan order quantity, Purchase raw material from supplier
2	Early Stage Quality Control	checking the quality of raw materials before the materials are processed or stored in the warehouse
3	Patterning	early pattern formation process

4	Cutting	the process of cutting the material according to the pattern before sewing
5	Sewing	The sewing process is divided by 2, namely ordinary sewing and overlock sewing
6	Finishing	semi-finished products then go to the overdeck sewing process and chain sewing as the final step in t-shirt production
7	Final Stage Quality Control	Quality checking process include checking the quality of yarn, stitching and overall proportion of the shirt

4.2 Data Processing (House of Risk Phase 1)

4.2.1 Risk Event Identification

Risk events may arise in business processes and their sub-processes that result in losses to the company which can be measured using a severity scale. Severity is the first step to analyze risk by calculating how much impact or intensity of events affect operational processes. The points in the risk event are obtained from data collection on MSMEs using a questionnaire. The following are risk events and their severity scale:

a. Saputra Bordir

Table 4. 3 Saputra Bordir Risk Event

E_i	Risk Event	S_i
E_1	Large procurement forecast error	1
E_2	Sudden additional raw material procurement	2
E_3	Improper production budget planning	2
E_4	Error planning process of machine and tool maintenance	2
E_5	Sudden changes in production planning	3
E_6	The quality of raw materials is not up to standard	3
E_7	Late arrival of raw materials	3
E_8	Negligence on raw materials inspection	4
E_9	Delay or stoppage during production process	3
E_{10}	Production equipment is interrupted during the production process	2
E_{11}	Damage to the goods during the production process (Production Defects)	3

b. Kedaton Tailor & Konveksi

Table 4. 4 Kedaton Tailor & Konveksi Risk Event

E_i	Risk Event	S_i
E_1	Large procurement forecast error	2
E_2	Sudden additional raw material procurement	2
E_3	Improper production budget planning	2
E_4	Error planning process of machine and tool maintenance	3
E_5	Sudden changes in production planning	3
E_6	The quality of raw materials is not up to standard	2
E_7	Late arrival of raw materials	2
E_8	Negligence on raw materials inspection	2
E_9	Delay or stoppage during production process	3
E_{10}	Production equipment is interrupted during the production process	2
E_{11}	Damage to the goods during the production process (Production Defects)	3

c. Az Zahra Batik & Modiste

Table 4. 5 Az Zahra Batik & Modiste Risk Event

E_i	Risk Event	S_i
E_1	Large procurement forecast error	1
E_2	Sudden additional raw material procurement	3
E_3	Improper production budget planning	1
E_4	Error planning process of machine and tool maintenance	1
E_5	Sudden changes in production planning	1
E_6	The quality of raw materials is not up to standard	2
E_7	Late arrival of raw materials	1
E_8	Negligence on raw materials inspection	1
E_9	Delay or stoppage during production process	3
E_{10}	Production equipment is interrupted during the production process	1
E_{11}	Damage to the goods during the production process (Production Defects)	2

d. Nine Apparel

Table 4. 6 Nine Apparel Risk Event

E_i	Risk Event	S_i
E_1	Large procurement forecast error	4
E_2	Sudden additional raw material procurement	3
E_3	Improper production budget planning	2
E_4	Error planning process of machine and tool maintenance	1
E_5	Sudden changes in production planning	1
E_6	The quality of raw materials is not up to standard	5
E_7	Late arrival of raw materials	5
E_8	Negligence on raw materials inspection	2
E_9	Delay or stoppage during production process	5
E_{10}	Production equipment is interrupted during the production process	3
E_{11}	Damage to the goods during the production process (Production Defects)	5

e. Ayu Konveksi

Table 4. 7 Ayu Konveksi Risk Event

E_i	Risk Event	S_i
E_1	Large procurement forecast error	1
E_2	Sudden additional raw material procurement	2
E_3	Improper production budget planning	4
E_4	Error planning process of machine and tool maintenance	2
E_5	Sudden changes in production planning	1
E_6	The quality of raw materials is not up to standard	2
E_7	Late arrival of raw materials	4
E_8	Negligence on raw materials inspection	4
E_9	Delay or stoppage during production process	5
E_{10}	Production equipment is interrupted during the production process	3
E_{11}	Damage to the goods during the production process (Production Defects)	1

4.2.2 Risk Agent Identification

Risk agent is any factor that can cause an identified risk event to occur which is measured using an occurrence scale. Occurrence is the probability of the emergence of a risk cause that appears and has an impact on events that affect operational processes (severity). Risk agent identification can be done by parsing the causes of risk from each Risk event using Fishbone Diagram. Figure 4.6 below will explain the use of fishbone diagrams:

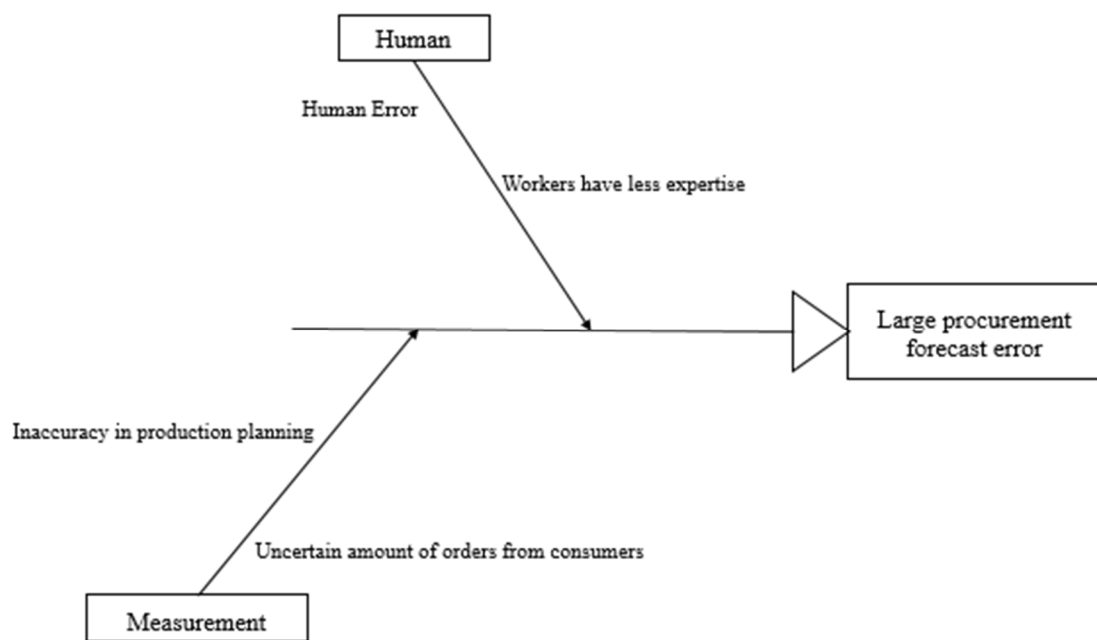


Figure 4. 6 The example of Fishbone Diagram of Risk Agent Process Plan

After determining each risk agent from each existing risk event, it can be continued to determine the level of occurrence to be continued again in the House of Risk phase 1.

The following are risk agents from every MSMEs and their occurrence level / scale:

a. Saputra Bordir

Table 4. 8 Saputra Bordir Risk Agent

A_i	Risk Agent	O_i
A_1	Inaccuracy in production planning	2
A_2	Uncertain amount of orders from consumers	5
A_3	Human Error	2
A_4	Suppliers Inability to provide raw materials according to quantity	1
A_5	Workers have less expertise	3
A_6	Production process being hampered	2
A_7	Machine maintenance planning error	2

A ₈	Lack of production tools	1
A ₉	Raw material below standard quality	1
A ₁₀	Increase in raw material prices	2
A ₁₁	Scarcity of raw materials	2
A ₁₂	Raw materials arrive late	2
A ₁₃	Standard Operating Procedure (SOP) for workers not going well	3
A ₁₄	Material storage management (warehouse) is not good	2
A ₁₅	Product quality inspection is not good	2
A ₁₆	Lack of Supervising towards the worker	2
A ₁₇	Miscommunication with the suppliers	3

b. Kedaton Tailor & Konveksi

Table 4. 9 Kedaton Tailor & Konveksi Risk Agent

A _i	Risk Agent	O _i
A ₁	Inaccuracy in production planning	3
A ₂	Uncertain amount of orders from consumers	3
A ₃	Human Error	3
A ₄	Suppliers Inability to provide raw materials according to quantity	3
A ₅	Workers have less expertise	3
A ₆	Production process being hampered	2
A ₇	Machine maintenance planning error	3
A ₈	Lack of production tools	3

A ₉	Raw material below standard quality	2
A ₁₀	Increase in raw material prices	4
A ₁₁	Scarcity of raw materials	3
A ₁₂	Raw materials arrive late	3
A ₁₃	Standard Operating Procedure (SOP) for workers not going well	3
A ₁₄	Material storage management (warehouse) is not good	3
A ₁₅	Product quality inspection is not good	3
A ₁₆	Lack of Supervising towards the worker	3
A ₁₇	Miscommunication with the suppliers	2

c. Az Zahra Batik & Modiste

Table 4. 10 Az Zahra Batik & Modiste Risk Agent

A _i	Risk Agent	O _i
A ₁	Inaccuracy in production planning	1
A ₂	Uncertain amount of orders from consumers	1
A ₃	Human Error	2
A ₄	Suppliers Inability to provide raw materials according to quantity	1
A ₅	Workers have less expertise	1
A ₆	Production process being hampered	2
A ₇	Machine maintenance planning error	1
A ₈	Lack of production tools	1
A ₉	Raw material below standard quality	1

A ₁₀	Increase in raw material prices	3
A ₁₁	Scarcity of raw materials	1
A ₁₂	Raw materials arrive late	1
A ₁₃	Standard Operating Procedure (SOP) for workers not going well	1
A ₁₄	Material storage management (warehouse) is not good	1
A ₁₅	Product quality inspection is not good	1
A ₁₆	Lack of Supervising towards the worker	1
A ₁₇	Miscommunication with the suppliers	2

d. Nine Apparel

Table 4. 11 Nine Apparel Risk Agent

A _i	Risk Agent	O _i
A ₁	Inaccuracy in production planning	5
A ₂	Uncertain amount of orders from consumers	1
A ₃	Human Error	5
A ₄	Suppliers Inability to provide raw materials according to quantity	2
A ₅	Workers have less expertise	2
A ₆	Production process being hampered	4
A ₇	Machine maintenance planning error	2
A ₈	Lack of production tools	1
A ₉	Raw material below standard quality	2

A ₁₀	Increase in raw material prices	5
A ₁₁	Scarcity of raw materials	1
A ₁₂	Raw materials arrive late	5
A ₁₃	Standard Operating Procedure (SOP) for workers not going well	3
A ₁₄	Material storage management (warehouse) is not good	3
A ₁₅	Product quality inspection is not good	3
A ₁₆	Lack of Supervising towards the worker	3
A ₁₇	Miscommunication with the suppliers	5

e. Ayu Konveksi

Table 4. 12 Ayu Konveksi Agent

A _i	Risk Agent	O _i
A ₁	Inaccuracy in production planning	5
A ₂	Uncertain amount of orders from consumers	3
A ₃	Human Error	3
A ₄	Suppliers Inability to provide raw materials according to quantity	2
A ₅	Workers have less expertise	3
A ₆	Production process being hampered	4
A ₇	Machine maintenance planning error	5
A ₈	Lack of production tools	1
A ₉	Raw material below standard quality	5
A ₁₀	Increase in raw material prices	2

A ₁₁	Scarcity of raw materials	3
A ₁₂	Raw materials arrive late	4
A ₁₃	Standard Operating Procedure (SOP) for workers not going well	4
A ₁₄	Material storage management (warehouse) is not good	2
A ₁₅	Product quality inspection is not good	3
A ₁₆	Lack of Supervising towards the worker	3
A ₁₇	Miscommunication with the suppliers	2

4.2.3 Correlation Level

The correlation level is used to identify the correlation that exists between the risk event and the risk agent. There are weights of 0, 1, 3 and 9 which are equipped with correlation information in the correlation table (Wahyudin Santoso, 2016).

Table 4. 13 Correlation Level Scale

Scale	Description
0	No correlation
1	Low correlation
4	Medium correlation
9	High correlation

4.2.4 House of Risk Phase 1 Matrix

The next step is to calculate the Aggregate Risk Potentials (ARP). The value of Aggregate Risk Potentials (ARP) is obtained from the multiplication of the probability of the

occurrence of a risk cause (occurrence), the magnitude of the disturbance or risk severity (severity), and the risk correlation between the risk event and the risk agent. The formula as below:

$$ARP_j = O_j \sum S_i \times R_{ij}$$

Description:

ARP_j = Aggregate Risk Potential on risk agent 'j', $j = 1, 2, 3, \dots, n$

O_j = Occurrence of risk agent 'j', $j = 1, 2, 3, \dots, n$

S_i = Severity of a risk, $i = 1, 2, 3, \dots, n$

R_{ij} = Correlation level between 'i' risk and 'j' risk, $ij = 1, 2, 3, \dots, n$

k = Respondent 'k', $k = 1, 2, 3, \dots, n$

The study aimed to find the root problem in general of the UMKM creative t-shirt production in the Bantul area. In order to achieve that, the ARP calculation will be carried out at each research location, followed by calculating the average ARP from each location for the MSME production of creative t-shirts. Then an example of ARP calculation is as follows:

$$ARP_1 \text{ at Saputra Bordir} = 2 \times [9 (1 + 2 + 3) + 3 (3) + 1 (2)] = 130$$

$$ARP_1 \text{ at Kedaton Tailor \& Konveksi} = 3 \times [9 (2 + 2 + 3) + 3 (2) + 1 (2)] = 213$$

$$ARP_1 \text{ at Az Zahra Batik \& Konveksi} = 1 \times [9 (1 + 3 + 1) + 3 (1) + 1 (1)] = 49$$

$$ARP_1 \text{ at Nine Konveksi} = 5 \times [9 (4 + 3 + 1) + 3 (5) + 1 (2)] = 445$$

$$ARP_1 \text{ at Ayu Konveksi} = 5 \times [9 (1 + 2 + 1) + 3 (4) + 1 (4)] = 260$$

$$ARP_1 \text{ average} = \frac{(130+213+49+445+260)}{5}$$

$$= 219.4$$

a. Saputra Bordir

Table 4. 14 House of Risk Phase 1 of Saputra Bordir

Risk	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	A ₇	A ₈	A ₉	A ₁₀	A ₁₁	A ₁₂	A ₁₃	A ₁₄	A ₁₅	A ₁₆	A ₁₇	Severity
E ₁	9	1	3		3													1
E ₂	9	3		9								1		1				2
E ₃	1	3	9							9								2
E ₄			3				9	1					9			1		2
E ₅	9	3	9	3			1	1		3	3	9						3
E ₆									3		1		3	1	9		9	3
E ₇	3		3								1					1	9	3
E ₈			9		9								9					4
E ₉													9			9		3
E ₁₀					3		9						9					2
E ₁₁			9		9		3								3	9		3

Occurrence	2	5	2	1	3	2	2	1	1	2	2	2	3	2	2	2	3	
ARP	130	110	252	27	216	0	96	5	9	54	30	58	324	10	72	118	162	

b. Kedaton Tailor & Konveksi

Table 4. 15 House of Risk Phase 1 of Kedaton Tailor & Konveksi

Risk	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	A ₇	A ₈	A ₉	A ₁₀	A ₁₁	A ₁₂	A ₁₃	A ₁₄	A ₁₅	A ₁₆	A ₁₇	Severity
E ₁	9	1	3		3													2
E ₂	9	3		9								1		1				2
E ₃	1	3	9							9								2
E ₄			3				9	1					9			1		3
E ₅	9	3	9	3			1	1		3	3	9						3
E ₆									3		1		3	1	9		9	2

E ₂	9	3		9								1		1				3
E ₃	1	3	9							9								1
E ₄			3				9	1					9			1		1
E ₅	9	3	9	3			1	1		3	3	9						1
E ₆									3		1		3	1	9		9	2
E ₇	3		3								1					1	9	1
E ₈			9		9								9					1
E ₉													9			9		3
E ₁₀					3		9						9					1
E ₁₁			9		9		3								3	9		2
Occur ence	1	1	2	1	1	2	1	1	1	3	1	1	1	1	1	1	2	
ARP	49	16	108	30	33	0	25	2	6	36	6	12	60	5	24	47	54	

d. Nine Konveksi

Table 4. 17 House of Risk Phase 1 of Nine Konveksi

Risk	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	A ₇	A ₈	A ₉	A ₁₀	A ₁₁	A ₁₂	A ₁₃	A ₁₄	A ₁₅	A ₁₆	A ₁₇	Severity
E ₁	9	1	3		3													4
E ₂	9	3		9								1		1				3
E ₃	1	3	9							9								2
E ₄			3				9	1					9			1		1
E ₅	9	3	9	3			1	1		3	3	9						1
E ₆									3		1		3	1	9		9	5
E ₇	3		3								1					1	9	5
E ₈			9		9								9					2
E ₉													9			9		5
E ₁₀					3		9						9					3
E ₁₁			9		9		3								3	9		5

