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ASSESSMENT OF RISK RELATED TO HUMAN FACTOR IN SUPPLY CHAIN PROCESS OF PT ICS USING FMEA

NISRINA GIANINDYA POER
NRP 024 1 14 40000 129

Supervisor
Dr. Ir. Sri Gunani Partiwi, M.T.
NIP. 196605311990022001

DEPARTMENT OF INDUSTRIAL ENGINEERING
Faculty of Industrial Technology
Institut Teknologi Sepuluh Nopember
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Surabaya, Indonesia

Author:
NISRINA GIANINDYA POER
NRP 02411440000129

Acknowledged and approved by:
Supervisor

Dr.Ir. Sri Gunani Partiwi, M.T.
NIP. 196605311990022001

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Name : Nisrina Gianindya Poer
NRP : 02411440000129
Supervisor : Dr. Ir. Sri Gunani Partiwi, M.T.

ABSTRACT

PT ICS is a company that focuses in the production of dried anchovy. The company produces two kinds of dried anchovy products called Prima Chirimen and Prima Excellent. The difference between the two product lies on the sorting process. PT ICS mainly distributes its product at international market by exporting the product to Japan, Europe, and many other countries. In order to support the activities of this company, this research is going to assess the risk of supply chain activities.

Risk assessment is done to help the company in conducting a more efficient and effective supply chain process since it is one of the competitive advantage of a company with international network. By conducting supply chain risk management, PT ICS can increase its competitiveness by maintaining the performance of supply chain activities. The process is started by observing the processes involved in the supply chain of this company. After that, the processes/activities will be mapped using SCOR (Supply Chain Operations Reference) process which consists of Plan, Source, Make, Deliver, Return, and Enable. The risk assessment is done using the method of FMEA (Failure Mode and Effect Analysis).

Based on the result of the research, there are 25 processes in the supply chain activities of this company. From those processes, 49 risks are found in the supply chain activities. These risks are assessed by assigning severity, occurrence, and detection score to each of the risk. The result of the multiplication of the three parameters is RPN which will be ranked from the largest to the smallest. Mitigation strategy is made for 10 of the selected risks.

Keywords: Risk Management, FMEA, SCOR, Supply Chain Risk Management

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Surabaya, June 2018

Author

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CHAPTER I
INTRODUCTION

This chapter consists of the background, problem formulation, objectives of research, benefits, scope of research, and outline of research.

1.1 Background

As an archipelago country with over 17,000 islands, Indonesia which two-third of its territory is covered by sea has a great potential regarding its marine sector. According to the decree of the Ministry of Marine Affairs and Fisheries, the potential of fish resources in Indonesia is estimated to be 6.8 million tons per year, making Indonesia one of the major producer of marine fisheries production. In fact, Indonesia is in the second place of the world's leading fishing nations by catching over 6.49 million tons of fish in 2015 with China as the leader (Statista, 2018). Fishery is non-arguably a very promising sector in this maritime country which happens to have 5.8 million square kilometers sea area. This sector continues to grow in recent years with the support from the government in terms of funding and regulations. The growth also increases the sector's contribution to the country's non-tax revenue as well as to the GDP (EIBN, 2017).

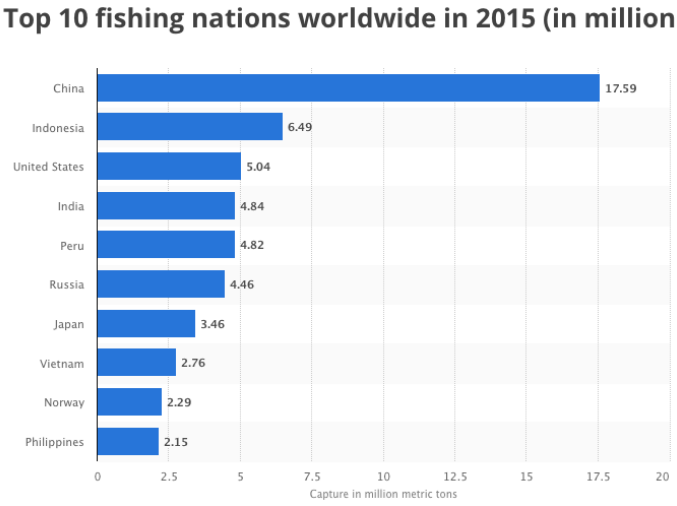

Figure 1. 1 Top 10 fishing nations worldwide in 2015

(Source: Statista, 2018)

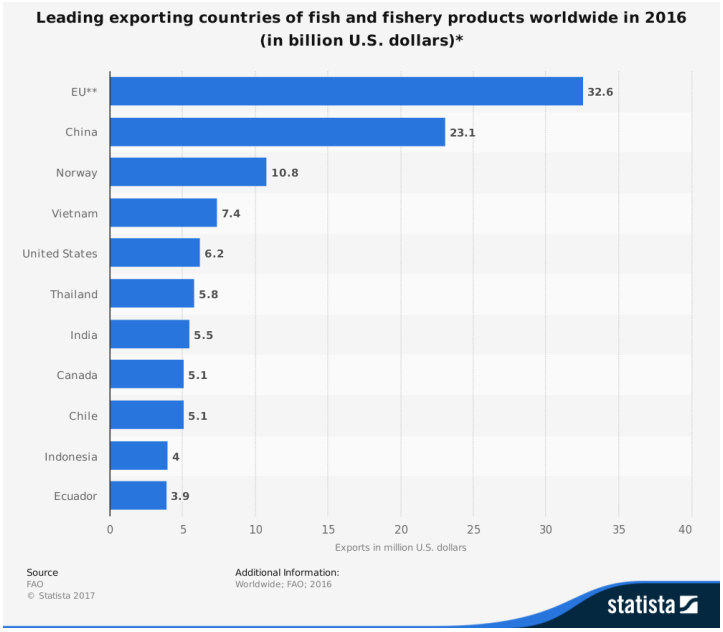

Figure 1. 2 Leading fishery exporting countries 2016

(Source: Statista, 2017)

Despite the huge potential of the marine and fishery sector, Indonesia doesn't make it to the top five list of the world's fish and fishery products exporter by only occupying the ninth position in 2016 (Statista, 2017). Moreover, Indonesia is far behind neighboring country, Vietnam and Thailand who occupied the third and fifth place. Last year, the export volume of fishery continued to decline to the level of 1.1 million tons, down 15 percent compared to 1.3 million tons in 2014. In other words, the fishery exports volume is down 4.76% per year, making Indonesia the 14th in the list of fishery exporting countries as of today (Sugandhi, 2018). Even though there is an increase in the export value by 8.12 percent, it is still under the target that was made in the earlier 2017. This condition should not be left unattained if the government wants to achieved the target of USD 9.5 billion in export value by 2019. The export of fishery which continues to perform under the target is the indication of inefficiency in the supply chain process.