Occurrence	5	1	5	2	2	4	2	1	2	5	1	5	3	3	3	3	5	
ARP	445	22	600	60	168	0	104	2	30	105	13	60	342	24	180	288	450	

e. Ayu Konveksi

Table 4. 18 House of Risk Phase 1 of Ayu Konveksi

Risk	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	A ₇	A ₈	A ₉	A ₁₀	A ₁₁	A ₁₂	A ₁₃	A ₁₄	A ₁₅	A ₁₆	A ₁₇	Severity
E ₁	9	1	3		3													1
E ₂	9	3		9								1		1				2
E ₃	1	3	9							9								4
E ₄			3				9	1					9			1		2
E ₅	9	3	9	3			1	1		3	3	9						1
E ₆									3		1		3	1	9		9	2

E ₇	3		3								1					1	9	4
E ₈			9		9								9					4
E ₉													9			9		5
E ₁₀					3		9						9					3
E ₁₁			9		9		3								3	9		1
Occurrence	5	3	1	2	3	4	1	1	1	2	3	4	4	2	1	3	2	
ARP	260	66	111	42	171	0	49	3	6	78	27	44	528	8	21	180	108	

f. Total Value of ARP

Table 4. 19 Total Value of ARP Table

Risk	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	A ₇	A ₈	A ₉	A ₁₀	A ₁₁	A ₁₂	A ₁₃	A ₁₄	A ₁₅	A ₁₆	A ₁₇
E ₁	9	1	3		3												
E ₂	9	3		9								1		1			

E ₃	1	3	9							9							
E ₄			3				9	1					9			1	
E ₅	9	3	9	3			1	1		3	3	9					
E ₆									3		1		3	1	9		9
E ₇	3		3								1					1	9
E ₈			9		9								9				
E ₉													9			9	
E ₁₀					3		9						9				
E ₁₁			9		9		3								3	9	
ARP Total	219,4	56,6	280,8	48	151,8	0	89	6	12,6	76,2	23	52,2	308,4	11,8	75,6	162	169,2
Rank	3	10	2	12	6	17	7	16	14	8	13	11	1	15	9	5	4

4.2.5 Risk Evaluation

At this stage, the results of the previous ARP calculations will be evaluated for risk events to find out which risk agent will be given priority treatment based on the Pareto diagram. The figure below is a Pareto ARP diagram of all existing risk agents.

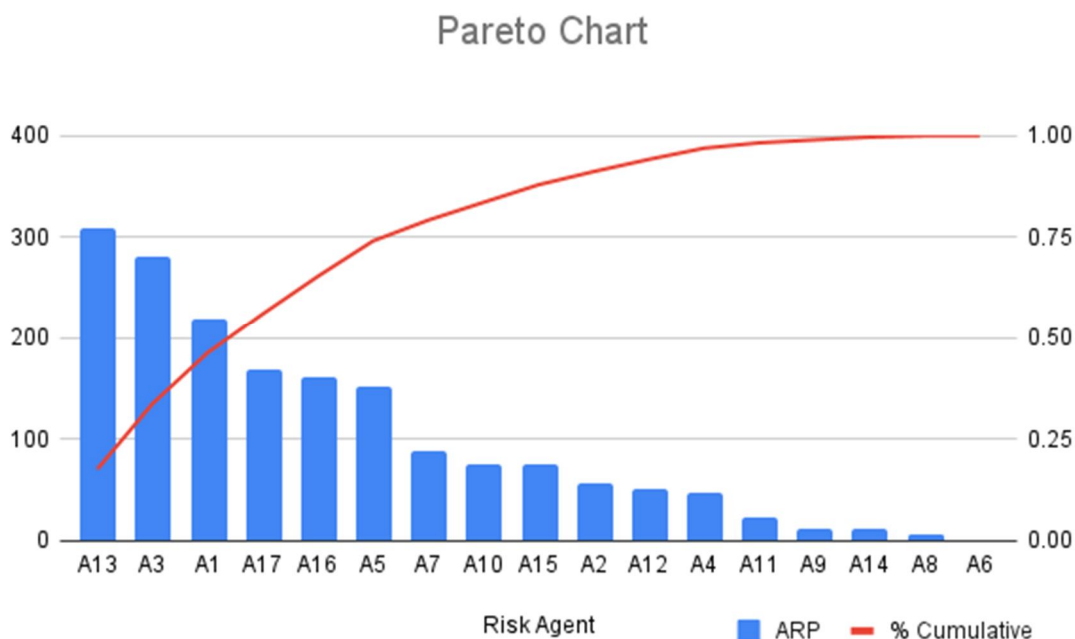


Figure 4. 7 Pareto Chart of Risk Evaluation

The Pareto principle used the 80/20 rule which describes that 80% of risk events come from 20% of the risk agents that caused them. All elements to the left of the 80%% line are the key elements that cause the most problems in supply chain flow. By restricting the area, it is possible to identify the elements that most cause problems that interfere with the smooth flow of the production process. Based on the diagram above, here are some risk elements/agents that cause more than 80% of risk events from production flows:

- A13 (Standard Operating Procedure (SOP) for workers not going well)
- A3 (Human Error)
- A1 (Inaccuracy in production planning)
- A17 (Miscommunication with the suppliers)
- A16 (Lack of Supervising towards the worker)
- A5 (Workers have less expertise)

- A7 (Machine maintenance planning error)

4.3 Data Processing (Root Cause Analysis)

In this phase, calculations will be carried out using two kinds of methods, namely the 5 why analysis and the fish bone diagram method.

4.3.1 Root Cause Analysis of Standard Operating Procedure (SOP) for workers not going well

a. Why – Why Analysis

Table 4. 20 Why – Why Analysis table of SOP for workers not worked

Risk Agent	Standard Operating Procedure (SOP) for workers not going well
	Reason
Why?	Workers do not understand the SOP
Why?	Worker supervision is not maximized
Why?	Periodic evaluation has not gone well
Why?	The working system has not perfect yet
Why?	There is no clear written SOP rules

Based on the Why - Why Analysis above, it can be seen that several factors causing the Standard Operating Procedure (SOP) for workers not going well are Workers do not understand the SOP. SOPs that have been running so far tend to be simple recommendations from MSME owners and are not in the form of standard rules. This makes workers often give less attention to the standard rules that must apply standards in the production process. In addition, MSME owners have not implemented maximum supervision of workers, so workers do not receive guidance from MSME owners in achieving MSME targets. The periodic evaluation that is expected to solve this problem is still not optimal. With the overall work system that is not perfect in the end, the main problem is that there are no clear written standard work rules and SOPs to control the entire production process.

b. *Fishbone Diagram*

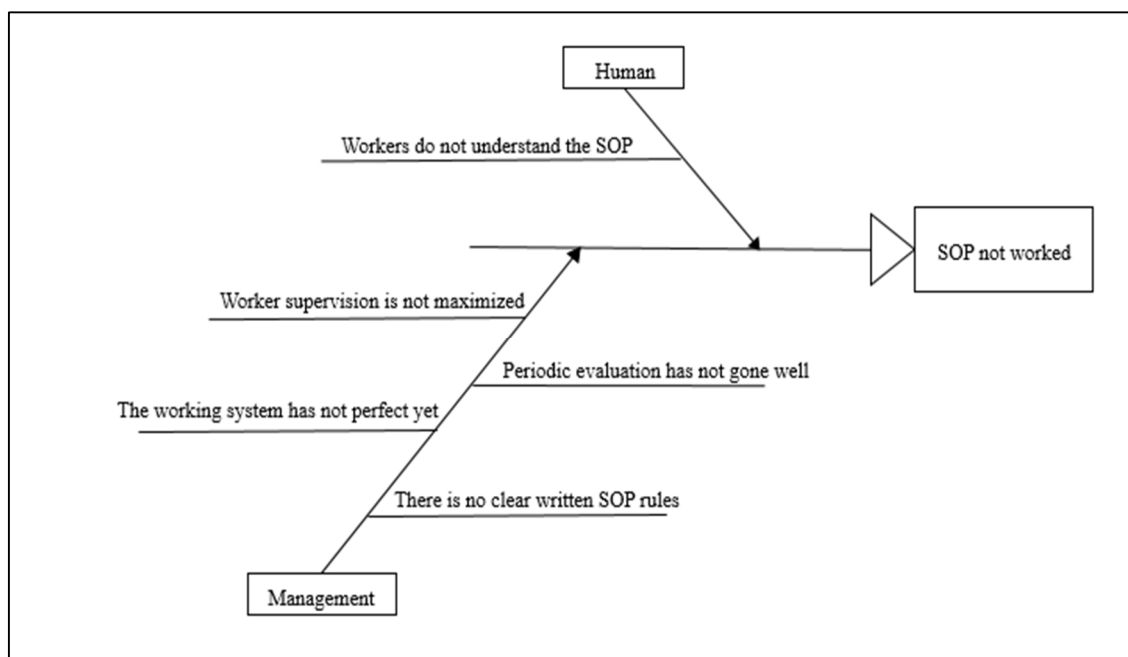


Figure 4. 8 Fishbone Diagram of SOP not worked

Based on the Fishbone Diagram of Standard Operating Procedure (SOP) for workers not going well, it is found that there are two influential factors which are human and management. In human factors, aspect that can cause the existing SOP not implemented properly, due to workers' less understanding of SOP. Meanwhile, in management factor various things that can cause the existing SOP to not work are Worker supervision, which is still not maximized, Periodic evaluation that does not go well, working system that is not perfect yet, and absence of clear written SOP rules.

4.3.2 Root Cause Analysis of Human Error

a. Why – Why Analysis

Table 4. 21 Why – Why Analysis table of Human Error

Risk Agent	Human Error
	Reason
Why?	Miscommunication between workers and MSME owners

Why?	Inadequate worker skills
Why?	Work instruction is not clear

Based on the Why-Why Analysis above, it can be seen that several factors that cause human errors are miscommunication between workers and MSME owners. Miscommunication between workers and MSME owners becomes a basic influence of human errors occurring throughout the production process. Furthermore, the lack of skills of workers causes frequent human errors throughout the daily production process. It all turn out that unclear working instruction often leads to more errors in carrying out the production process.

b. Fishbone Diagram

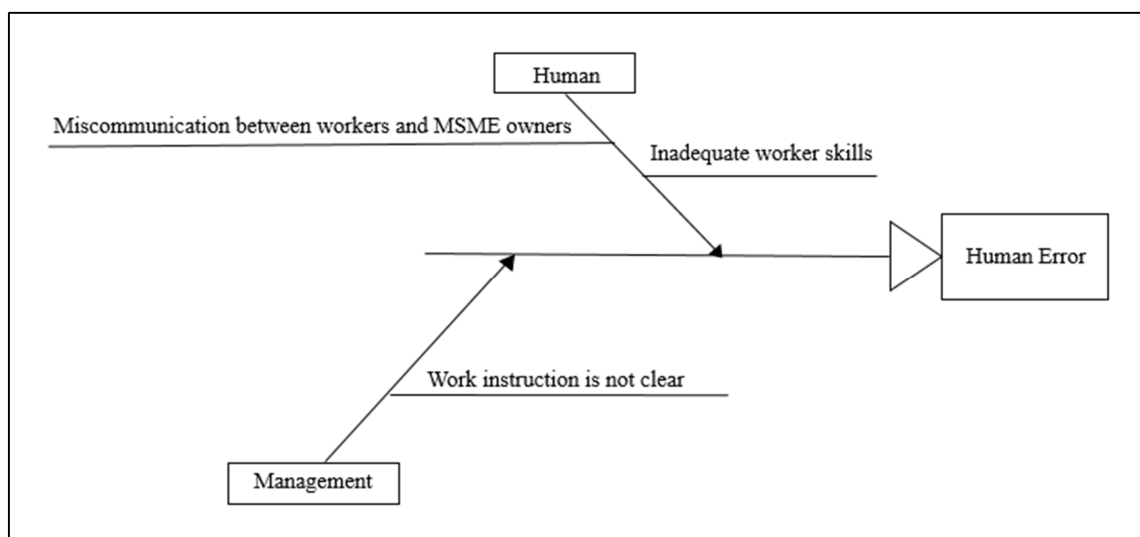


Figure 4. 9 Fishbone Diagram of Human Error

Based on the following Fishbone Diagram, there are two influential factors of human error which are human and management factors. In human factors, things that can cause error are miscommunication between workers and owners and also inadequate worker skills. Meanwhile, the management factor has a causal point as well, which is unclear work instruction.

4.3.3 Root Cause Analysis of Inaccuracy in production planning

a. Why – Why Analysis

Table 4. 22 Why – Why Analysis table of Inaccuracy in production planning

Risk Agent	Inaccuracy in production planning
	Reason
Why?	COVID – 19 Pandemic
Why?	More volatile Demand
Why?	There is no calculation in determining both the stock and the right order time

Why – Why Analysis above describes that COVID – 19 Pandemic influences the demand comes up more volatile than the regular day before. On a regular day, MSMEs are able to minimize losses and maximize the profit by only using simple predictions for the procurement process, either in terms of raw material for stock or order time. However, pandemic conditions make MSME difficult even more when there is no calculation or method to determine a more suitable moment for order time and safe amount of stock which allows MSMEs to maximize profits in the midst of a pandemic condition.

b. Fishbone Diagram

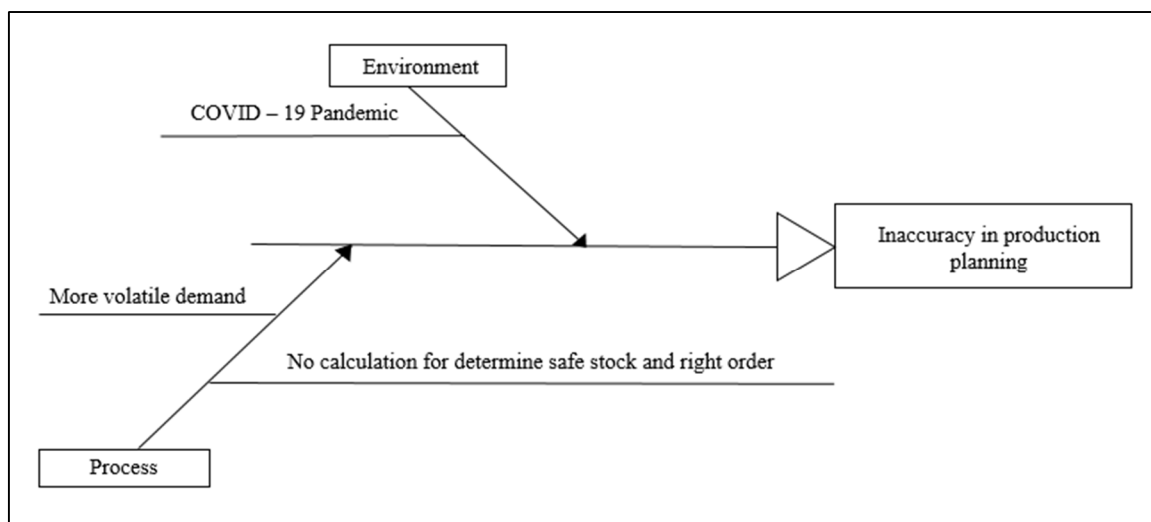


Figure 4. 10 Fishbone Diagram of Inaccuracy in production planning

Based on the fishbone diagram, there are two influential factors that increase the inaccuracy in production planning: environment and process. In Environment factor, the problem tends to happen due to COVID–19 pandemic situation. Meanwhile, in process

factor, the various things that influence the inaccuracy in production planning are more volatile demand and the absence of a calculation method to determine the safety stock and right order time.