Inefficiency of supply chain is the biggest threat in the era where competition is not addressed to a particular company but to the whole supply chain. Christopher (2011) labeled this as 'supply chain competition', the era where an organization should no longer stand as an independent entity who competes with

other isolated and inclusive organizations. Instead, companies should integrate with other entities who are involved in the upstream and downstream process of their products. In all industries, supply chain plays a big role in providing support for industries in order to conduct their business processes effectively and efficiently.

In seafood industry, there are at least three parties that contributes to the operation of fishery production; namely the fishers, supplier, and the manufacturer/exporter. The fishery product exporter and manufacturer, such as PT ICS, is unable to control the material availability without getting the help from the supplier and the fishers. This dependency makes PT ICS unable to run its business process completely separate from the suppliers and fishers. Even though PT ICS already established trustworthy relationship with some suppliers, the price of the product might still be unstable due to several conditions which both the exporter and the suppliers cannot control.

PT ICS is a corporation that focuses its operation in seafood industry by producing and supplying seafood to both local and international market. PT ICS' main products are fish and shrimp. Currently, PT ICS has several production site that are placed near the resources such as in Tuban, Banyuwangi, Madura, etc. in this company, supply chain holds a big share in transforming the raw materials into finished goods because of the diverse production site and destinations. This company, who specializes in export, faces several problems related to the availability of raw materials as well as the unstable production.

In seafood industry, the availability of raw materials is highly dependent on the weather and region. The problems arise in the supply chain process of PT ICS can affect the whole performance of the company which can result in declining performance. The problems also affect the utility of the production site which eventually yield in higher cost. Obviously, the problems in supply chain can not be neglected as it might endanger the company. That's why risk assessment should be implemented throughout the supply chain process to anticipate risks before they happen. As Merna and Al-Thani, (2008) said, risk management allows an organization to identify risks specific to that particular organization and to respond to them in an appropriate way.

This research proposes to conduct a risk assessment in the supply chain process of PT ICS in order to identify and evaluate the risks. Risks that are associated with human factor will be assessed using FMEA process. Human factor analysis is done because almost all processes in PT ICS are done manually with the help of human. Since the involvement of human is extremely important, the assessment of risk related to human factor is expected to provide a comprehensive list of activities that might turn into risk event. The result of the risk assessment can be used to prevent risks from happening as well as to increase the contribution of human in reducing risks by evaluating the performance of human.

1.2 Problem Formulation

The problem that is going to be solved through this research is related to supply chain risk management. Supply chain holds an important role in the business process of PT ICS, thus a risk assessment should be employed to prevent unwanted event to occur that might affect the performance of PT ICS. The risks that are going to be assessed are those related to human factor since PT ICS done its process manually.

1.3 Objectives of Research

The following are the objectives that are going to be achieved by conducting this research:

1. To identify the supply chain risks involved in the seafood industry business process.
2. To identify the human factor involved in the supply chain of seafood industry.
3. To provide the appropriate mitigation strategy to handle the risks of supply chain process.

1.4 Benefits of Research

Benefits which will be able to gained by conducting this research are mentioned as follows:

1. The company will be able to know the supply chain risk of its business operation as a reference for conducting a more effective and efficient business process in order to increase the competitiveness.
2. The company can implement the mitigation strategy provided by this research.
3. The company will have the information regarding the human factor in its supply chain process.

1.5 Scope of Research

The scope of this research, which consists of the limitations and assumptions, is explained as follows:

1.5.1 Limitations

Limitations used in this research is that the research is focused on the dried anchovy product.

1.5.2 Assumptions

Assumptions used in this research is that the company business process, regulation, and condition are following the existing condition.

1.6 Outline of Research

In this sub-chapter, the outline of the research will be shown in order to give the big picture of the whole research. The outline is as follows:

CHAPTER I INTRODUCTION

This chapter explains about the background of conducting this research, problem formulation that will be observed in the research, objectives that are going to be achieved through the research, benefits of doing this research, scope of research which consists of the limitations and assumptions used in this research, and outline of research which highlight the overall structure of the thesis.

CHAPTER II LITERATURE REVIEW

This chapter shows several literature review that will be used to conduct this research. Among them are the supply chain, supply chain risk management, risk management, SCOR model, FMEA, and human factor. In this chapter, the literature

review functions as a basis for doing this research which contains some of the experts' opinions as well as the author's opinion.

CHAPTER III RESEARCH METHODOLOGY

This chapter reveals the steps that will be taken while conducting this research. The steps will give a comprehensive understanding of the flow of this research.

CHAPTER IV DATA COLLECTION & PROCESSING

This chapter tells about the process of collecting the research data which will be the input of this research. The processing of the data will also be shown using the appropriate method. In this case, the research will conduct the data processing process using SCOR model to determine the business process and then using FMEA to perform risk management.

CHAPTER V ANALYSIS & INTERPRETATION

The result of the data processing that has been done in the previous chapter will be analyzed in this chapter. This research will also give the explanation of human factor in the supply chain process in this chapter.

CHAPTER VI CONCLUSION & SUGGESTION

After conducting the whole research, the conclusions that are obtained from the research will be written in this chapter. There will also be some suggestion for the object of the research according to the result of this research.

CHAPTER II
LITERATURE REVIEW

In this chapter, the literature review that will be used to support this thesis is going to be explained. The literature review will cover the theories, concepts, and knowledge about some specific topics that are gathered from several sources.

2.1 Indonesia Seafood Industry

Based on the data obtained from CEA (2016), Indonesia exported more than USD 3 billion of seafood in 2011. Among the destination countries; US, Japan, and Europe are the leading importer. This performance is in line with the target of export value of seafood to reach USD 9.5 billion by 2019. In addition, the seafood trade has shown positive trends since 2007-2011 in which the export quantity of seafood is greater than the import quantity in almost all commodities of seafood. The fishing industry itself accounted for 21 percent of Indonesia's agricultural economy and 3 percent of national GDP in 2012 (FAO, 2014).

Figure 2. 1 Indonesia Seafood Trade on Average

(Source: CEA, 2016)

Seafood; such as fish, shrimp, crab, and many others; can not last long enough to be distributed to other area without a sufficient cold storage or without being processed in advance. Thus, the seafood industry holds an important role in maintaining the seafood quality until it reaches its destination. However, the lack of technology in the traditional vessels which bring the fish back to the shore results in higher logistic costs and the fish to be less fresh (Surya, 2016).

Though seafood industry increases the value of the product up to 250% through primary, secondary, or tertiary process done within the industry (Sutjiamidjaja & Sutjiamidjaja, 1999), it is still facing some problems ahead. One of the most crucial has to do with fish as raw materials itself. Fish resources can not stay constant due to the high dependency with season (Perbowo, 2017). Furthermore, Poernomo and Heruwati (2011) also explains that the problem facing this industry is the availability of raw materials which can occur due to various things, among others:

- In some seasons when the catch of fish is low, fishers tends to export the fish rather than sell it to domestic buyer
- The stock of fish in the sea is decreasing
- Unstable relationship between the fishers and the buyer (supplier) that affects the decision of the fishers to export the fish when the price of fresh fish is higher abroad

One of the major weaknesses of Indonesia's fishery sector is that 95% of the 2.2 million people engaged in the sector are traditional fishers (GBGI, 2016). These fishers lack the resources and capital to explore the huge potential of Indonesian aquatic resources. The majority of fishers still use small boats and traditional equipment, which prevents them from going in to deep waters which results in lower catch volumes.

Another big obstacle that is faced by seafood industry is the spoilage of fish. Spoilage is usually accompanied by change in physical characteristics. Change in color, odor, texture, color of eyes, color of gills and softness of the muscle are some of the characteristics observed in spoiled fish (Singh et al., 2018). Fish is an extremely perishable food which is vulnerable to decay and very quickly to spoil.

According to FAO, most fish become inedible within twelve hours at tropical temperatures. Therefore, processing or preserving on cold storage must be done quickly to prevent the growth of spoilage bacteria. Fellows and Hampton (1992) also stated that fish is very susceptible to the growth of food poisoning bacteria due to its low acid contamination. Here are some methods of preservation that widely used in fishery products:

- Cooking (such as boiling and frying)
- Lowering the moisture content (by salting, smoking, and dying or collectively known as curing)
- Lowering the pH (by fermentation)
- Lowering the temperature (using ice or cold storage)

2.2 Human Factor

Human factors (or ergonomics) as the scientific discipline concerned with the understanding of the interactions among human and other elements of a system and the profession that applies theory, principles, data, and methods to design in order to optimize human well-being and overall system performance (IEA, 2003). The interactions can be with machines, environment, computers, and other components in the system. Catchpole (2018) perceived human factor as an enhancement of performance through an understanding of the effects of teamwork, tasks, equipment, workspace, culture, organization on human behavior and abilities, and application of that knowledge in clinical settings. Human factors present in almost all process in a business, whether directly or indirectly in contact. However, human is always associated with errors and deviation from the intended goals. The ever-changing environment of human requires effective communication, team management, and constant lifecycle innovation (Jurcevic et al., n.d.). In supply chain operations, human is not only involved as an operator but also as a decision maker. Human holds an important role in either minimizing or contributing to the errors/mistakes made during the supply chain process. The involvement of human is an opportunity to use its intelligence in avoiding mistakes such as record-keeping and other errors.

2.3 Supply Chain

Supply chain represents the flow of operation from the upstream to the downstream of a particular product/industry. A supply chain involves all entities who directly or indirectly fulfil a customer's request (Chopra & Meindl, 2004). Transporters who deliver the products and retailers who sell the products to the end customers are both included in the supply chain. Beside that, warehouses, retailers, and customers are also part of supply chain in addition to the manufacturers and suppliers. Similar to that, Lambert, Stock and Ellram (1998) defined supply chain as the alignment of firms that bring products or service to market. Supply chain includes the activity of materials procurement, transformation of the materials into intermediate and finished products, and the distribution of the finished products to customers (Ganeshan & Harrison, 1995). There are at least five areas in a company that are affected by the supply chain, which are (Hugos, 2003):

1. Production (regarding the type and number of product to be produced or the master production schedule)
2. Inventory (optimal inventory levels and reorder points at each stage of supply chain)
3. Location (choosing the most cost efficient locations for production and for storage of inventory)
4. Transportation (deciding when it is better to use which mode of transportation considering the cost and time constraints)
5. Information (accurate information and data sharing for better coordination in terms of effective production, inventory, and transportation)

Christopher (2011) defines supply chain management as the management of both upstream and downstream relationships with suppliers and customers which is aimed to give excellent customer value at less cost to the supply chain as a whole. The ultimate goal of supply chain management is to achieve a more profitable outcome for all parties in the chain.

2.4 Supply Chain Operations Reference (SCOR) Model

SCOR or supply chain operations reference model is a tool which enables the management to address, improve, and communicate supply chain management decisions within a company and with suppliers and customers of a company (Poluha, 2007). The supply chain operations reference was first introduced by the Supply Chain Council as a model that helps to elaborate the processes along the entire supply chain. This model is able to help an organization to satisfy the customer's demand by improving the six primary management processes that include plan, source, make, deliver, return, and enable. Using these process building blocks, supply chains that are very simple or very complex can be described using a common set of definitions. This resulted in the flexibility of the model that can link disparate industries and provide a basis for supply chain framework.

The Supply Chain Council stated that although the model can describe processes along the supply chain, it does not attempt to describe every business process or activity such as sales and marketing (demand generation), product development, research and development, and some elements of post-delivery customer support. But it should be noted that with the new introduction of Return, the model was extended to the area of post-delivery customer support.

SCOR reference model consists of four major sections which are performance, processes, practices, and people. However, this research applies only the SCOR process model as a business process framework to define the activities involved in a company. The Process section in SCOR provides three levels of processes as presented in the figure below. Level-1 process consists of six activities that most companies perform to effectively execute their supply chains. Level-2 process mainly determines the operations strategy such as Make-to-Stock, Make-to-Order, Engineer-to-Order, etc. While level-3 process defines the steps that are performed in a certain sequence in order to plan supply chain activities.

Table 2. 1 Hierarchy of SCOR Process Model

	Level		Examples	Comments
	#	Description		
Within scope of SCOR	1 	Process Types (Scope)	Plan, Source, Make, Deliver, Return and Enable	Level-1 defines scope and content of a supply chain. At level-1 the basis-of-competition performance targets for a supply chain are set.
	2 	Process Categories (Configuration)	Make-to-Stock, Make-to-Order, Engineer-to-Order Defective Products, MRO Products, Excess Products	Level-2 defines the operations strategy. At level-2 the process capabilities for a supply chain are set. (Make-to-Stock, Make-to-Order)
	3 	Process Elements (Steps)	• Schedule Deliveries • Receive Product • Verify Product • Transfer Product • Authorize Payment	Level-3 defines the configuration of individual processes. At level-3 the ability to execute is set. At level-3 the focus is on the right: • Processes • Inputs and Outputs • Process performance • Practices • Technology capabilities • Skills of staff
Not in scope	4 	Activities (Implementation)	Industry-, company-, location- and/or technology specific steps	Level-4 describes the activities performed within the supply chain. Companies implement industry-, company-, and/or location-specific processes and practices to achieve required performance

(Source: SCOR: Supply Chain Operations Reference, 2012)

SCOR model can be utilized as a versatile model which functions include analyzing the current state of a company's processes and goals, quantifying operational performance, and comparing company performance to benchmark data. As mentioned earlier, in this research, the SCOR process model will be used to map the business process along the supply chain of a company. The mapping of the supply chain is done to get the list of processes from upstream to downstream. It should be acknowledged that this research will only use the level-1 of the SCOR process model as reference to classify the business process. The business process will further be classified into six categories of activity which are plan, source, make, deliver, return, and enable. According to the newest revision of SCOR 11.0 made by Supply Chain Council, there are six major processes of level-1 SCOR process model which are:

1. PLAN

   This process consists of the activities regarding the development of plans to operate the supply chain. It includes the gathering of requirements, gathering of information on available resources, balancing requirements and resources to determine planned capabilities and gaps in demand or resources and identify actions to correct these gaps.