4.3.4 Root Cause Analysis of Miscommunication with the suppliers

a. Why – Why Analysis

Table 4. 23 Why – Why Analysis table of Miscommunication with the suppliers

Risk Agent	Miscommunication with the suppliers
	Reason
Why?	Incapable supplier
Why?	Procurement procedures are not yet systematic
Why?	There is no clear agreement between suppliers and SMEs (management)

Based on Why–Why Analysis above, miscommunication with the suppliers tends to happen because of an incapable supplier that is enough to influence the occurrence of this problem. On the other hand, unsystematic procurement procedures increase the risk of miscommunication to happen. In this case, the procurement procedure is equipped with unstructured steps and is recorded improperly. Hence, it is possible for miscommunication to occur both in terms of order quantity and material quality. In the end, the absence of a clear agreement between the supplier and the MSME related to the procurement process is very influential in the occurrence of misunderstandings between the two parties.

b. Fishbone Diagram

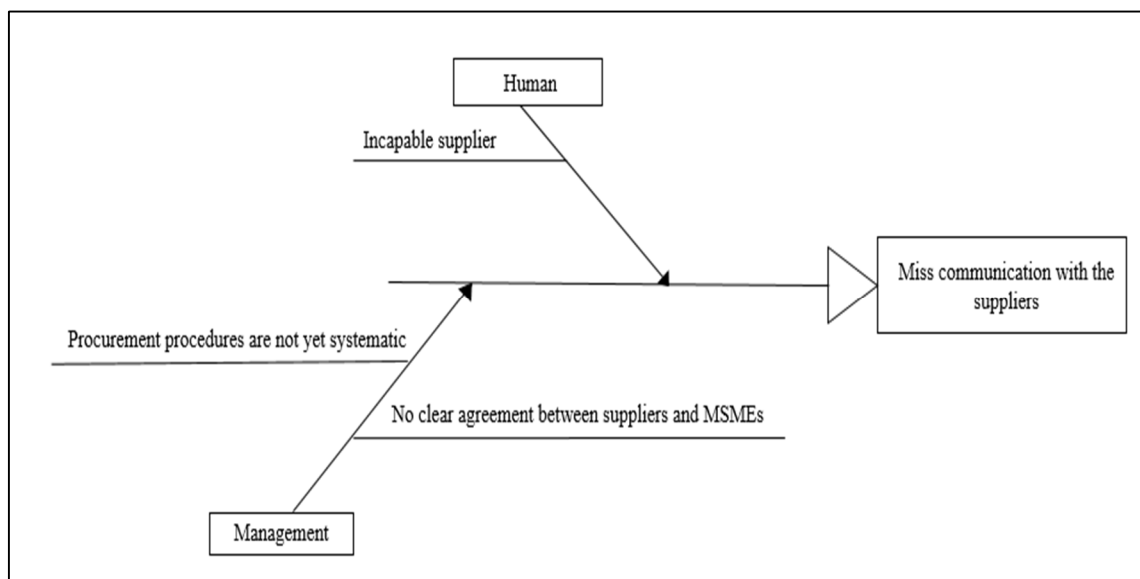


Figure 4. 11 Fishbone Diagram of Miscommunication with the suppliers

Based on Fishbone Diagram above, there are two influential factors that increase miscommunication with the suppliers: human and management factors. In the human factor, the aspect that influences the problem is the supplier incapability. Meanwhile, in the management factor, unsystematic procurement procedure and no clear agreement between suppliers and MSMEs during the procurement are aspects that can cause miscommunication.

4.3.5 Root Cause Analysis of Lack of Supervising towards the worker

a. Why – Why Analysis

Table 4. 24 Why – Why Analysis table of Lack of supervising towards the worker

Risk Agent	Lack of supervising towards the worker
	Reason
Why?	Work procedure is not clear
Why?	Lack of communication between workers and MSME owners
Why?	No supervisory policy from MSME owners yet

Based on the analysis, the lack of supervision towards the worker is influenced by several factors between workers and owners relation. Unclear work procedure is arguably the first factor that makes either worker or owner itself become uncertain in terms of supervising. Lack of communication and contact between these two parties worsens the condition where the lack of supervision is not even realized between the two parties. In the end, the main problem which influences the lack of supervision is the absence of supervisory policy from MSME's owners.

b. Fishbone Diagram

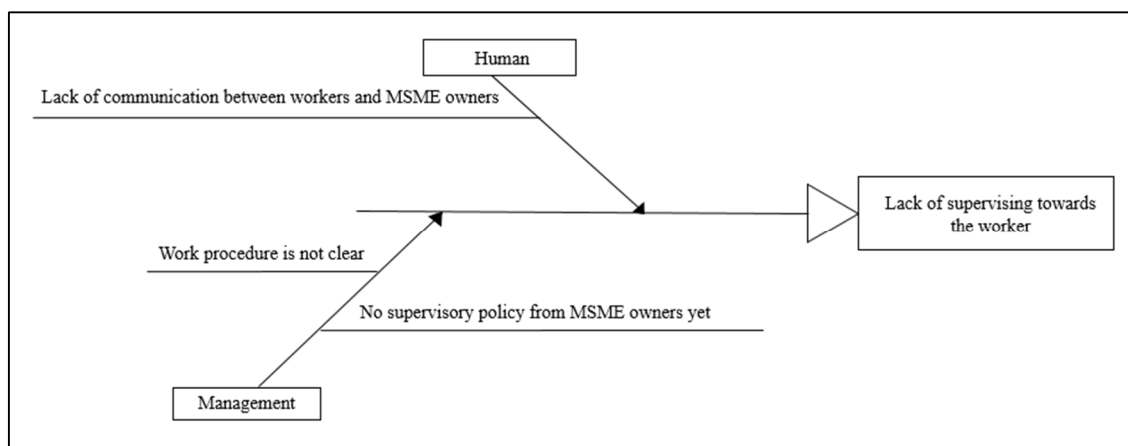


Figure 4. 12 Fishbone Diagram of Lack of supervising towards the worker

Based on Fishbone Diagram analysis there are two influential factors which are human and management factors. In human factor, lack of communication between workers and MSME owners become the influential point. Meanwhile in management factor, unclear work procedure and no supervisory policy become the influential points of this factor.

4.3.6 Root Cause Analysis of Workers have less expertise

a. Why – Why Analysis

Table 4. 25 Why – Why Analysis table of Workers have less expertise

Risk Agent	Workers have less expertise
	Reason
Why?	Workers are not familiar with the equipment

Why?	No training to improve the workers ability yet
------	--

Based on analysis, workers less expertise in this occasion influenced by two factors which are workers unfamiliarity to the equipment and also no training provided by the owner to improve the workers ability.

b. Fishbone Diagram

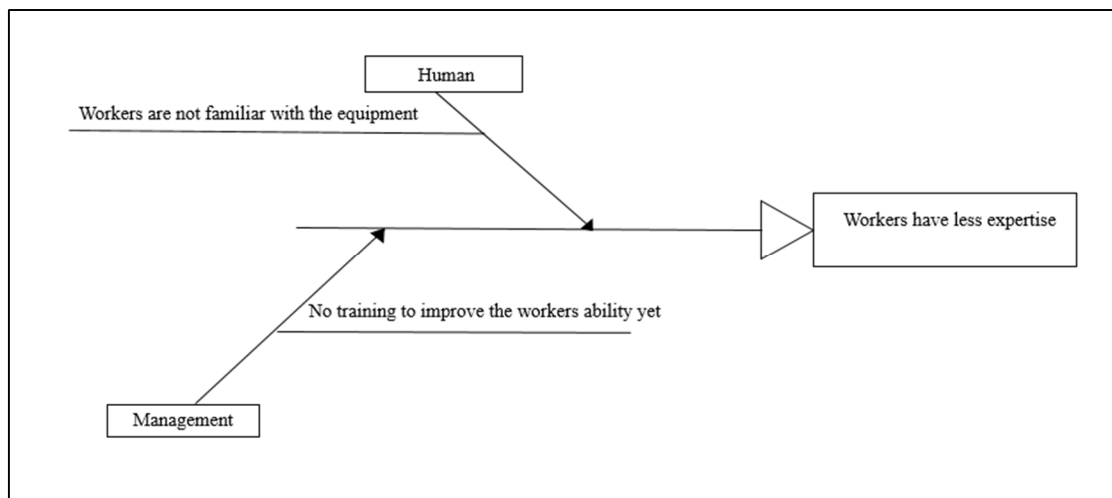


Figure 4. 13 Fishbone Diagram of Worker have less expertise

Based on Fishbone Diagram there are two influential factors which are human and management factor. Either human factor or management factor have one thing that influence the problem to happen which are unfamiliarity toward the equipment for human factor and absence of training to improve workers ability for management factor.

4.3.7 Root Cause Analysis of Machine maintenance planning error

a. Why – Why Analysis

Table 4. 26 Why – Why Analysis table of Machine maintenance planning error

Risk Agent	Machine maintenance planning error
	Reason
Why?	Not paying attention to the equipment usage period
Why?	No routine equipment service schedule yet

Based on analysis, machine maintenance planning error influenced by two factors which are not paying attention to the equipment usage period and no routine equipment service schedule yet. Neither owner nor worker are paying attention to the equipment usage period yet, which leads to over usage of the equipment or incidental error of the equipment. Later on turns out that no routine equipment service schedule yet is the main cause of the machine error problem.

b. Fishbone Diagram

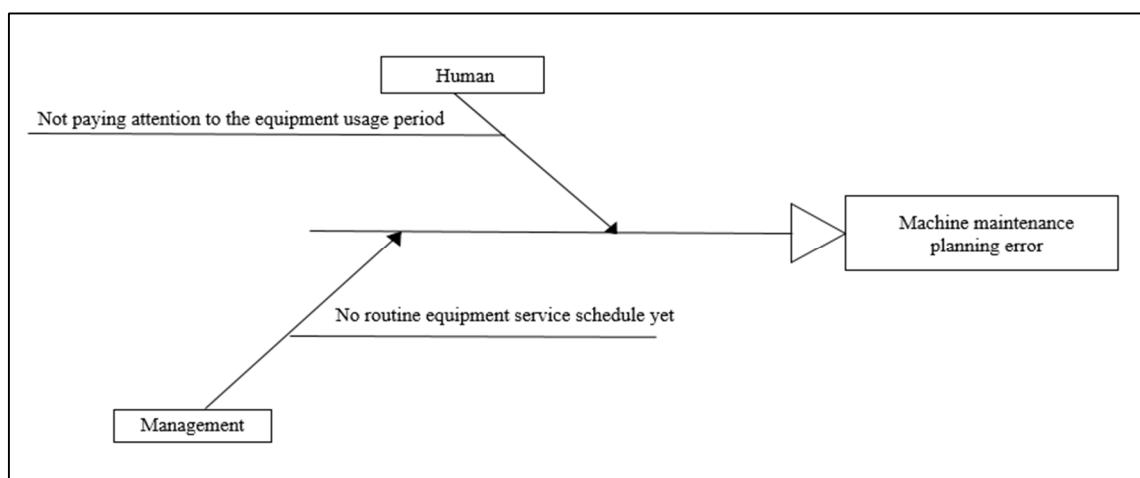


Figure 4. 14 Fishbone Diagram of Machine maintenance planning error

Based on Fishbone Diagram above, human factors and management factors become influential factors for machine maintenance planning errors to happen. In human factor, less attention to the equipment usage period tends to lead error in machine. On the other hand, the management factor has one cause that influences the problem: the absence of routine equipment service schedule.

Table 4. 27 Root Cause recapitulation

Rank	Code	Risk Agent	Root Cause
1	A13	Standard Operating Procedure (SOP) for workers not going well	There is no clear written SOP rules
2	A3	Human Error	Work instruction is not clear

3	A1	Inaccuracy in production planning	There is no calculation in determining both the stock and the right order time
4	A17	Miscommunication with the suppliers	There is no clear agreement between suppliers and SMEs (management)
5	A16	Lack of supervising towards the worker	No supervisory policy from MSME owners yet
6	A5	Workers have less expertise	No training to improve the workers ability yet
7	A7	Machine maintenance planning error	No routine equipment service schedule yet

4.4 Data Processing (HOR Phase 2)

After going through the House of Risk analysis phase 1 and root cause analysis, the next step is the House of Risk phase 2 analysis which will produce output in the form of a strategic design as the basis for priority actions by considering effectiveness in reducing the potential for existing risk agents.

4.4.1 Mitigation Strategy Design

At the design stage of mitigation strategy, a mitigation strategy is formulated which is obtained from the results of discussions with the owner with the aim of obtaining suitable mitigation actions. Possible mitigation strategies can be described further using a fishbone diagram in order to make it easier for visualize the available mitigation. Here the following figure 4.15 is an example of a fishbone diagram

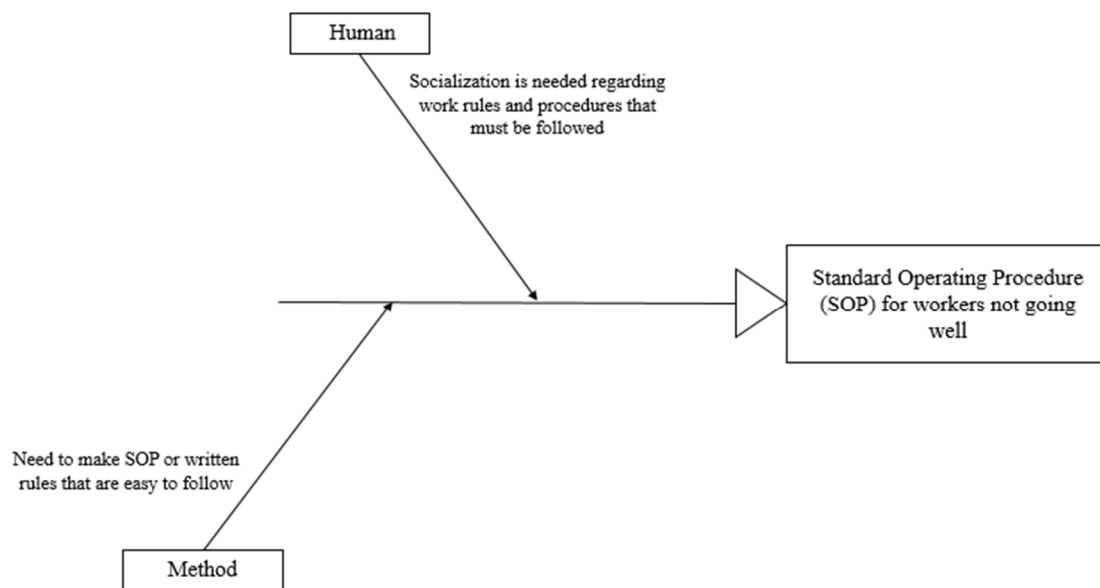


Figure 4. 15 Example of Fishbone Diagram of Mitigation strategy

The results of the fishbone diagram are then further brainstormed with the owner of the UMKM to find which mitigation strategy is the best. The following are the mitigation strategies that will be used in the House of Risk method phase 2:

Table 4. 28 Table of Mitigation Strategy Design

No	Mitigation Strategy	PA _k
1	Organize and complete the Standard Operating Procedures (SOPs) in written form	PA ₁
2	Socialization of SOPs to workers in understandable language	PA ₂
3	Conduct a simple method to determine the minimum stock and order time	PA ₃
4	Create agreements between MSMEs and suppliers such as details for submitting orders, agreements in case of errors, etc.	PA ₄
5	Making supervisory policies by owners such as workers who are obliged to report after the task is	PA ₅

	completed, conduct weekly evaluations of worker performance, etc.	
6	Provide regular training on how to use sewing tools (2 - 3 months)	PA ₆
7	Making a schedule for servicing sewing tools on a regular basis (1 week)	PA ₇

4.4.2 Correlation Identification

The next process is correlation identification between the risk agent and the previously planned mitigation action using a scale of 0, 1, 3, and 9 as before in the HOR stage 1. The following is the result of identifying correlation between selected risk agent and planned mitigation action.

Table 4. 29 Table of Mitigation Strategy Correlation

Risk Agent	Mitigation Strategy	PA _k
A13, A3, A16, A7	Organize and complete the Standard Operating Procedures (SOPs) in written form	PA ₁
A13, A3	Socialization of SOPs to workers in understandable language	PA ₂
A13, A1, A16	Conduct a simple method to determine the minimum stock and order time	PA ₃
A17	Create agreements between MSMEs and suppliers such as details for submitting orders, agreements in case of errors, etc.	PA ₄

A13, A3, A16	Making supervisory policies by owners such as workers who are obliged to report after the task is completed, conduct weekly evaluations of worker performance, etc.	PA ₅
A5	Provide regular training on how to use sewing tools (2 - 3 months)	PA ₆
A7	Making a schedule for servicing sewing tools on a regular basis (1 week)	PA ₇

4.4.3 Degree of Difficulty (D_k) and Total Effectiveness (TE_k)

Degree of Difficulty (D_k) shows how difficult the following strategies are to implement in these MSMEs. In this assessment, a scale of 1 - 5 which consecutively indicates a level from very easy to very difficult, is used to translate the perception of SMEs in response to the implementation of the following strategy proposals. After determining the handling strategy and the value of the degree of difficulty (D_k), the next step is to calculate the Total Effectiveness (TE_k) value, which is how effectively the handling strategy is applied. The next step is to calculate the Effectiveness to Difficulty (ETD_k) ratio by dividing the result of Total Effectiveness (TE_k) by Degree of Difficulty (D_k). If the Effectiveness to Difficulty value has been obtained, then the priority ranking of the mitigation action design strategy can be known.