2. SOURCE

   Source process explained the activities of ordering (or scheduling deliveries) and receipt of goods and services. It covers the activities of purchase order issuance, scheduling deliveries, receiving, validation and storage of goods and accepting the invoice from the supplier. This process, however, doesn't describe the identification, qualification, and contract negotiation with the supplier.

3. MAKE

   In this process, activities which associated with the conversion of materials or creation of the content for services are described. Make process is the representation of production or manufacturing process in a common manufacturing industry.

4. DELIVER

   The process of deliver describes activities such as receipt, validation, and creation of customer orders, scheduling order delivery, pick, pack and shipment, and invoicing the customer.

5. RETURN

   Return process describes the activities associated with the reverse flow of goods such as the identification of the need to return, the disposition decision making, the scheduling of the return and the shipment, and receipt of the return goods.

6. ENABLE

   The activities which are included in this process are management of business rules, performance management, supply chain network management, managing regulatory compliance and risk management.

2.5 Risk Management

Nowadays, more and more companies and organizations conduct risk management to assess their business processes. In this era of tight competition, risk management has become an absolute necessity for every company to keep up with the always-changing business environment. The importance of risk management is affirmed by Norrman and Jansson (2004) by stating that both Apple and Ericsson suffered from over 400 and 300 million euro losses due to poor risk management.

Risk by Pettit, Fiksel and Croxton (2010) is defined as changes in the function of potential output, the probability of their occurrence and amount. Beside that, Treasury Board of Canada (2010) defines risk as the expression of the likelihood and impact of an event with the potential to influence the achievement of an organization's objectives. Moreover, Hampton (2009) acknowledges risk as an event with a possibility of loss or injury or an event which has potential for a negative impact. He also added that risk should have the likelihood of an undesirable event. In accordance with that, Monahan (2008) stated that anything that produces a distribution of various outcomes of various probabilities is risk. Unlike other experts, Collier and Agyei-Ampomah (2006) noted that risk can be seen as a source of opportunity to business. Risk can be concluded as an event which yet to occur but the possibility of it occurring can affect the performance of a company in achieving the goals.

In order to be able to do its business process with minimum disruption, company usually performs risk management. Risk management aims to manage the unexpected things that potentially become the obstacle to reach the company's objectives. Risk management process aims to protect an organization against the unfavorable and unfortunate events along with the consequences in order to gain maximum power and ability to make profit as much as possible. Merna et al. (2008) describes risk management as a process to identify risks specific to an organization and to respond to them in an appropriate way. A proper risk management should be able to provide an organization with the list of potential risks that might affect the objectives of the organization as well as to guide the organization in managing the risks through a mitigation strategy.

There are several standards that commonly used in conducting a risk management, including:

- Australia Standards AS/NZS (2004) – Standard on Risk Management
- ISO 31000:2009 – Risk Management Principles and Guidelines
- A Risk Management Standard – IRM/Alarm/AIRMIC (2002) – developed in 2002 by the UK's 3 main risk organizations.
- ISO/IEC 31010:2009 – Risk Management - Risk Assessment Techniques
- COSO (2004) – Enterprise Risk Management - Integrated Framework
- OCEG "Red Book" 2.0: 2009 – a Governance, Risk and Compliance Capability Model

As one of the most widely used standard, the ISO 31000:2009 gives a general understanding and guideline in performing risk management. The standard is not specific to a particular sector or area which makes it very applicable to many industries and organizations. The general process of risk management based on ISO 31000:2009 is shown in the figure below:

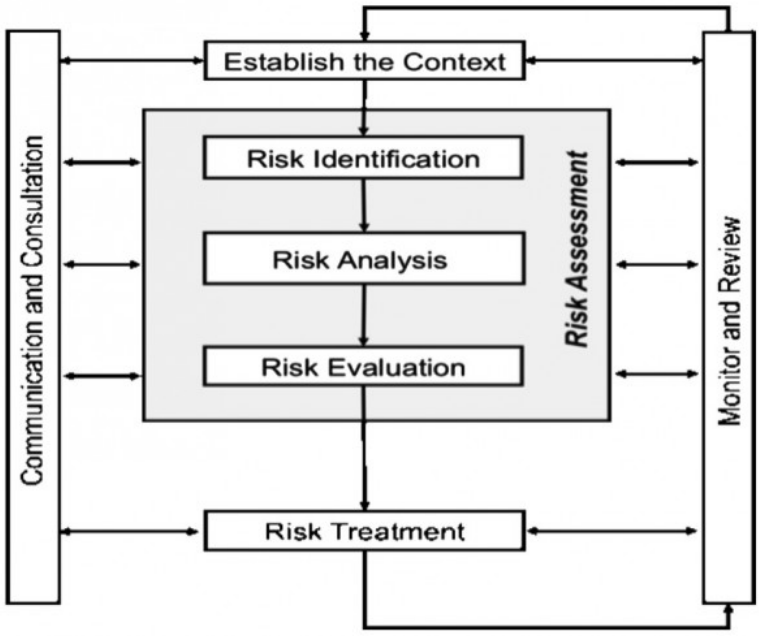

Figure 2. 2 AS/NZS ISO 31000:2009 Risk Management

(Source: Standards Australia, 2009)

Based on the figure above, there are three main activities in risk management which are establishing the context, risk assessment, and risk treatment. Risk assessment consist of risk identification, risk analysis, and risk evaluation. These activities are accompanied by the process of communication and consultation and monitoring and review.

2.5.1 Establish the Context

Establishing the context is defined as the basic parameters within which risks must be managed and sets the scope for the rest of the risk management process. The context includes the organization's external and internal environment and the purpose of the risk management activity. This also includes consideration of the interface between the external and internal environments.

2.5.2 Risk Identification

Risk identification, as the name implies, is the process to identify the risks to be managed. The aim of this process is to generate a comprehensive list of sources of risks and events that might have an impact on the achievement of each of the objectives identified in the context. All risks must be identified at this stage to avoid unidentified risk that can appear as a threat in the future. It is also important to consider the possible causes of the risks. In this step also, not only the risks and the causes, the source of the risks as well as the consequences will be known.

2.5.3 Risk Analysis

Risk analysis is about developing an understanding of the risk. It provides an input to decisions on whether risks need to be treated and the most appropriate and cost-effective risk treatment strategies. Risk analysis involves consideration of the sources of risk, their positive and negative consequences and the likelihood that those consequences may occur. Factors that affect consequences and likelihood may be identified. Risk is analyzed by combining consequences and their likelihood. In most circumstances existing controls are taken into account. risk is a function of both likelihood and a measure of consequence. This can be shown mathematically as:

$$Risk = Consequence \times Likelihood \quad (R = C \times L)$$

The consequence of a risk refers to the potential impact if the risk event

occurred. While likelihood relates to the frequency of occurrence of the risk. These two factors should be represented in a risk matrix which is a graphical representation of the relationship between the consequence and likelihood of a risk. Through this matrix, the level of each risk can be classified into low, medium, high, and extreme or other description of risk level. These classification is greatly affected by the risk appetite of an organization. Risk appetite is the amount of willingness that an organization would take which usually is related to the strategy of the organization.

RISK MATRIX					
CONSEQUENCE / LIKELIHOOD	1 Insignificant	2 Minor	3 Moderate	4 Major	5 Extreme
A - Almost certain (frequent)	M	M	H	E	E
B - Likely (probable)	L	M	H	H	E
C - Possible (occasional)	L	M	M	H	H
D - Unlikely (uncommon)	L	L	M	M	H
E - Rare (remote)	L	L	L	L	M

Figure 2. 3 Example of Risk Matrix

(Source: University of Adelaide)

2.5.4 Risk Evaluation

Based on the result of the previous step, the risks are further evaluated. The process of risk evaluation will result in the decision on whether a certain risk needs treatment or not and whether an activity should be undertaken or not. The outcome of this process is also to determine the priorities for risk treatment. Basically, this process decides whether the risk is acceptable or unacceptable. The decision taken in this stage is closely related to the risk appetite of an organization. Risk appetite is the amount and type of risk that an organization willing to pursue or retain.

2.5.5 Risk Treatment

Risk treatment involves identifying the range of option for treating risks, assessing these options and the preparation and implementation of treatment plans. Treatment of a risk can vary from avoiding such risk until accepting the risk. A proper understanding of the risk is needed to decide what kind of treatment should

be taken to handle it. Treatment to risk generally fall into the following categories (Harvey, 2007):

- Risk Avoidance
- Risk Reduction
- Risk Sharing or Transfer
- Risk Acceptance

Additionally, risk treatment is then concerned with changing the magnitude and likelihood of consequences, both positive and negative, to achieve a net increase in benefit while controls are the outcomes of risk treatment, whose purpose is to modify risk.

2.6 Supply Chain Risk Management

The supply chain is becoming a very important part of a business operation more than ever. With the success of several companies who depend greatly on their supply chain operations; such as ZARA, Seven Eleven, Ikea, and many more; the activity of supply chain gets more recognition and attention. Corporations become aware that conducting an efficient supply chain can bring additional benefits to the company. However, this doesn't mean that supply chain comes with zero risks. Some factors and trends are in fact increased the exposure of supply chain to disturbance (Cagliano et al., 2014). Moreover, Cagliano (2014) added that fiercer competition and escalated market globalization which recently challenged all industries will require enterprises to make intra-firm and inter-firm business processes more efficient and responsive.

When responsiveness is extremely needed, corporations should eliminate disturbance to its business process to make sure business runs smoothly, including the supply chain. In order to limit such vulnerability, Sheffi (2005) suggests organizations to reduce the likelihood of a disruption and to increase its resilience, which is defined as the ability of an organization to quickly recover from unanticipated changes and adverse events without rising costs. The fluctuations of oil price in the market and the unstable political atmosphere in some parts of the worlds are two examples of uncertainty and unpredictability which contribute to the

disruption of supply chain. This is where supply chain risk management is required, to limit the vulnerability and to tackle disturbance as well as to minimize the uncertainty faced by supply chain operations. It seems that the frequency and intensity of catastrophes, disasters, and crises that seem to have increased on a global scale have triggered the urge of the adaptation of risk management in supply chain. Beside that, Bode (2008) highlights the terrorist attack of WTC in 2001, the SARS epidemic in South-East Asia in 2003, and the Hurricane Katrina disaster in 2005 as the main reason of the incremental growth of supply chain risk management. The ever-changing business environment and the uncertainty that lies within it has caused supply chain managers to conduct deeper assessment of risks across the activities involved in supply chain as well as to provide mitigation strategy that well suited the condition.

The identification and management of risks that influences a supply network through a coordinated effort within supply chain members to narrow the vulnerability as a whole is defined as supply chain risk management (Christopher et al. 2002). Generally, risk identification, risk assessment, risk management and risk monitoring are the four components of risk management. However, Jüttner, Peck and Christopher (2003) argued that SCRM consists of four key management aspects including assessing the risk sources for the supply chain, defining the supply chain adverse consequences, identifying the risk drivers, and finally mitigating risks for the supply chain.

2.7 Failure Mode and Effects Analysis (FMEA)

Failure mode and effects analysis is one of the method that can be used to implement risk assessment process. This method is widely used in manufacturing company as it can detect failure modes in a product or process. FMEA is able to identify potential failures which might causes a failure if left unattained. It is also useful to be used as a tool that allows risks to further be eliminated, and to reduce the impacts by locating the failure impacts.

McDermott et al, (2008) wrote the ten steps for implementing a systematic FMEA as such:

1. Review the process or product
2. Brainstorm potential failure modes
3. List potential effects of each failure mode
4. Assign a severity rating for each effect
5. Assign an occurrence rating for each failure mode
6. Assign a detection rating for each failure mode and effect
7. Calculate the risk priority number (RPN) for each effect
8. Prioritize the failure modes for action
9. Take action to eliminate or reduce the high risk failure modes
10. Calculate the resulting RPN as the failure modes are reduced or eliminated

In calculating the RPN, a standard for assigning the rating is used. Actually, there is no certain standard since risk management is unique for every case, however usually there is a standard for one research so that the result is not biased in one research. The standard can be developed in the process of data gathering to adjust with the condition of the object. The tables below are examples of ratings standard that can be used to conduct supply chain risk management.