Calculation of Total Effectiveness and Effectiveness to Difficulty are able by using the formula:

$$TE_k = \sum_j ARP_j E_{jk}$$

TE_k : Total Effectiveness

ARP_j : Aggregate Risk Potential on risk agent 'j', $j = 1, 2, 3, \dots, n$

E_{jk} : Correlation level between 'j' risk agent and 'k' mitigation action, $jk = 1, 2, 3, \dots, n$

$$ETD_k = TE_k / D_k$$

ETD_k : Effectiveness to Difficulty

TE_k : Total Effectiveness

D_k : Degree of Difficulty

Table 4. 30 Table of House of Risk Phase 2

To be treated Risk Agent (A_j)		Preventive Action (PA_k)							Aggregate Risk Potential (ARP_j)
		PA1	PA2	PA3	PA4	PA5	PA6	PA7	
No clear written SOP rules	A13	9	3	3		3			308.4
Work instruction is not clear	A3	3	9			9			280.8
No calculation in determining both the stock and the right order time	A1			9					219.4
No clear agreement between suppliers and MSMEs (management)	A17				9				169.2
No supervisory policy from MSME owners yet	A16	9		3		9			162
No training to improve the workers ability yet	A5						9		151.8
No routine equipment service schedule yet	A7	3						9	89
Total Effectiveness (TE_k)		5343	3452.4	3385.8	1522.8	4910.4	1366.2	801	
Degree of Difficulty (D_k)		2	2	3	2	2	3	2	
Effectiveness To Difficulty (ETD_k)		2671.5	1726.2	1128.6	761.4	2455.2	455.4	400.5	
Rank		1	3	4	5	2	6	7	

Based on Total Effectiveness (TE_k) and Degree of Difficulty (D_k) calculation from House of Risk phase 2 matrix above, here are the following mitigation strategy ranking from highest score of Effectiveness To Difficulty (ETD_k) to lowest:

Table 4. 31 Table of Mitigation Priority Rank

PA_k	Mitigation Action	ETD_k	Priority Rank
PA_1	Organize and complete the Standard Operating Procedures (SOPs) in written form	2671.5	1
PA_5	Making supervisory policies by owners such as workers who are obliged to report after the task is completed, conduct weekly evaluations of worker performance, etc.	2455.2	2
PA_2	Socialization of SOPs to workers in understandable language	1726.2	3
PA_3	Conduct a simple method to determine the minimum stock and order time	1128.6	4
PA_4	Create agreements between MSMEs and suppliers such as details for submitting orders, agreements in case of errors, etc.	761.4	5
PA_6	Provide regular training on how to use sewing tools (2 - 3 months)	455.4	6
PA_7	Making a schedule for servicing sewing tools on a regular basis (1 week)	400.5	7

CHAPTER V

DISCUSSION

5.1 Business Processes in Textile Creative T-shirts Production MSMEs

Business process mapping was carried out on 5 MSMEs producing creative t-shirts located in Bantul, Yogyakarta as a process of identifying the supply chain process flow in the business pattern. The business processes obtained through observation are as follows:

1. Procurement process

The process begins with simple planning the order quantity of raw materials needed in production, then proceeds with purchasing raw materials from suppliers who have become customers of the MSMEs.

2. Early process Quality Control

After the raw material arrives, an initial quality check will be carried out first. These checks include checking the color consistency on the rolls of raw fabric materials, checking the physical rolls of the fabric raw materials such as the presence or absence of defect, the consistency of the quality of the material's durability, and the size consistency of the material.

3. Warehousing

Several MSMEs which are in this case Saputra Bordir and Ayu Konveksi, already have a fairly good warehouse system in terms of management of unused raw materials, both as reserves and excess of previous post-production. The system includes the arrangement of excess raw material storage, time information about the age of raw materials and simple data on the amount of raw materials stored in the storage warehouse. Meanwhile, although the following MSMEs are able to store excess raw materials from previous post-production, Kedaton Tailor & Convection,

Az Zahra Batik & Modiste and Nine Convection do not yet have an organized warehouse system.

4. Patterning

The patterning process includes measuring the order pattern on raw materials and describing the order pattern model on raw materials.

5. Cutting

Raw materials that already have patterns then being cut to form raw materials according to the size and shape of the pattern itself. This process is done manually using scissors.

6. Sewing

The raw material that has been cut into pieces according to the pattern will then go through several stages of sewing. At this stage, the usual sewing process will be carried out to join the two sides of the t-shirt material and the over-lock sewing process to sew special stitches (hem) on the edge of the fabric.

7. Finishing

Semi - finished goods are then sewn again through the over-deck and chain stitch sewing process to strengthen the existing stitches.

8. Final Stage Quality Control

This stage includes checking the quality of the stitches, the material of the finished goods, the consistency of the desired size of the finished goods, and the number of finished goods according to the order.

5.2 Risk Event Identification

The severity value is used as an indicator to find the magnitude of the resulting risk impact. Severity results are obtained from the results of questionnaires distributed to owners of textile SMEs producing creative T-shirts in Bantul, Yogyakarta. Based on 5 MSMEs which set as research objects, the risk event values were obtained as follows:

a. Saputra Bordir

For large procurement forecast error (E₁) risk event, the risk has scored 1, sudden additional raw material procurement (E₂) risk event has scored 2, improper production budget planning (E₃) risk event has scored 2, error planning process of machine and tool maintenance (E₄) risk event has scored 2, sudden changes in production planning (E₅) risk event has scored 3, the quality of raw materials is not up to standard (E₆) risk event has scored 3, late arrival of raw materials (E₇) risk event has scored 3, negligence on raw materials inspection (E₈) risk event has scored 4, delay or stoppage during production process (E₉) risk event has scored 3, production equipment is interrupted during the production process (E₁₀) risk event has scored 2, and damage to the goods during the production process (Production Defects) (E₁₁) risk event has scored 3.

b. Kedaton Tailor & Konveksi

For large procurement forecast error (E₁) risk event, the risk has scored 2, sudden additional raw material procurement (E₂) risk event has scored 2, improper production budget planning (E₃) risk event has scored 2, error planning process of machine and tool maintenance (E₄) risk event has scored 3, sudden changes in production planning (E₅) risk event has scored 3, the quality of raw materials is not up to standard (E₆) risk event has scored 2, late arrival of raw materials (E₇) risk event has scored 2, negligence on raw materials inspection (E₈) risk event has scored 2, delay or stoppage during production process (E₉) risk event has scored 3, production equipment is interrupted during the production process (E₁₀) risk event has scored 2, and damage to the goods during the production process (Production Defects) (E₁₁) risk event has scored 3.

c. Az Zahra Batik & Modiste

For large procurement forecast error (E₁) risk event, the risk has scored 1, sudden additional raw material procurement (E₂) risk event has scored 3, improper production budget planning (E₃) risk event has scored 1, error planning process of machine and tool maintenance (E₄) risk event has scored 1, sudden changes in production planning (E₅) risk event has scored 1, the quality of raw materials is not up to standard (E₆) risk event has scored 2, late arrival of raw materials (E₇) risk event has scored 1,

negligence on raw materials inspection (E₈) risk event has scored 1, delay or stoppage during production process (E₉) risk event has scored 3, production equipment is interrupted during the production process (E₁₀) risk event has scored 1, and damage to the goods during the production process (Production Defects) (E₁₁) risk event has scored 2.

d. Nine Apparel

For large procurement forecast error (E₁) risk event, the risk has scored 4, sudden additional raw material procurement (E₂) risk event has scored 3, improper production budget planning (E₃) risk event has scored 2, error planning process of machine and tool maintenance (E₄) risk event has scored 1, sudden changes in production planning (E₅) risk event has scored 1, the quality of raw materials is not up to standard (E₆) risk event has scored 5, late arrival of raw materials (E₇) risk event has scored 5, negligence on raw materials inspection (E₈) risk event has scored 2, delay or stoppage during production process (E₉) risk event has scored 5, production equipment is interrupted during the production process (E₁₀) risk event has scored 3, and damage to the goods during the production process (Production Defects) (E₁₁) risk event has scored 5.

e. Ayu Konveksi

For large procurement forecast error (E₁) risk event, the risk has scored 1, sudden additional raw material procurement (E₂) risk event has scored 2, improper production budget planning (E₃) risk event has scored 4, error planning process of machine and tool maintenance (E₄) risk event has scored 2, sudden changes in production planning (E₅) risk event has scored 1, the quality of raw materials is not up to standard (E₆) risk event has scored 2, late arrival of raw materials (E₇) risk event has scored 4, negligence on raw materials inspection (E₈) risk event has scored 4, delay or stoppage during production process (E₉) risk event has scored 5, production equipment is interrupted during the production process (E₁₀) risk event has scored 3, and damage to the goods during the production process (Production Defects) (E₁₁) risk event has scored 1.

5.3 Risk Agent Identification

The occurrence value are used as an indicator to find out how big the source of risk. Occurrence results are obtained from the results of questionnaires distributed to owners of textile MSMEs producing creative T-shirts in Bantul, Yogyakarta. Based on 5 MSMEs which set as research objects, the risk agent values were obtained as follows:

a. Saputra Bordir

For Inaccuracy in production planning (A_1) risk agent has scored 2, Uncertain amount of orders from consumers (A_2) risk agent has scored 5, Human Error (A_3) risk agent has scored 2, Suppliers Inability to provide raw materials according to quantity (A_4) risk agent has scored 1, Workers have less expertise (A_5) risk agent has scored 3, Production process being hampered (A_6) risk agent has scored 2, Machine maintenance planning error (A_7) risk agent has scored 2, Lack of production tools (A_8) risk agent has scored 1, Raw material below standard quality (A_9) risk agent has scored 1, Increase in raw material prices (A_{10}) risk agent has scored 2, Scarcity of raw materials (A_{11}) risk agent has scored 2, Raw materials arrive late (A_{12}) risk agent has scored 2, Standard Operating Procedure (SOP) for workers not going well (A_{13}) risk agent has scored 3, Material storage management (warehouse) is not good (A_{14}) risk agent has scored 2, Product quality inspection is not good (A_{15}) risk agent has scored 2, Lack of Supervising towards the worker (A_{16}) risk agent has scored 2, Miscommunication with the suppliers (A_{17}) risk agent has scored 3.

b. Kedaton Tailor & Konveksi

For Inaccuracy in production planning (A_1) risk agent has scored 3, Uncertain amount of orders from consumers (A_2) risk agent has scored 3, Human Error (A_3) risk agent has scored 3, Suppliers Inability to provide raw materials according to quantity (A_4) risk agent has scored 3, Workers have less expertise (A_5) risk agent has scored 3, Production process being hampered (A_6) risk agent has scored 2, Machine maintenance planning error (A_7) risk agent has scored 3, Lack of production tools (A_8) risk agent has scored 3, Raw material below standard quality (A_9) risk agent has scored 2, Increase in raw material prices (A_{10}) risk agent has scored 4, Scarcity of raw materials (A_{11}) risk agent has scored 3, Raw materials arrive late (A_{12}) risk agent has scored 3, Standard Operating Procedure (SOP) for workers not going well (A_{13}) risk

agent has scored 3, Material storage management (warehouse) is not good (A₁₄) risk agent has scored 3, Product quality inspection is not good (A₁₅) risk agent has scored 3, Lack of Supervising towards the worker (A₁₆) risk agent has scored 3, Miscommunication with the suppliers (A₁₇) risk agent has scored 2.

c. Az Zahra Batik & Modiste

For Inaccuracy in production planning (A₁) risk agent has scored 1, Uncertain amount of orders from consumers (A₂) risk agent has scored 1, Human Error (A₃) risk agent has scored 2, Suppliers Inability to provide raw materials according to quantity (A₄) risk agent has scored 1, Workers have less expertise (A₅) risk agent has scored 1, Production process being hampered (A₆) risk agent has scored 2, Machine maintenance planning error (A₇) risk agent has scored 1, Lack of production tools (A₈) risk agent has scored 1, Raw material below standard quality (A₉) risk agent has scored 1, Increase in raw material prices (A₁₀) risk agent has scored 3, Scarcity of raw materials (A₁₁) risk agent has scored 1, Raw materials arrive late (A₁₂) risk agent has scored 1, Standard Operating Procedure (SOP) for workers not going well (A₁₃) risk agent has scored 1, Material storage management (warehouse) is not good (A₁₄) risk agent has scored 1, Product quality inspection is not good (A₁₅) risk agent has scored 1, Lack of Supervising towards the worker (A₁₆) risk agent has scored 1, Miscommunication with the suppliers (A₁₇) risk agent has scored 2.

d. Nine Apparel

For Inaccuracy in production planning (A₁) risk agent has scored 5, Uncertain amount of orders from consumers (A₂) risk agent has scored 1, Human Error (A₃) risk agent has scored 5, Suppliers Inability to provide raw materials according to quantity (A₄) risk agent has scored 2, Workers have less expertise (A₅) risk agent has scored 2, Production process being hampered (A₆) risk agent has scored 4, Machine maintenance planning error (A₇) risk agent has scored 2, Lack of production tools (A₈) risk agent has scored 1, Raw material below standard quality (A₉) risk agent has scored 2, Increase in raw material prices (A₁₀) risk agent has scored 5, Scarcity of raw materials (A₁₁) risk agent has scored 1, Raw materials arrive late (A₁₂) risk agent has scored 5, Standard Operating Procedure (SOP) for workers not going well (A₁₃) risk agent has scored 3, Material storage management (warehouse) is not good (A₁₄) risk

agent has scored 3, Product quality inspection is not good (A₁₅) risk agent has scored 3, Lack of Supervising towards the worker (A₁₆) risk agent has scored 3, Miscommunication with the suppliers (A₁₇) risk agent has scored 5.

e. Ayu Konveksi

For Inaccuracy in production planning (A₁) risk agent has scored 5, Uncertain amount of orders from consumers (A₂) risk agent has scored 3, Human Error (A₃) risk agent has scored 3, Suppliers Inability to provide raw materials according to quantity (A₄) risk agent has scored 2, Workers have less expertise (A₅) risk agent has scored 3, Production process being hampered (A₆) risk agent has scored 4, Machine maintenance planning error (A₇) risk agent has scored 5, Lack of production tools (A₈) risk agent has scored 1, Raw material below standard quality (A₉) risk agent has scored 5, Increase in raw material prices (A₁₀) risk agent has scored 2, Scarcity of raw materials (A₁₁) risk agent has scored 3, Raw materials arrive late (A₁₂) risk agent has scored 4, Standard Operating Procedure (SOP) for workers not going well (A₁₃) risk agent has scored 4, Material storage management (warehouse) is not good (A₁₄) risk agent has scored 2, Product quality inspection is not good (A₁₅) risk agent has scored 3, Lack of Supervising towards the worker (A₁₆) risk agent has scored 3, Miscommunication with the suppliers (A₁₇) risk agent has scored 2.

5.4 Risk Event and Risk Agent Correlation

The correlation between the risk event and the risk agent will function in the calculation of the Aggregate Risk Potential (ARP). The correlation of risk events with risk agents shows how closely related the potential risks that exist with risk factors are symbolized by weights of 0, 1, 3, and 9 in the correlation table. Risk Agent A₁, A₂, A₃ and A₅ are included in Risk Event E₁, Risk Agent A₁, A₂, A₄, A₁₂ and A₁₄ are included in Risk Event E₂. Risk Agent A₁, A₂, A₃, and A₁₀ are included in Risk Event E₃. Risk Agent A₃, A₇, A₈, A₁₃ and A₁₆ are included in Risk Event E₄. Risk Agent A₁, A₂, A₃, A₄, A₇, A₈, A₁₀, A₁₁ and A₁₂ are included in Risk Event E₅. Risk Agent A₉, A₁₁, A₁₃, A₁₄, A₁₅ and A₁₇ are included in Risk Event E₆. Risk Agent A₁, A₃, A₁₁, A₁₆ and A₁₇ are included in Risk Event E₇. Risk Agent A₃, A₅ and A₁₃ are included in Risk Event E₈. Risk Agent A₁₃ and A₁₆ are included in Risk Event E₉. Risk Agent A₅, A₇ and A₁₃ are included in Risk Event E₁₀. Risk Agent A₃, A₅, A₇, A₁₅ and A₁₆ are included in Risk Event E₁₁.