Table 2. 2 Severity Ranking

Degree of Severity Ranking		
Degree	**Description**	**Median Rating**
Very High	When a potential failure mode affects safe operation of the product and/or involves non-conformance with government regulations. May endanger people or product. Assign "9" if there will be a warning before failure, assign "10" if there will NOT be a warning before failure.	10 9
High	When a high degree of customer dissatisfaction is caused by the failure. Does not involve safety of people or product or compliance with government regulations. May cause disruption to subsequent processes/operations and/or require rework.	8 7
Moderate	When a moderate degree of customer dissatisfaction is caused by the failure. Customer is made uncomfortable or is annoyed by the failure. May cause rework or result in damage to equipment.	6 5 4
Low	When a failure will cause only slight annoyance to the customer.	3 2
Minor	When a failure is not likely to cause any real affect on subsequent processes/operations or require rework. Most customers are not likely to notice any failure. Any rework that might be required is minor.	1

(Source: Curkovic et al., 2013)

Table 2. 3 Occurrence Ranking

Degree of Occurrence Ranking			
Chance	**Description**	**Probability**	**Median Rating**
Very High	Failure is almost inevitable	1 in 2 1 in 3	10 9
High	Process is "similar" to previous processes with a high rate of failure	1 in 8 1 in 20	8 7
Moderate	Process is "similar" to previous processes which have occasional failures.	1 in 80 1 in 400 1 in 2000	6 5 4
Low	Process is "similar" to previous processes with isolated failures	1 in 15000	3
Very low	Process is "similar" to previous processes with very isolated failures	1 in 150000	2
Remote	Process is "similar" to previous processes with no known failures	1 in 1500000	1

(Source: Curkovic et al., 2013)

Table 2. 4 Detection Ranking

Degree of Detection Ranking			
Degree	**Degree in %**	**Description**	**Median Rating**
Detection is not possible	0	Control method(s) cannot or will not detect the existence of a problem.	10
Very Low	0 to 50	Control method(s) probably will not detect the existence of a problem.	9
Low	50 to 60 60 to 70	Control method(s) has a poor chance of detecting the existence of a problem.	8 7
Moderate	70 to 80 80 to 85	Control method(s) may detect the existence of a problem.	6 5
High	85 to 90 90 to 95	Control method(s) has a good chance of detecting the existence of a problem.	4 3
Very High	95 to 100	Control method(s) will almost certainly detect the existence of a problem.	2 1

(Source: Curkovic et al., 2013)

2.8 Previous Research

In conducting this research, there are several existing researches that can be used as a reference and comparison of method. These previous researches have similar topic with this research in terms of the theme and the method. However, there are also some differences among those researches as shown in the table below:

Table 2. 5 Previous Research

No.	Author	Title	Method
1	Syahidan Hidaya (2013)	*Analisis dan Mitigasi Risiko Rantai Pasok pada* PT Crayfish Softshell Indonesia	Using SCOR Model to map the business process and applying House of Risk (HOR) as a tool to conduct risk management
2	Nyka Fahma Utami (2013)	*Pendekatan* Supply Chain Risk Management *pada Aktivitas* Supply Chain PG. Pesantren Baru	Using SCOR Model to map the business process and conducting risk management using FMEA and Root Cause Analysis (RCA)
3	Profita Sari Aji (2016)	Supply Chain Performance Measurement and Improvment Using Scor Model and FMEA at Perum Bulog Divre Jatim	Measuring supply chain performance using SCOR Model and improving the performance using FMEA and Root Cause Analysis (RCA)
4	Muhammad Hadyan Riski (2016)	*Penyusunan Peta Risiko Proses* Order *dan* Order Fulfillment *Layanan Jasa Logistik dengan Menggunakan Metode* Failure Mode and Effect Analysis (FMEA)	Using Fault Tree Analysis (FTA) to identify the risks and performing risk management using FMEA

The first research of Syahidan Hidaya (2013) focuses on the analysis and mitigation of risks in supply chain process of PT Crayfish Softshell Indonesia. The research is conducted using House of Risk (HOR) and SCOR Model as the business process mapping tool. The research manages to identify 37 risks and 64 risk agent. Among them, there are 13 risks which are classified as high-risk. There are 21 mitigation action that are successfully created but only 5 of them that are chosen to be implemented.

On the other hand, the research of Nyka Fahma Utami (2013) performs supply chain risk management in PG. Pesantren Baru. The research is done by mapping the business process using SCOR Model and by performing FMEA. The result shows that there are 47 risks in which 8 of them are high-risks. The mitigation strategy is developed using Root Cause Analysis (RCA).

The next research conducts a broader area than just risk management, it also covers the performance measurement. Profita Sari Aji (2016) measures the supply chain performance of Perum Bulog Divre Jatim by implementing the SCOR Model. The result shows that the performance only reaches 75.45% and needs immediate improvement. The research also suggests several improvements by performing FMEA to some activities that are below standard. The result of the research, which is mitigation strategy, is obtained through Root Cause Analysis (RCA).

The last research that will be explained is written by Muhammad Hadyan Riski (2016). In this research, the author aims to develop a risk mapping in the process of Order and Order Fulfillment in a logistics service company. There are 60 risks found in the observed processes. Those risks are identified using the help of Fault Tree Analysis (FTA). Among the 47 high-risks, only 27 risks that are mitigated with the treatment of risk avoidance and risk mitigation.

Based on the researches above, there are no research that analyzed the human factor in the supply chain process. In this case, this research aims to conduct an assessment of risk that related to human factor in the supply chain process of PT ICS. The research will be conducted using FMEA process and SCOR Model as the business process mapping. The mitigation plan will be developed with the help of Root Cause Analysis (RCA) to find the initial problem of each mitigated risk.

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CHAPTER III
RESEARCH METHODOLOGY

This chapter contains the flowchart that shows the methodology used in this research. The step by step process of conducting this research will be explained based on the flowchart. The flowchart is used as a guideline to do the research which comprises as observation and literature review, supply chain process mapping, risk assessment using FMEA, and conclusion and suggestion.

3.1 Research Methodology Flowchart

The flowchart below shows the methodology to conduct this research from the start until the end.

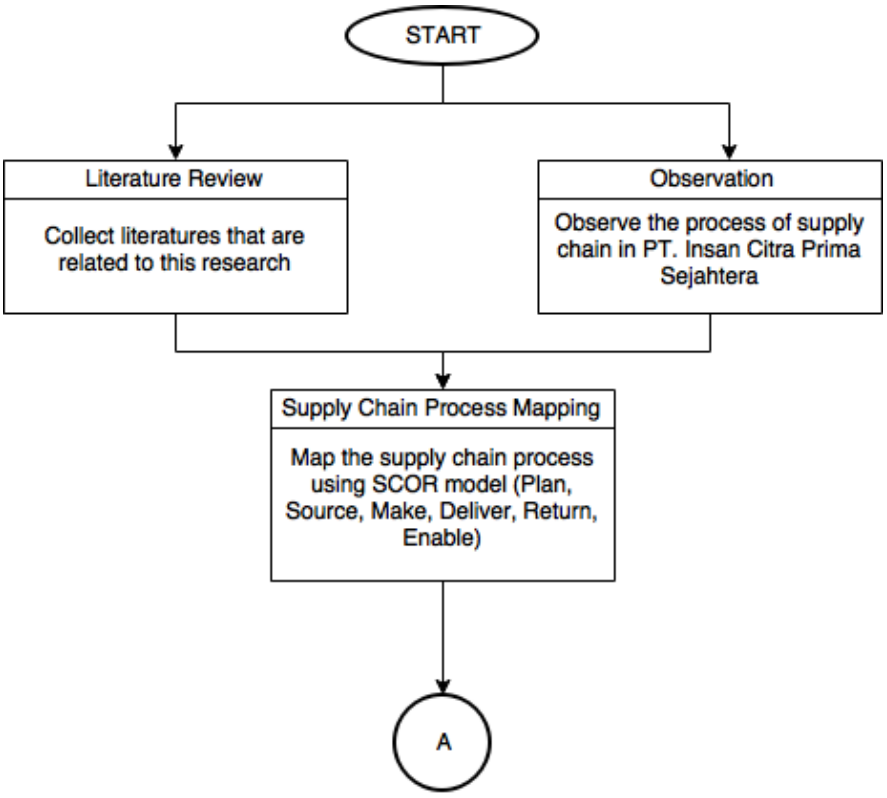

Figure 3. 1 Research Methodology Flowchart

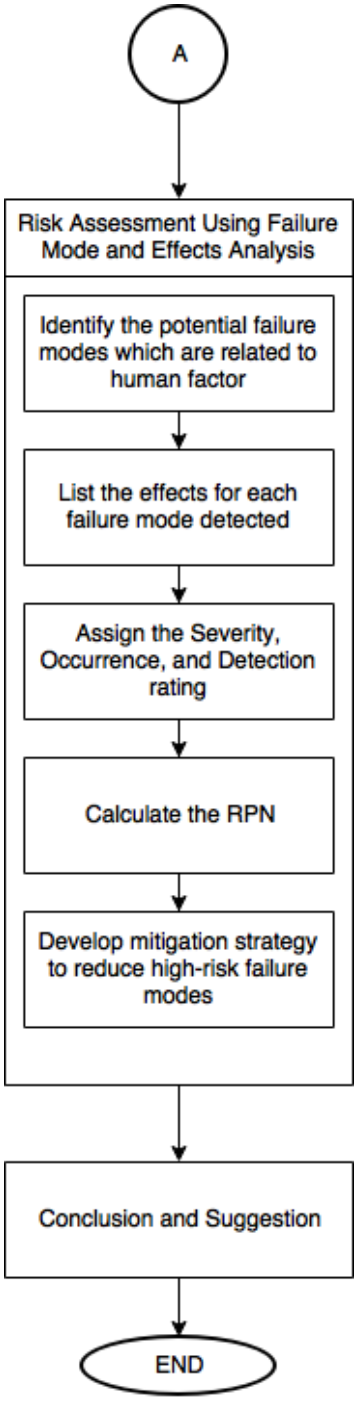

Figure 3.1 Research Methodology Flowchart (Cont.)

3.2 Preliminary and Preparation Stage

During this stage, the research is focused on gathering literature review regarding the topics of this research while defining the objective of the research. The objective of the research is closely related to the problem that is found in the

object, in this case PT ICS. The problem is found during the discussion with the representative of the company. After the brief discussion, the research will proceed to the formation of objectives of the research. The objective of the research is anything that is expected to be achieved by doing this research. The observation is also done in this stage by doing a visitation which is aimed to get the insight of the production process in the company. In the observation process, the researcher wants to observe the current situation of the supply chain process of PT ICS.

Meanwhile, the problem and objectives are supported by the findings in the form of another researches, books, or articles around the topic of research. The literature review consists of the explanations of supply chain, supply chain risk management, human factor, risk management, Failure Mode and Effects Analysis (FMEA), Supply Chain Operation Reference (SCOR) model, and also the overview of Indonesia's fishery industry.

3.3 Supply Chain Process Mapping

After knowing the process of supply chain in PT ICS, the next step is to classify the activities involved in the supply chain process into the SCOR model. Supply Chain Operation Reference (SCOR) categorizes the supply chain activity into six major categories, these categories include plan, source, make, deliver, return, and enable. The activities of supply chain process of PT ICS will be categorized according to the nature of the activity itself. These classifications will become the input of the next step of the research.

3.4 Risk Assessment

In this stage of research, the risk assessment will be conducted. The result of the previous step, which is activities of supply chain that are already mapped using SCOR, will be used as an input of this step. The method that will be used to assess the risks is Failure Mode and Effect Analysis (FMEA).

The first step of the risk assessment process is the identification of all potential failure modes. The failure modes that will be identified are those that related to human factor. The failure modes are identified by analyzing every activity in each category of the supply chain process.

The next step is the process of analyzing each failure mode/risk to determine the effect that can be caused by the risk. This process will also affect the severity rating that will be given later. Beside that, the cause of each risk should also be determined. The current control of the risk should also be noted and it will affect the detection rating later on.

After that, the severity, occurrence, and detection rating should be given to the already listed risks. The ratings are in the range of 1-10. The score is given by the respondents through a FMEA questionnaire. The respondents of the questionnaire are those who are the experts of this field or in this company. There are three questionnaires that are distributed to the Director of Operational, Head of Production, and QC of Production. Each of the respondent fills the questionnaire by giving scores to the severity, occurrence, and detection of the failure modes. After that, the RPN number can be obtained by multiplying the ratings of severity, occurrence, and detection. The maximum number of RPN is 1000. The higher the number means the higher of the risk category.

The RPN number will be used to prioritize the risk that are going to be mitigated. The risks that are going to be mitigated are the risks that have high RPN number. Those risks need to be paid attention carefully in order to reduce impact of the risks or to be eliminated entirely.

The mitigation strategies will be developed based on the risks with high category. Those risks will be mitigated to prevent it from happen. The mitigation strategy should also pay attention to the cost incurred by doing an action. The root cause analysis will be used to find the source of the problem.

3.5 Conclusion and Suggestion

In this stage, the conclusion will be drawn from the result of the research. The conclusion will answer the objectives that are already stated in the first chapter. The suggestion will also be added after analyzing the result of the research. The suggestion will be given to the company and also to the research that will be conducted later.

CHAPTER IV
DATA COLLECTION AND DATA PROCESSING

This chapter provides the information related to data collection and data processing of this research. The data are collected through a series of interviews with the object and also through questionnaire. The data that is processed in this chapter will later be used as an input of the next chapter.

4.1 Company Profile

ICS Group was established on 11 November 1987. ICS Group consists of several companies that focus their operation in seafood industry. One of them is PT Insan Citra Prima Sejahtera which focuses its main business in the production of dried anchovy or sometimes known as chirimen. The head office of PT Insan Citra Prima Sejahtera is located in Waru, Sidoarjo while the production site is in Jenu, Tuban. As one of the major seafood company in Indonesia, especially in Java, ICS Group aims to develop and improve in years ahead. It is reflected through its three visions and missions which are written below.