5.5 House of Risk Phase 1 Analysis

In this step, the calculation of ARP obtained from the multiplication results of occurrence times (O_j), severity (S_i) and the level of correlation. Furthermore, the existing ARP will be sorted in rank from the largest to the smallest. Since there are 5 locations which purposed to find the ARP value in cluster form, ARP of the five existing locations will then be averaged for later calculations of Total ARP to find the largest to the smallest rank of ARP that represents cluster conditions. Based on Table 4. 19, The risk agent total code A_1 has an ARP value of 219.4 as 3rd rank, A_2 has an ARP value of 56.6 as a 10th rank, A_3 has an ARP value of 280.8 as a 2nd rank, A_4 has an ARP value of 48 as a 12th rank, A_5 has an ARP value of 151.8 as a 6th rank, A_6 has an ARP value of 0 as a 17th rank, A_7 has an ARP value of 89 as a 7th rank, A_8 has an ARP value of 6 as a 16th rank, A_9 has an ARP value of 12.6 as a 14th rank, A_{10} has an ARP value of 76.2 as a 8th rank, A_{11} has an ARP value of 23 as a 13th rank, A_{12} has an ARP value of 52.2 as a 11th rank, A_{13} has an ARP value of 308.4 as a 1st rank, A_{14} has an ARP value of 11.8 as a 15th rank, A_{15} has an ARP value of 75.6 as a 9th rank, A_{16} has an ARP value of 162 as a 5th rank, and A_{17} has an ARP value of 169.2 as a 4th rank.

5.6 Risk Evaluation

In order to determine the level of risk priority, Pareto diagram is used according to its principal which is 80/20 rule, describes that 80% of risk events come from 20% of the risk agents that caused them. All elements to the left of the 80% line are the key elements that cause the most problems in supply chain flow. According to figure 4.6, there are 7 risk points that must be followed up for further mitigation which are: A_{13} (Standard Operating Procedure (SOP) for workers not going well) with ARP value of 308.4, A_3 (Human Error) with ARP value of 280.8, A_1 (Inaccuracy in production planning) with ARP value of 219.4, A_{17} (Miscommunication with the suppliers) with ARP value of 169.2, A_{16} (Lack of Supervising towards the worker) with ARP value of 162, A_5 (Workers have less expertise) with ARP value of 151.8, and A_7 (Machine maintenance planning error) with ARP value of 89.

5.7 Root Cause Analysis

1. Standard Operating Procedure (SOP) for workers not going well

Based on the results of the why-why analysis in accordance with table 4. 20, the SOP's not working for workers are caused by the workers' misunderstanding of the existing SOPs. This can occur, among others, due to inadequate supervision of workers, which makes workers are exposed with insufficient control. In addition, improper periodic evaluations and also the unclear work system makes the main problem more likely to occur. In the end, the absence of SOPs and the concept of a clearly and well-written work system became the basic cause of the non-working of the existing SOPs. Meanwhile, according to the fishbone diagram Figure 4. 7, human and management factor become two influential factors of Standard Operating Procedure for workers not working. One thing that can influence SOP not working from human factors is workers who do not understand the SOP. On the other hand, things that can influence SOP not worked from management factor are worker's supervision, which is still not maximized, a periodic evaluation that does not go well, a working system that is not perfect yet, and absence of clear written SOP rules.

2. Human Error

Based on why-why analysis results in Table 4.21, human error is caused by miscommunication between workers and MSMEs owners. This miscommunication problem is probable to occur because of the worker's inadequate skills. In the end, the basic issue from the human error problem is the unclear work instruction. In Figure 4. 8, the fishbone diagram of human error shows that human and management factors are two influential factors that exist. In human factor, miscommunication between workers and MSMEs owners and inadequate worker skills become things that influence human error. Meanwhile, unclear work instruction is the only thing that influences human error.

3. Inaccuracy in Production Planning

According to Table 4. 22, why-why analysis shows a result that inaccuracy in production planning caused by COVID – 19 pandemic issue, which happened later. This condition makes the demand even more volatile than the normal one. The basic issue of inaccuracy in production planning is the absence of method and calculation to determine both stock and right order time for reducing the unpredictable level that does occurs due to the pandemic. Meanwhile, based on Figure 4. 9, the fishbone diagram shows that

environment and process factors both influential to inaccuracy in production planning to occur. For the environment factor, COVID – 19 pandemic is the most influential cause for the problem to happen. On the other hand, in process factors, the thing that influences the problem to exist are more volatile demand and the absence of a calculation method to determine the safety stock and right order time.

4. Miscommunication with the Suppliers

Information on table 4. 23 shows that Miscommunication with the suppliers tend to happen because of incapable supplier. It turns out that supplier incompetence is often caused by unsystematic procurement procedures which causes confusion in some conditions. At the end, the basic reason of Miscommunication with the suppliers to happen is the unclear agreement between suppliers and MSMEs related to procurement process. Meanwhile from fishbone diagram in figure 4. 10, there are two influential factors which increase Miscommunication with the suppliers to be occur which are human and management factors. On human factor the inability of the supplier is the thing that triggers the problem. While on the management factor, two things that trigger miscommunication with suppliers are procurement procedures that are not yet systematic and there is no clear agreement between suppliers and MSMEs regarding the procurement process.

5. Lack of Supervising Towards the Worker

Based on why – why analysis on table 4. 24, lack of supervising towards the worker caused by unclear work procedures. This condition is also worsen by the lack of communication between workers and owners of MSMEs. In the end, the basic cause of the case was that there was no clear and structured supervisory policy from the MSME owners. Meanwhile in figure 4. 11, fishbone diagram of lack of supervising towards the worker have two influential factors which are human and management. Lack of communication between workers and MSME owners is the influential point in human factor, on the other hand management factor have two influential factors which are unclear of work procedure and no supervisory policy from the owners.

6. Workers Have Less Expertise

Based on table 4. 25, why – why analysis shows that workers less expertise resulted from unfamiliar workers towards the equipment / machines. This is also due to the absence of training to improve the ability of workers to use existing equipment, which is the basic obstacle to the workers lack of expertise. Meanwhile on figure 4. 12, fishbone diagram shows that there are two influential factors which contributed for workers less expertise to happen which are human and management factors. Turns out both factors have one thing that triggered the problem, there are workers unfamiliar with the equipment in human factor and no training to improve workers ability in management factor.

7. Machine Maintenance Planning Error

The why - why analysis in table 4. 26 shows that the cause of the Machine maintenance planning error is the absence of special attention to the period of use of production equipment so that excessive use often occurs. This is basically caused by the absence of a routine equipment service schedule that can prevent either over usage of existing equipment or even more severe damage. Meanwhile in figure 4. 13, the fishbone diagram of the machine maintenance planning error shows that human and management factors are the causative factors. In the human factor, the absence of special attention to the period of use of existing equipment is the thing that affects the occurrence of machine maintenance planning errors. While on the management factor, the thing that contributed to the occurrence of this problem was the absence of a routine service schedule for equipment and machinery.

5.8 House of Risk Phase 2 Analysis

In this phase 2 house of risk, the first thing to do is design a mitigation strategy from the priority risk results obtained from the house of risk 1 method of visualizing the Pareto diagram. The mitigation strategy is formulated through discussion with the MSME owner to obtain a mitigation design that is in accordance with the selected risk agent. Mitigation actions that have been successfully designed include: Organize and complete the Standard Operating Procedures (SOPs) in written form (PA₁), Socialization of SOPs to workers in understandable language (PA₂), Conduct a simple method to determine the minimum stock and order time (PA₃), Create agreements between MSMEs and suppliers such as details for submitting orders, agreements in case of errors, etc. (PA₄), Making supervisory

policies by owners such as workers who are required to report after the task, conduct weekly evaluations of worker performance, etc. (PA₅), Provide regular training on how to use sewing tools (2 - 3 months) (PA₆), and Making a schedule for servicing sewing tools on a regular basis (1 week) (PA₇). The design that has been formed then correlated with a scale of 0, 1, 3 and 9. In order to find out the difficulties in implementing mitigation actions, Degree of Difficulty (D_k) measurement is carried out. The main purpose is to determine the total effectiveness by multiplying the value of the Aggregate Risk Potential (ARP) and the correlation between risk agent j and risk mitigation k (E_{jk}). The next step is to calculate the Total Effectiveness (TE_k) value, which is how effective the handling strategy could be. The next step is calculate the Effectiveness to Difficulty (ETD_k) ratio by dividing the result of Total Effectiveness (TE_k) with Degree of Difficulty (D_k). If the Effectiveness to Difficulty value has been obtained, the next step is priority ranking of the mitigation action design strategy can be determined. Based on house of risk phase 2 results in table 4. 30 can be shown that PA₁ has an ETD_k value of 2671.5 with a 1st rank, PA₂ has an ETD_k value of 1726.2 with a 3rd rank, PA₃ has an ETD_k value of 1128.6 with a 4th rank, PA₄ has an ETD_k 761.4 with a 5th rank, PA₅ has an ETD_k value of 2455.2 with a 2nd rank, PA₆ has an ETD_k value of 455.4 with a 6th rank, and PA₇ has an ETD_k value of 400.5 with a 7th rank. In the end, the ranking order of Effectiveness to Difficulty ETD_k according to priority and mitigation actions from largest to smallest are PA₁, PA₅, PA₂, PA₃, PA₄, PA₆, and PA₇. The value of effectiveness to difficulty will be used to determine which handling strategy should be prioritized. In the previous data, it can be seen that PA₁ has the highest ETD value so that the Organize and complete the Standard Operating Procedures (SOPs) in written form must be prioritized to be executed first. Standard Operating Procedures (SOPs) in written form can be interpreted as actions to clarify the work process and what must be done throughout the production process at the MSME. With the work process and rules that are clear and easy to follow by the workers, the possibility of other risks such as worker negligence, miscommunication, and others can be prevented.

5.9 Mitigation Proposal Implementation Design

5.9.1 Organize and Complete the Standard Operating Procedures (SOPs) in written form

5.9.1.1 Procurement Process

STANDARD OPERATING PROCEDURE

PROCUREMENT PROCESS PREPARATION SOP

1. Purpose

Preparation before the procurement process aims to ensure aspects such as quantity and variants as efficiently as possible according to existing demands and needs.

2. Scope

Production Department

3. Definition

Owner (Production Chief)

4. Document

Order note

Memorandum payment

Cash book

Raw material ID document

5. Procedure Description

Table 5. 1 Procurement Process Procedure Description

Person Responsible	No	Procedure Description	Document / Form
Warehouse Worker	1	Check the existing stock in the warehouse such as what colors are left and how long the cloth rollers	Raw material ID document

		are left based on existing warehouse inventory data	
Owner (Production Chief)	2	Estimate the details of raw materials to be purchased by considering the existing demand, the majority of incoming requests during the last month and the calculation of the minimum stock of inventory and the ordering period	
Warehouse Worker	3	Make orders according to the quantity previously planned, order fulfillment is prioritized on one supplier first so that the quality and consistency of the material is maintained. Each order made must be accompanied by an order note that includes the person in charge of the supplier, the worker responsible for ordering, details of the identity of the raw materials ordered and the time for ordering and picking up that has been determined.	Order note
Owner	4	Make payments both cash and non-cash according to the bill that comes out along with the incoming order to the supplier. In this process, a proof of payment for orders that have been made will be generated	Memorandum payment

Owner	5	The proof of payment that has been produced is directly recorded in the cash book in the form of daily purchase documents and MSME spending recapitulation documents	Cash book
-------	---	--	-----------

6. Flowchart

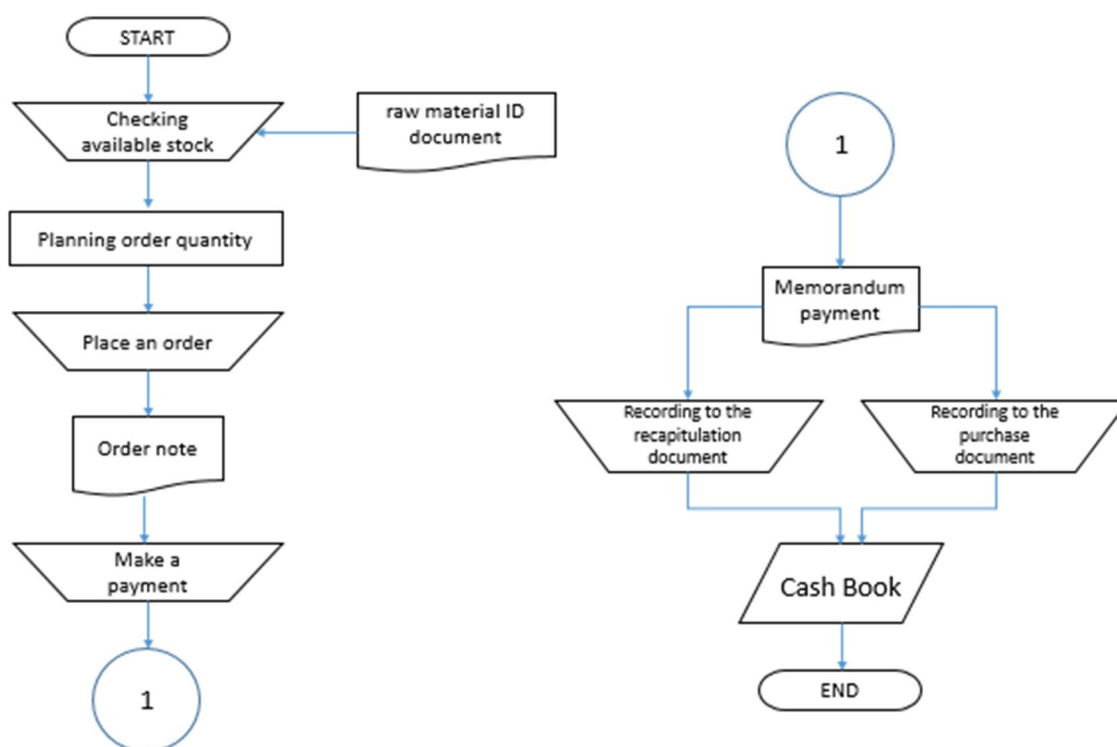


Figure 5. 1Procurement Process Flowchart

Table 5. 2Procurement Process Disposition Table

Disposition	Name	Position	Signature
Created By			
Inspected By			
Approved By			

5.9.1.2 Warehousing

STANDARD OPERATING PROCEDURE

WAREHOUSING SOP

1. Purpose

Manage the flow of warehousing starting from the arrival of raw materials, quality checks, labeling of raw materials to data collection of incoming and outgoing raw materials so that an orderly system is formed

2. Scope

Production Department

3. Definition

Warehouse Worker

4. Document

Raw material quality document

Raw material ID document

5. Procedure Description

Table 5. 3Warehousing Procedure Description

Person Responsible	No	Procedure Description	Document / Form
Warehouse Worker	1	The raw materials are taken by the warehouse worker after the payment is paid off. Pick-up and delivery of raw materials must be carried out according to the pick-up schedule listed on the order note	

Warehouse Worker	2	Carry out light checks on the quality of newly arrived raw materials, this process is carried out by referring to the quality documents of raw materials that have been previously provided with the aim of maintaining the consistency of the raw materials used.	Raw material quality document
Warehouse Worker	3	Recording data on the identity of newly arrived raw materials such as color, type of fabric raw material used, warehouse entry time and quantity of raw materials	Raw material ID document
Owner	4	Raw materials that have been recorded and lightly checked and then it is possible to load them to the warehouse	

6. Flowchart

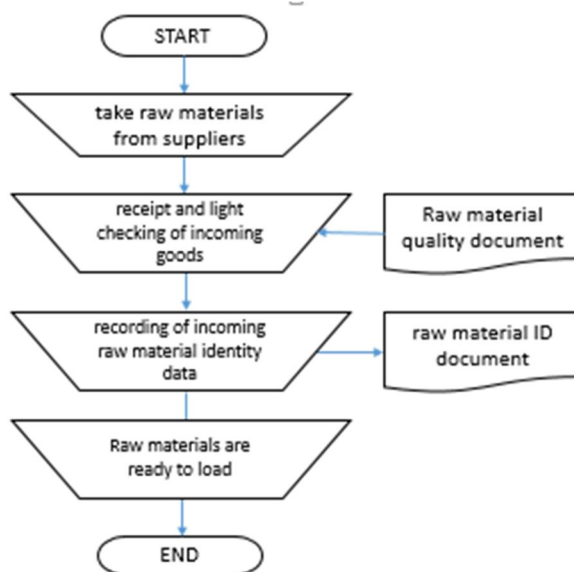


Figure 5. 2 Warehousing Flowchart

Table 5. 4 Warehousing Disposition Table

Disposition	Name	Position	Signature
Created By			
Inspected By			
Approved By			

5.9.1.3 Early Stage Quality Control

STANDARD OPERATING PROCEDURE

EARLY STAGE QUALITY CONTROL SOP

1. Purpose

Quality control at this early stage aims to ensure that the raw fabric materials to be used in the production process are of good quality and in accordance with the desired standards. In addition, this will also minimize material failures in the middle of the production process so that there are no delays during production

2. Scope

Production Department

3. Definition

Cutting and Patterning worker

4. Document

Customer order note

Raw material ID document

5. Procedure Description

Table 5. 5Early Stage Quality Control Procedure Description

Person Responsible	No	Procedure Description	Document / Form
Cutting and Patterning worker	1	Checking the compatibility between the existing raw materials and the fabric material specifications on the raw material identity data, this process is based on the raw material ID document	Raw material ID document
Cutting and Patterning worker, Owner	2	If the material does not match the specifications recorded, then the raw material will be submitted by the owner for return and exchange of replacement fabric raw materials	
Cutting and Patterning worker	3	If the material complies with the specifications recorded, the raw material is ready to be used for production	Customer order note

6. Flowchart

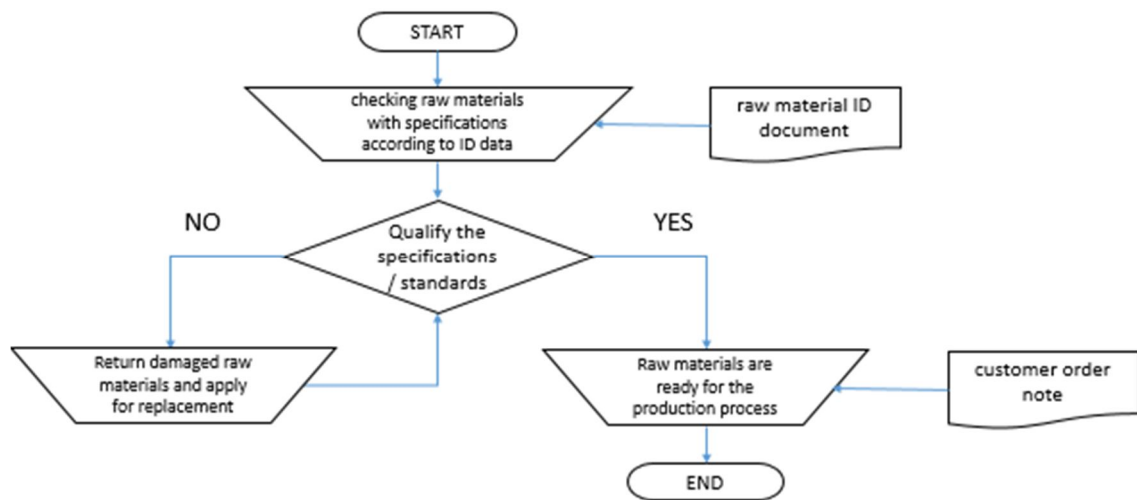


Figure 5. 3Early Stage Quality Control Flowchart

Table 5. 6Early Stage Quality Control Disposition Table

Disposition	Name	Position	Signature
Created By			
Inspected By			
Approved By			

5.9.1.4 Patterning and Cutting

STANDARD OPERATING PROCEDURE

PATTERNING AND CUTTING PROCESS SOP

1. Purpose

The patterning process includes a description of the product design that will be used as a reference in production according to customer requests, then the process will continue to cutting for separating the raw material into specific shape which expected.

2. Scope

Production Department

3. Definition

Cutting and Patterning worker

4. Document

Customer order note

5. Procedure Description

Table 5. 7 Patterning and Cutting Procedure Description

Person Responsible	No	Procedure Description	Document / Form
Cutting and Patterning worker	1	Drawing a pattern model that will be used as a mold or reference from a customer request model before being applied to the material. This creation refers to the customer order note	Customer order note
Cutting and Patterning worker, Owner	2	If the pattern model does not match what is in the customer request data, it is necessary to revise it until it is appropriate. If it is appropriate then it can be continued on the depiction of the pattern on the existing fabric raw materials.	
Cutting and Patterning worker	3	The pattern that has been formed on the raw material of the fabric and then cut according to the desired shape	
Cutting and Patterning worker	4	If the cut results have an error, it needs to be readjusted to the	

		customer's initial request, if the cut results are in accordance with the desired shape then the raw material for the cut is ready to be sewn and put together further	
--	--	--	--

6. Flowchart

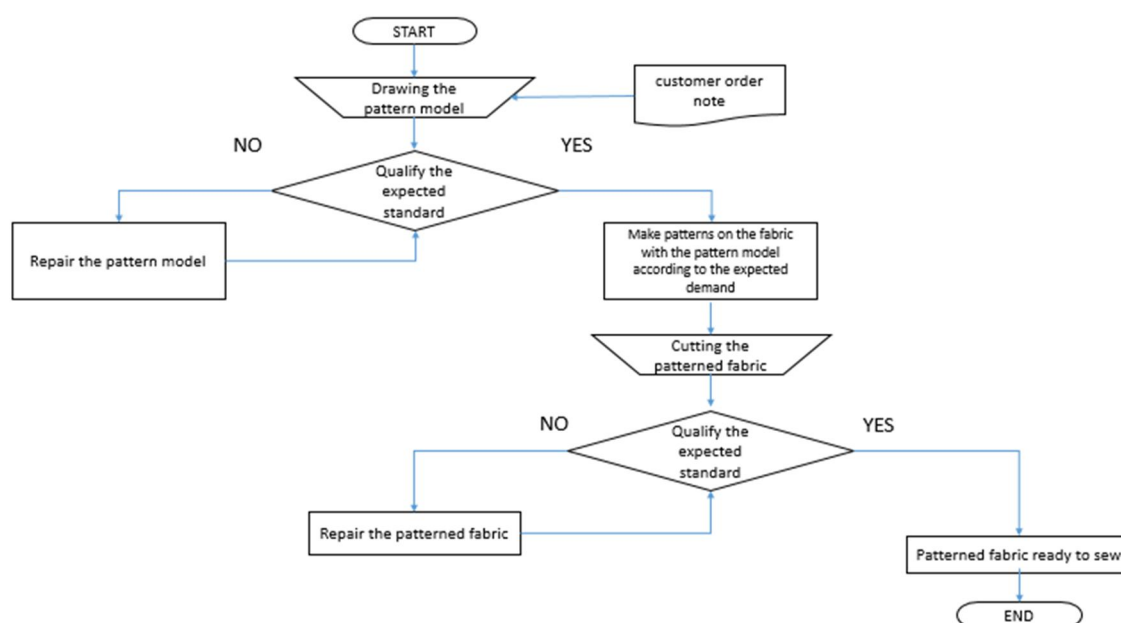


Figure 5. 4 Patterning and Cutting Flowchart

Table 5. 8 Patterning and Cutting Disposition Table

Disposition	Name	Position	Signature
Created By			
Inspected By			
Approved By			

5.9.1.5 Sewing Process (Regular & Over-lock Sewing)

STANDARD OPERATING PROCEDURE

SEWING PROCESS SOP

1. Purpose

The usual sewing process aims to unite pieces of fabric that have been previously cut into a semi-finished shape according to the previously desired model. After the regular sewing process is complete, over-lock sewing will be carried out to cover the edges of the fabric that are still stringy with stitches so that they are neater

2. Scope

Production Department

3. Definition

Tailor (Ordinary sewing and Over-lock sewing)

4. Document

(-)

5. Procedure Description

Table 5. 9 Sewing Process Procedure Description

Person Responsible	No	Procedure Description	Document / Form
Tailor (Ordinary sewing)	1	Patterned fabrics that have been pre-cut are sewn using the usual sewing technique first to create a semi-finished shape	
Tailor (Ordinary sewing)	2	If the sewing process has not produced a good connection, it is necessary to make repairs and re-stitching according to the pattern that has been formed. If the results	

		of the sewing process have produced good seams, the semi-finished goods can be continued to be sewn over-lock	
Tailor (Over-lock sewing)	3	over-lock sewing as a follow-up process from regular sewing is done to cover the edges of the fabric that has been fused together	
Tailor (Over-lock sewing)	4	If the over-lock sewing is not neat, then repairs must be made until the edges of the fibrous fabric are completely covered, if the over-lock sewing is in accordance with the target, the semi-finished goods can be processed in the finishing section.	

6. Flowchart

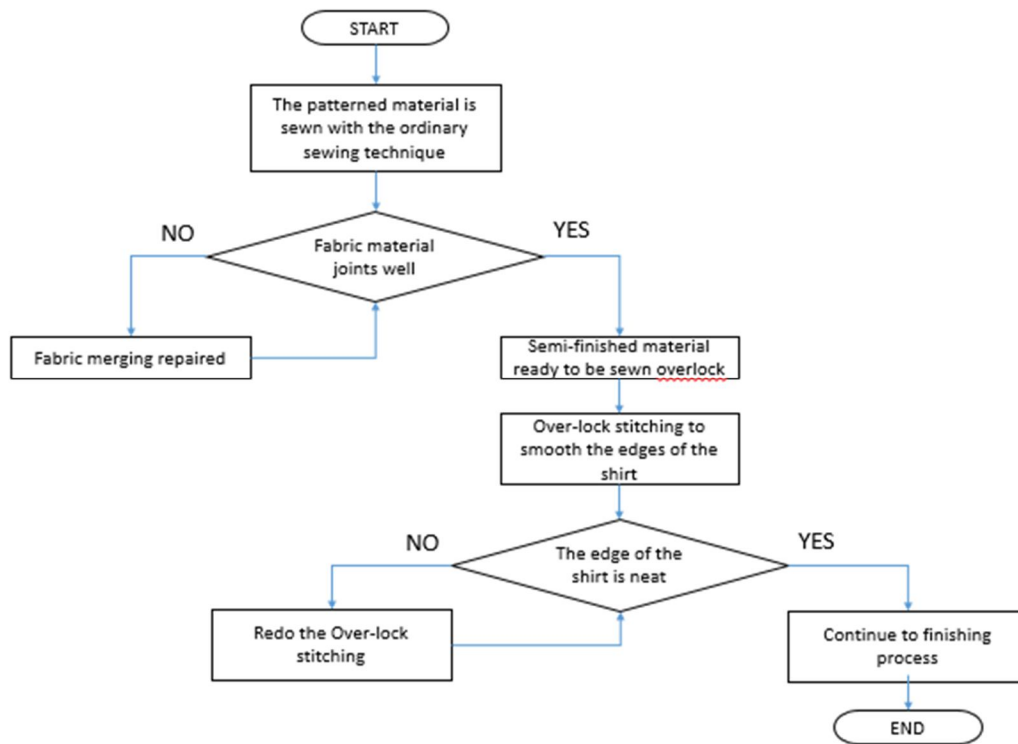


Figure 5. 5 Sewing Process Flowchart

Table 5. 10 Sewing Process Disposition Table

Disposition	Name	Position	Signature
Created By			
Inspected By			
Approved By			

5.9.1.6 Finishing (Over-deck & Chain Sewing)

STANDARD OPERATING PROCEDURE

FINISHING PROCESS SOP

1. Purpose

Finishing the process is useful for tidying up the details that have not been done before. Over-deck sewing will be used to strengthen the existing stitches on the edges of the sleeves and also the bottom edge of the shirt. Meanwhile, chain sewing will function as a final lock on the edge stitches on the shirt and form strong and quality stitches on the product

2. Scope

Production Department

3. Definition

Tailor (Over-deck sewing and Chain sewing)

4. Document

(-)

5. Procedure Description

Table 5. 11 Finishing Process Procedure Description

Person Responsible	No	Procedure Description	Document / Form
Tailor (Over-deck sewing)	1	semi-finished products will then be sewn with over-deck stitches so that the seams of the sleeves and bottom edges become stronger and neater	
Tailor (Over-deck sewing)	2	If the over-deck seam has not locked the seam completely, it needs to be repaired and repeated	

		over-deck stitching until a well-locked seam is achieved. If the over-deck sewing has been completed, the final sewing process, namely chain sewing, can be done	
Tailor (Chain sewing)	3	Chain sewing is done after all the sewing processes have been carried out and become the final stage of making a t-shirt. The chain sewing process must be carried out when all products are really good in quality and have gone through all the sewing sequences	
Tailor (Chain sewing)	4	If the chain sewing has been completed properly, the stitches have been locked neatly and there are no errors, then you can proceed to the final quality checking process. If there are still seam that are not completely closed, further repairs are needed. One t-shirt production badge must wait and must not be separated if one or more mistakes occur.	

6. Flowchart

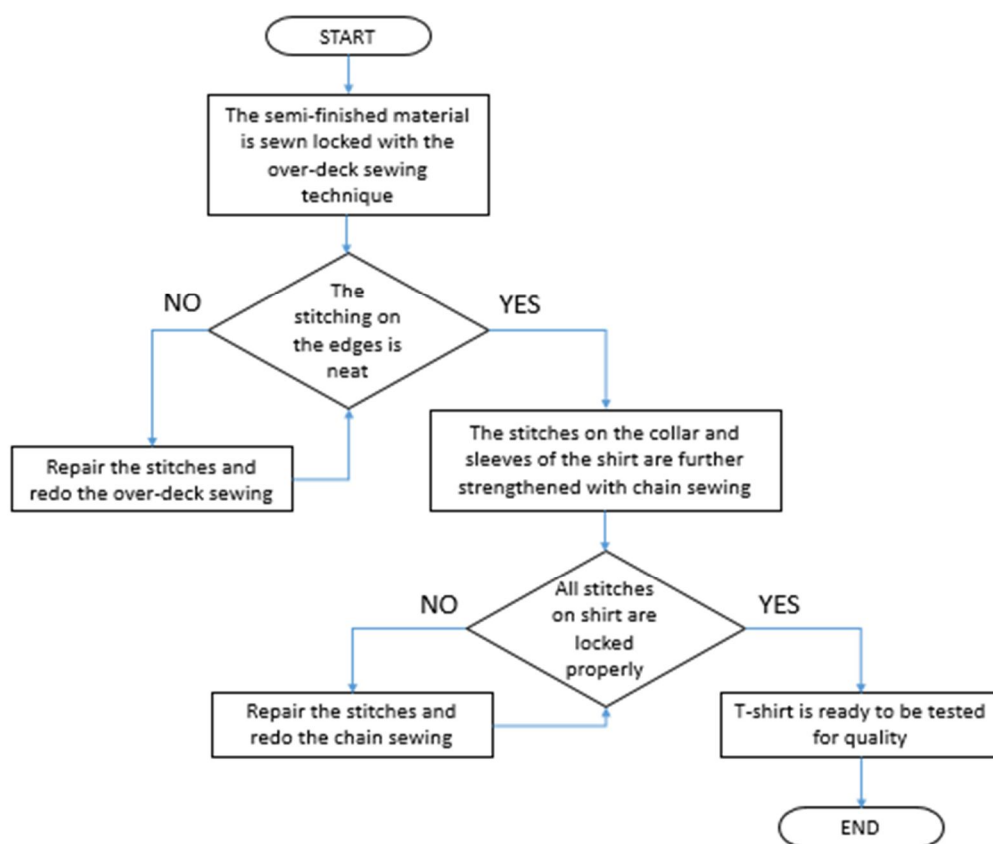


Figure 5. 6 Finishing Process Flowchart

Table 5. 12 Finishing Process Disposition Table

Disposition	Name	Position	Signature
Created By			
Inspected By			
Approved By			

5.9.1.7 Final Stage Quality Control

STANDARD OPERATING PROCEDURE

FINAL STAGE QUALITY CONTROL SOP

1. Purpose

The final stage of quality control is held to ensure that the products that have been produced are in accordance with the requirements of the customer and that there are no mistakes that make the quality not up to standard.

2. Scope

Production Department

3. Definition

Owner (Production Chief)

4. Document

Customer order note

Defects checklist

5. Procedure Description

Table 5. 13 Final Stage Quality Control Procedure Description

Person Responsible	No	Procedure Description	Document / Form
Owner (Production Chief)	1	Quality checks are carried out based on the customer's request note so that the goods to be delivered to the customer are in accordance with what was requested from the beginning. Defects which occur will be noted in defects checklist as a reference	Customer order note Defects checklist

		for the repair or replacement procedure.	
Owner (Production Chief)	2	If the product does not match the existing demand or standards, it is necessary to replace the item or repair the item in question if it is still possible. Repairs or replacements will be adjusted to the defects record that summarizes the errors that occurred	Defects checklist
Owner (Production Chief)	3	If the product have already match the existing demand and standards so that means the product already approved and ready to be given to the customers.	

6. Flowchart

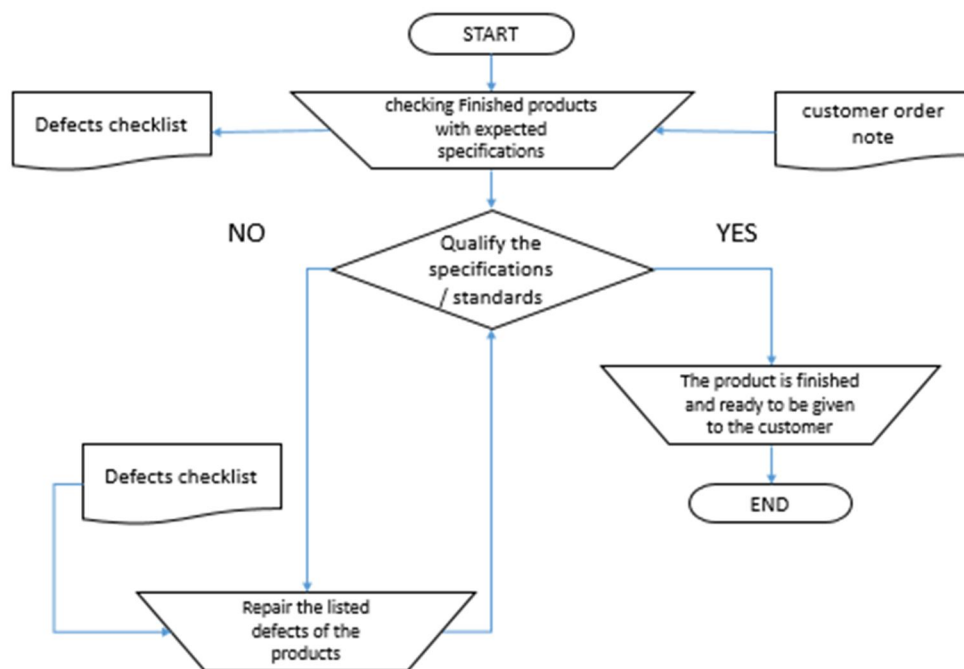


Figure 5. 7 Final Stage Quality Control Flowchart

Table 5. 14 Final Stage Quality Disposition Table

Disposition	Name	Position	Signature
Created By			
Inspected By			
Approved By			

CHAPTER VI

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

Based on the results obtained from research that has been carried out at 5 locations as the cluster of textile SMEs producing creative t-shirts in the Bantul area, Yogyakarta, the conclusions are:

1. There are 11 risk events and 17 risk agents identified through house of risk phase 1, then based on Pareto diagram analysis, 7 priority risk agents are obtained, namely Standard Operating Procedure (SOP) for workers not going well, human error, inaccuracy in production planning, Miscommunication with the suppliers, lack of supervision towards the worker, workers have less expertise, and machine maintenance planning errors.
2. There are 7 priority handling strategies that can be applied including organize and complete the Standard Operating Procedures (SOPs) in written form, socialization of SOPs to workers in understandable language, conduct a simple method to determine the minimum stock and order time, create agreements between MSMEs and suppliers such as details for submitting orders, agreements in case of errors, etc., making supervisory policies by owners such as workers who are required to report after the task, conduct weekly evaluations of worker performance, etc., provide regular training on how to use sewing tools (for example : 2 - 3 months), and making a schedule for servicing sewing tools on a regular basis (for example : 1 week).

6.2 Recommendation

Recommendations or suggestions that can be submitted based on this research are:

1. As future research it is necessary to carry out simulations and also evaluations based on the mitigation proposals generated from this research so that the mitigation proposals can be more perfect, effective and efficient in solving existing problems.

2. For further research, further analysis can be carried out on the risks that have not been handled by this research, such as the financial sector in order to provide a more detailed perspective on the advantages and disadvantages of the textile MSME cluster in the production of creative t-shirts, as well as other fields in the remaining 20% area on the Pareto diagram.

REFERENCES

- Ahmed, M. and Ahmad, N. (2011). An Application of Pareto Analysis and Cause-and-Effect Diagram (CED) for Minimizing Rejection of Raw Materials in Lamp Production Process. *Management Science and Engineering* Vol. 5, No. 3, 2011, pp.87-95
- Ahmed, T., Acharjee, R. N., Abdur Rahim, M.D., Sikder, N., Akther, T., Khan, M. R., Fazle Rabbi, M. D., Saha, A. (2013). An Application of Pareto Analysis and Cause-Effect Diagram for Minimizing Defect Percentage in Sewing Section of a Garment Factory in Bangladesh. *International Journal of Modern Engineering Research (IJMER)* Vol. 3, Issue. 6, Nov - Dec. 2013 pp-3700-3715
- Ayverdia, L., Nakiboğlu, C., & Aydın, S.Ö.Z. (2014). Usage of Graphic Organizers in Science and Technology Lessons', *Procedia - Social and Behavioral Sciences*, 116, 4264-4269.
- Benjamin, S.J. and Murugaiah, M. S. M. U. (2015). The use of 5-WHYs technique to eliminate OEE's speed loss in a manufacturing firm, *Journal of Quality in Maintenance Engineering*, Vol. 21 Iss 4 pp. 419 – 435
- Coccia, M. (2017). The Fishbone diagram to identify, systematize and analyze the sources of general purpose Technologies. *Journal of Social and Administrative Sciences*, 4(4), 291-303. Retrieved on April 19, 2020 from https://www.researchgate.net/publication/322526380_The_Fishbone_diagram_to_identify_systematize_and_analyze_the_sources_of_general_purpose_technologies
- Conrad, L. & Yau, C. (2010). Enterprise risk management: A critical tool for strategic decision-making. *SGS Zurich*, 10, 26 – 90
- COSO. (2004). Enterprise Risk Management-Integrated Framework. *Sarbanes-Oxley Guide for Finance and Information Technology Professionals*, (September), 224–232. <https://doi.org/10.1002/9781119201939.app4>
- Darmawi, H. (2014). *Manajemen Perbankan*. Jakarta: PT Bumi Aksara.

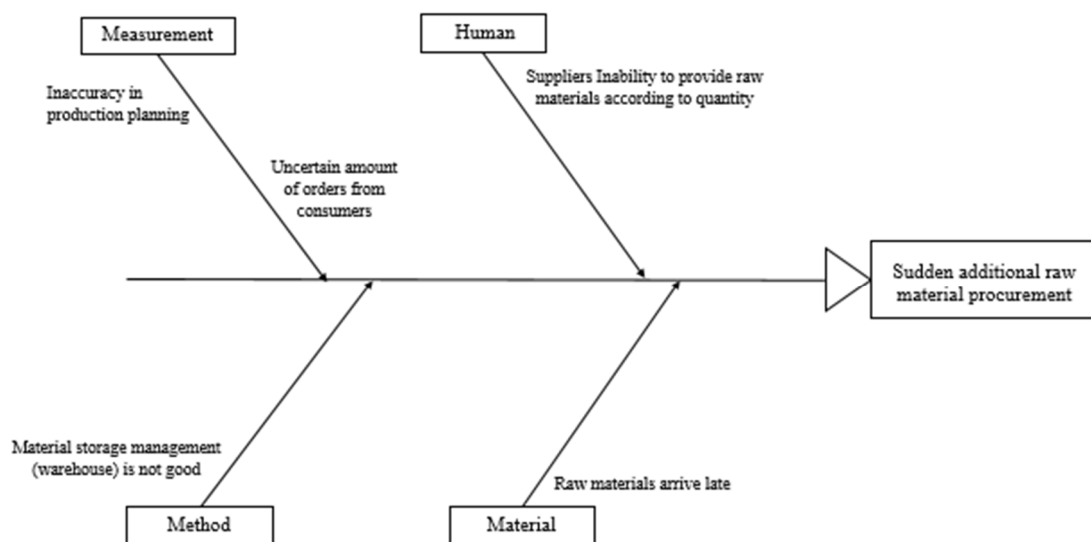
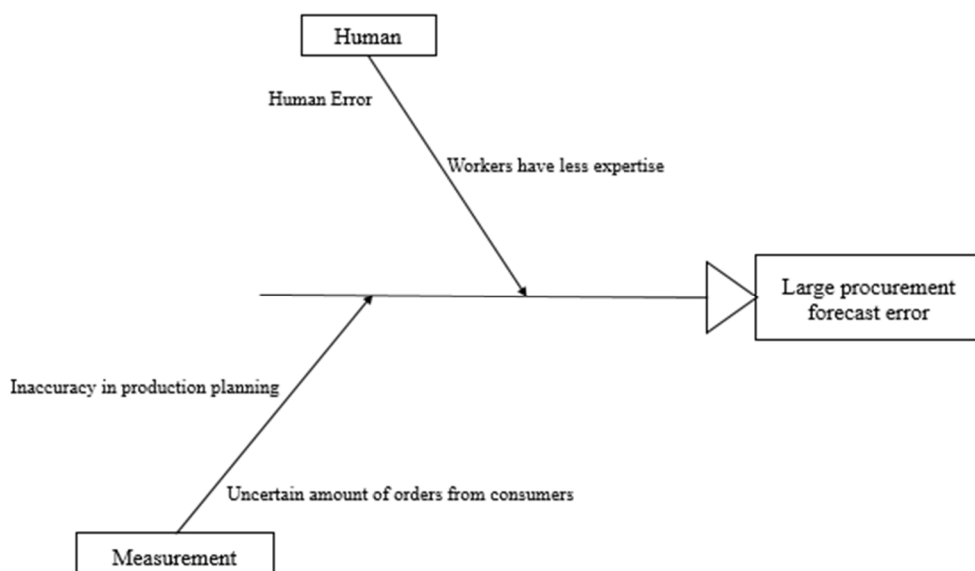
- Dinas Koperasi dan UMKM Yogyakarta. (2018). *Dinas Koperasi dan UMKM*. Cited on April 19, 2020 from Dinas Koperasi dan UMKM website: http://www.depkop.go.id/uploads/tx_rtgfiles/22._Paparan_Rakornas_Yogyakarta_2018_-_DIY.pdf
- Evans, James R, dan William M. Lindsay. 2007. *An Introduction to Six Sigma & Process Improvement*. McGraw-Hill: New York.
- Franch, X., Kenett, R. S., Susi, A., Galanis, N., Glott, R., & Mancinelli, F. (2015). Community data for OSS adoption risk management. In *The Art and Science of Analyzing Software Data* (pp. 377-409). Morgan Kaufmann.
- Hanggraeni, Dewi. (2010). *Pengelolaan Risiko Usaha*. Penerbit Fakultas Ekonomi Indonesia. Jakarta.
- Hartono, D. S. (2015). Harmonisasi Tantangan Hukum Indonesia Dalam Menghadapi Masyarakat Ekonomi ASEAN. (*Value Added*) *Majalah Ekonomi Bisnis*.
- Hekmatpanah, M. (2011). The application of cause and effect diagram in the oil industry in Iran: The case of four liter oil canning process of Sepahan Oil Company. *African Journal of Business Management* Vol. 5(26), pp. 10900-10907, 28 October, 2011
- Kasidi. 2010. *Manajemen Risiko*. Yogyakarta: Sekolah Tinggi Ilmu Manajemen YKPN.
- Kementerian Koperasi dan UMKM Republik Indonesia. 2020. “PERKEMBANGAN DATA USAHA MIKRO, KECIL, MENENGAH (UMKM) DAN USAHA BESAR (UB) TAHUN 2018 - 2019”. Cited April 19, 2020 from <https://kemenkopukm.go.id/data-umkm/?1iozLu0Km06yslehDTdgF6X16M32k0VbY9QkuGuW7qKpSpMW8q>
- Kot, S., & Dragon, P. (2015). Business Risk Management in International Corporations. *Procedia Economics and Finance*.
- Kristanto, B. R., & Hariastuti, N. P. (2014). Aplikasi Model House of Risk Untuk Mitigasi Risiko Pada Supply Chain bahan Baku Kulit. *Jurnal Ilmiah Teknik Industri*, 149-157.

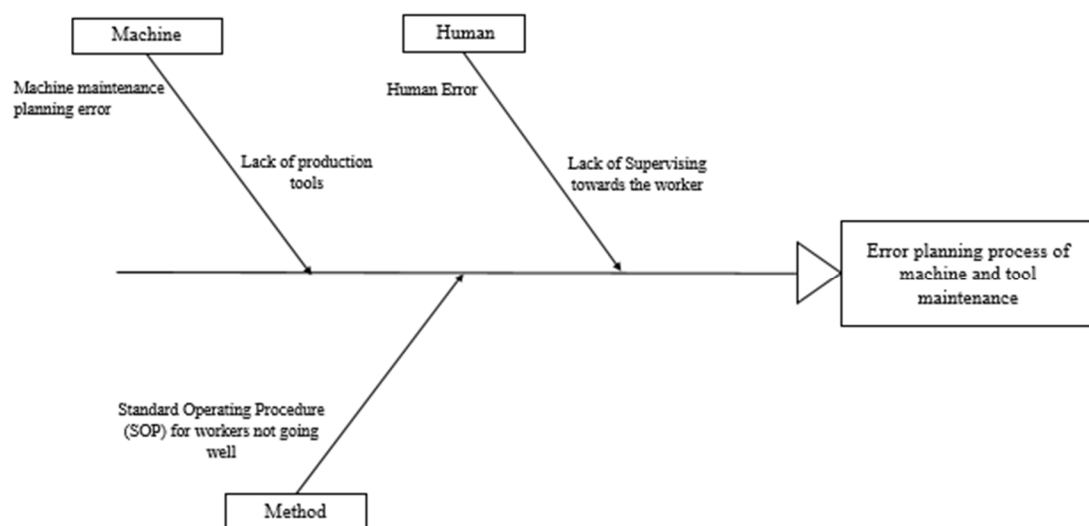
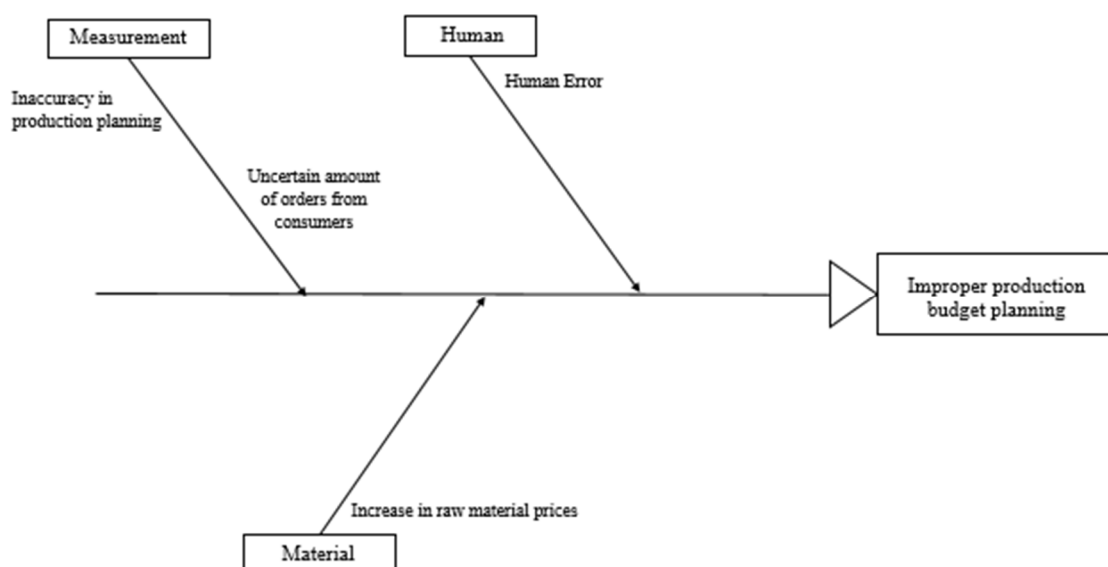
- Magdalena, R. & Vannie (2019). Analisis Risiko Supply Chain Dengan Model House of Risk (HOR) Pada Pt Tatalogam Lestari. *Jurnal Teknik Industri*, Vol. 14, No. 2, Mei 2019
- Nicolae, R. M., Nedelcu, A., and Dumitraşcu, A.E. (2015). Improvement the Quality of Industrial Products by Applying the Pareto Chart. *Review of the Air Force Academy* No 3 (30) 2015
- Nurlela, & Suprpto, H. (2014). Identifikasi dan Analisis Manajemen Risiko Pada Proyek Pembangunan Infrastruktur Bangunan Gedung Bertingkat. *Jurnal Desain Kontruksi*, 114-124.
- Pemerintah Kabupaten Bantul. (2020). *Lindungi UMKM Pemkab Bantul Luncurkan Program Perisai*. Cited on April 19, 2020 from bantulkab.go.id/berita/detail/4374.html
- Pranatha, M. A., Moeljadi & Hernawati, E. (2018). PENERAPAN ENTERPRISE RISK MANAGEMENT DALAM MENINGKATKAN KINERJA KEUANGAN DI PERUSAHAAN “XYZ”. *EKONOMI DAN BISNIS*, Vol. 5 No. 1, January - June 2018
- Pujawan, I. N., & Geraldin, L. H. (2009). House of risk: a model for proactive supply chain risk management. *Business Process Management Journal* 15.6, 953-967.
- Siahaan, Hinsu. 2009. Manajemen Risiko Pada Perusahaan dan Biokrasi. PT. Elex Media Komputindo. Jakarta.
- Tempo (2020, April 6). Wabah Corona, Sri Mulyani Sebut 8 Industri Ini Berpotensi Cuan. Recited from bisnis.tempo.com/read/1328566/wabah-corona-sri-mulyani-sebut-8-industry-ini-berpotensi-cuan
- Ulfah, M., Maarif, M. S., & Sukardi, S. R. (2016). Analisis dan perbaikan manajemen risiko rantai pasok gula rafinasi dengan Pendekatan house of risk. *Journal of Agroindustrial Technology*, 26(1).
- Voley, G., 2008. MINI GUIDE TO ROOT CAUSE ANALYSIS. Quality Management & Training Limited, London

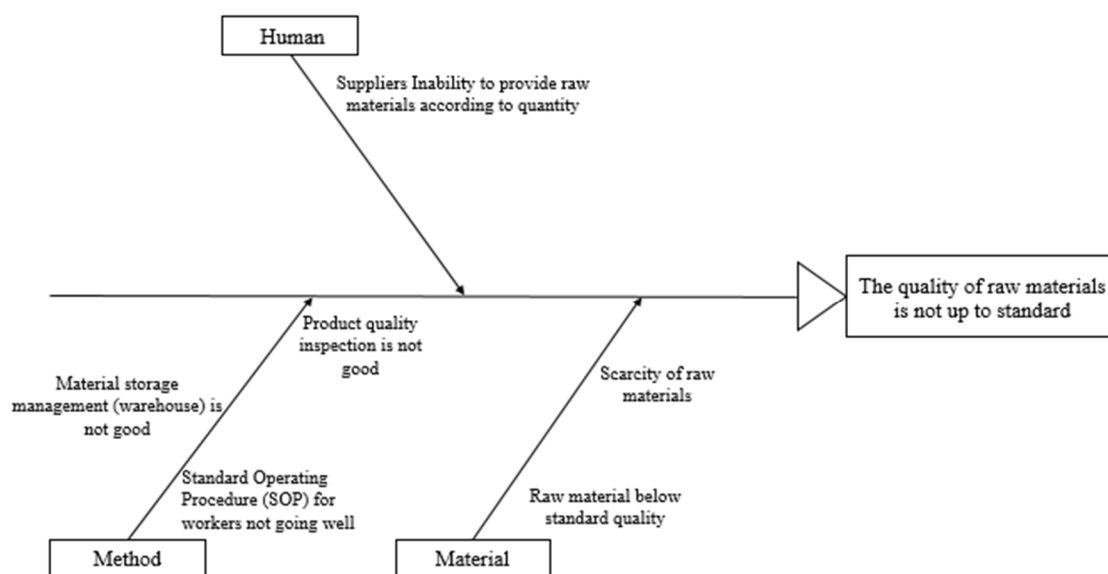
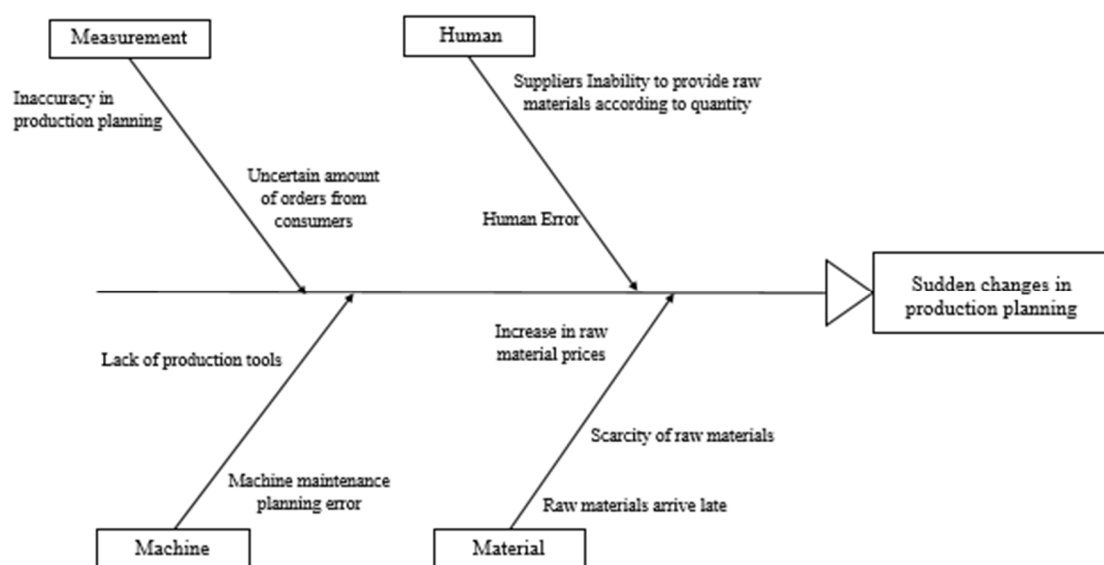
- Wibowo, K., Sugiyarto and Setiono (2018). Analisa dan Evaluasi: Akar Penyebab dan Biaya Sisa Material Konstruksi Proyek Pembangunan Kantor Kelurahan di Kota Solo, Sekolah, dan Pasar Menggunakan Root Cause Analysis (RCA) dan Fault Tree Analysis (FTA). Jurnal MATRIKS TEKNIK SIPIL, (303) Juni 2018
- Worldometers.(2019,94). *Jumlah Penduduk Indonesia*. Recited from Worldometers.info: <https://www.worldometers.info/world-population/indonesiapopulation/>. (13 Agustus 2019)

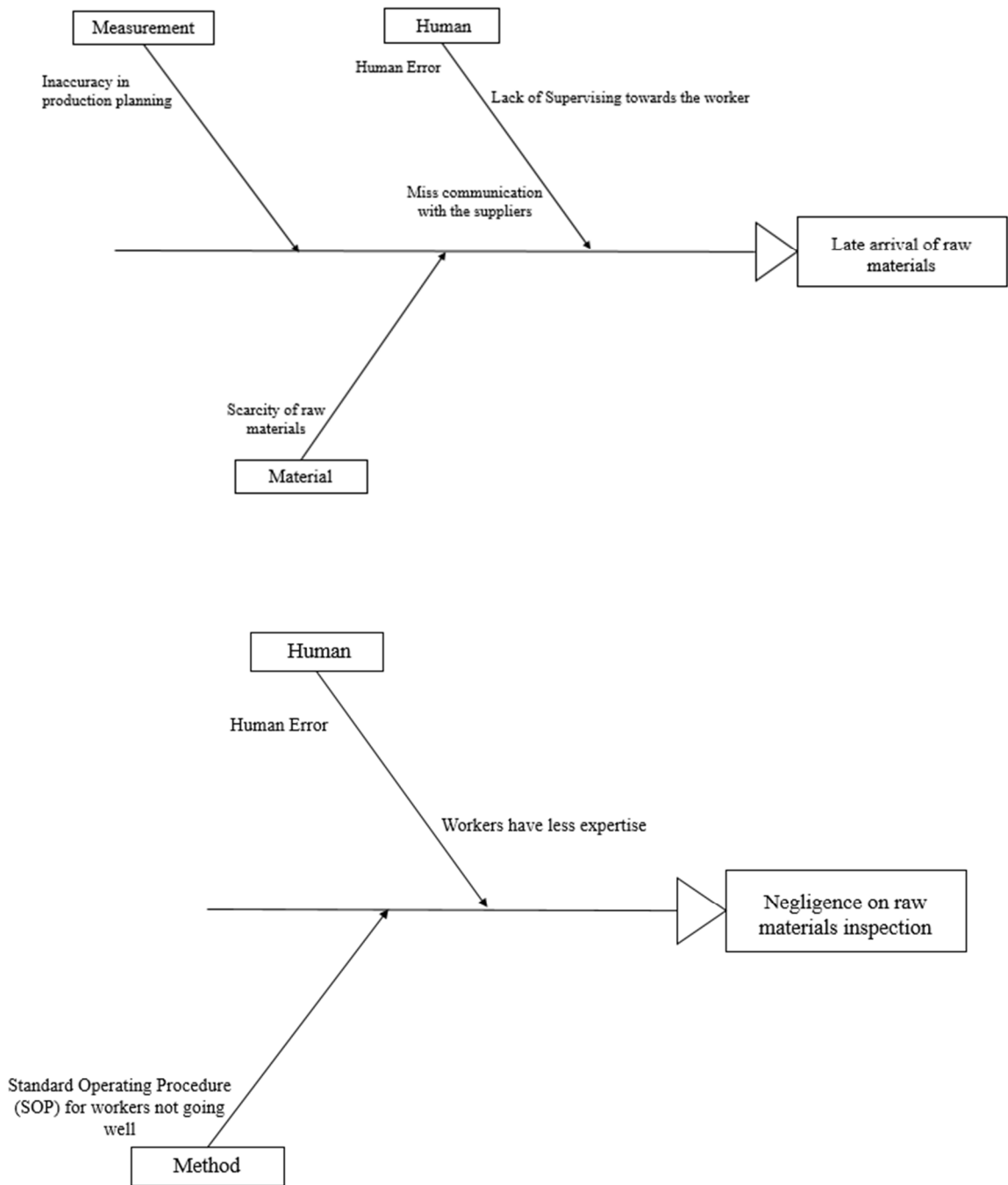
APPENDIX

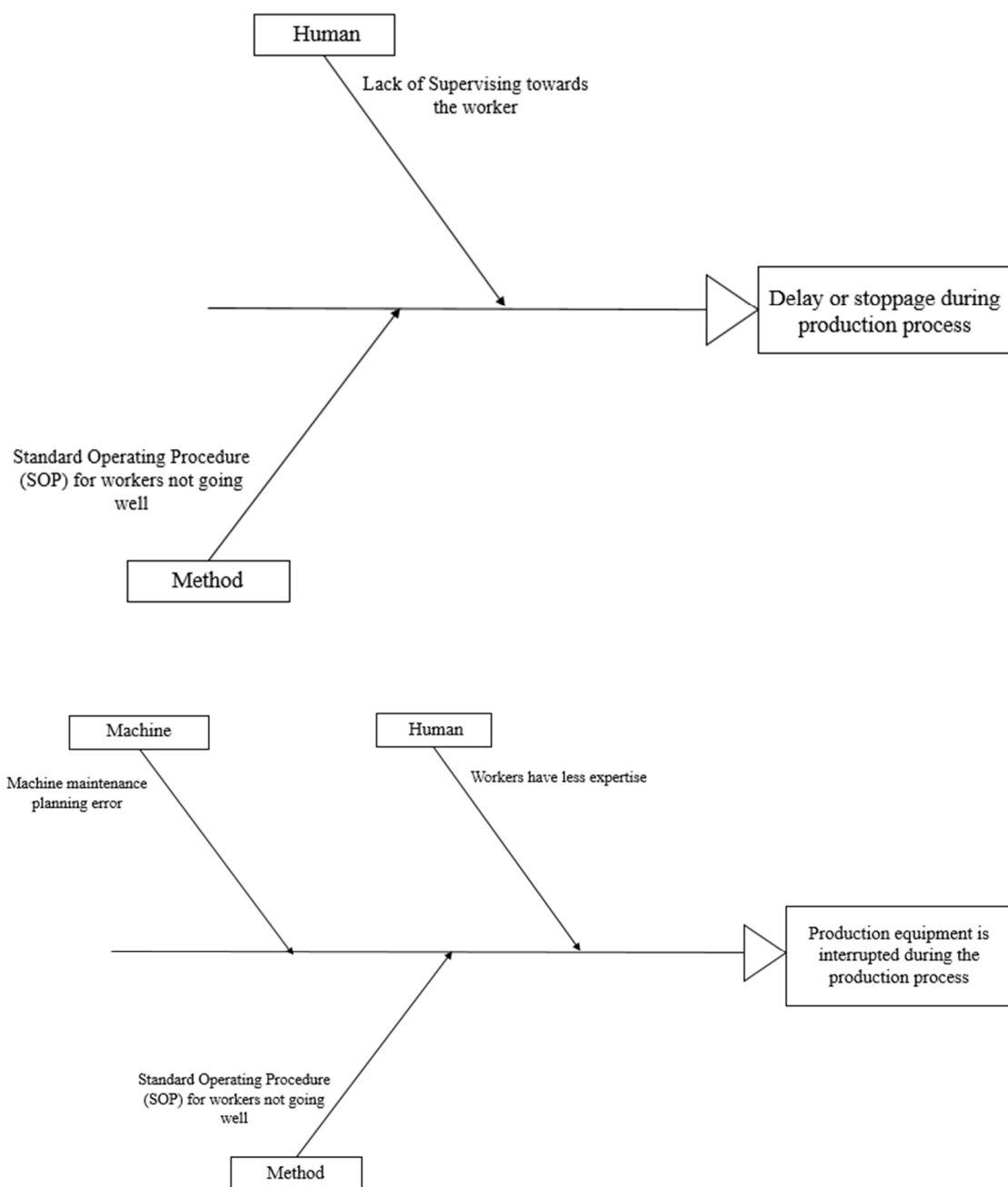
1. Fishbone Diagram of Risk Agent

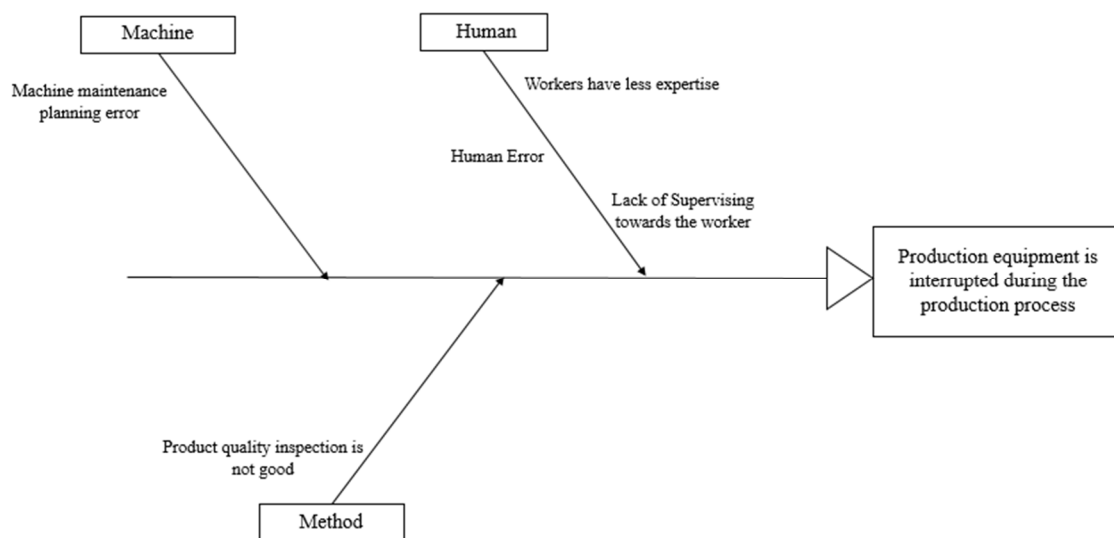












2. Fishbone Diagram of Mitigation Strategy Design