1. To produce and serve only in high quality standard
2. Always strive to satisfy ICS's customers
3. To become a world-class company in food and beverage industry

It can be seen from the first statement that the priority of PT ICS is the quality of the product. This company values quality as the first criteria to describe their product. The second priority of this company is the customer's satisfaction. Customer satisfaction is fulfilled through high quality standard of product and also good customer management. Since the company mainly serve international market, the company also aimed to be a world-class company in food and beverage industry. Vision and mission of a company functions as an objective that should be achieved in the future. Risk assessment done in this research is useful to ensure that the company will be able to achieve its objective by minimizing or eliminating the obstacle or disruption.

PT ICS produces two kinds of dried anchovy, which are Prima Chirimen and Prima Excellent. Both of the products are produced simultaneously in the same production site. The difference between the two product lies in the sorting process. Prima Chirimen requires only one sorting process while Prima Excellent requires at least four sorting process. The sorting process of Prima Excellent consists of 1st Sorting and 2nd Sorting which consists of white and green tray sorting process, and metal magnet sorting process. The complicated sorting process in Prima Excellent is aimed to produce a high quality product with no or minimum foreign object and other species contamination. The foreign objects that should be removed from the dried anchovy through sorting process are listed below.

- Seashell eyes
- Plastic
- Crushed seashell
- Fish scale
- Hair strands
- Flies
- Sea lice
- Seashell
- Wooden scrap
- Paint waste
- Thread and string
- Stones

Besides that, Prima Excellent also needs to be free from other sea species listed below.

- *Buntek*
- *Amber-amber*
- *Blirik*
- *Cemek*
- *Dodok & Pindang*
- *Japoh*
- *Kempel Kuning*
- *Layur*
- *Petek & Dodok*
- *Sumbi*
- Red tail anchovy
- Black anchovy
- Yellow anchovy
- *Teri padi*
- *Teri temple*

All of the objects above should be removed to get a high quality product and to maintain the company's good reputation. PT ICS also provides several sizes of dried anchovy. There are five sizes available in the company which are SS, S2, S, S1, and M. The product of dried anchovy is shipped in the packaging of carton

weighed 6 kg each. The export destination of dried anchovy of PT ICS is 85% to Japan and the rest is to Europe, America , and other Asia Region.

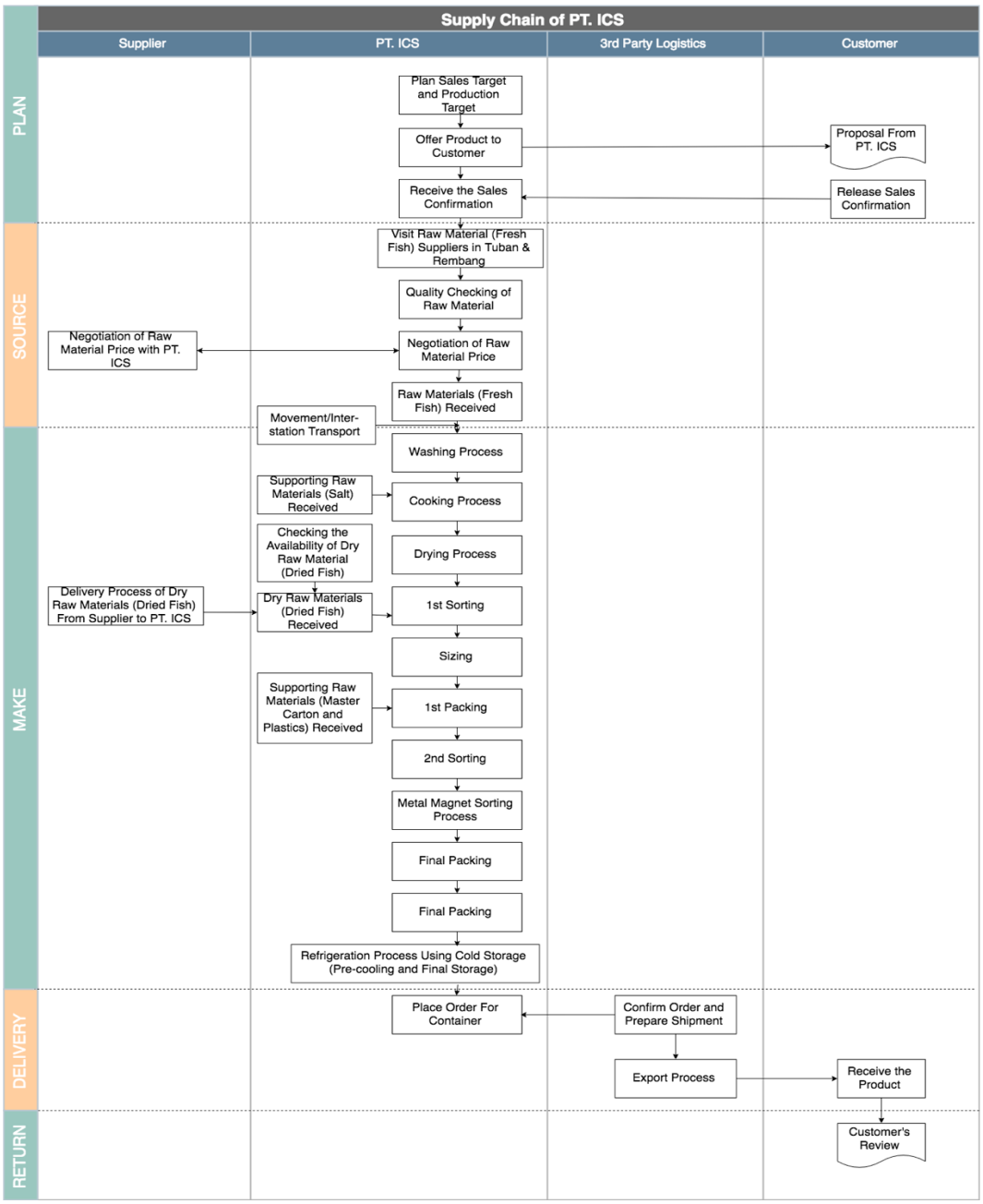

Figure 4. 1 Business Process of PT ICS

The figure above displays the processes of supply chain in PT ICS and its relation to the other parties. There are three other parties beside PT ICS that is involved which are the supplier, 3rd party logistics, and the customer.

4.2 Business Process Mapping Using SCOR

As a manufacturing company, PT ICS has many activities along its supply chain processes. The activity is started by planning the sales target and production target for the production unit of dried anchovy product which is located in Tuban, East Java. Most of the activities are the Make process which actually is the production process of dried anchovy. The business processes of PT ICS are mapped based on five major processes of SCOR. The five main processes of SCOR are Plan, Source, Make, Deliver, and Return. The result of the mapping is shown in the table below:

Table 4. 1 Business Process Mapping Using SCOR

Level 1		Level 2	
No.	**SCOR Process**	**Code**	**Process**
1	PLAN	P.1	Plan Sales Target and Production Target
		P.2	Offer Product to Customer
		P.3	Receive The Sales Confirmation
2	SOURCE	S.1	Visit Raw Material (Fresh Fish) Suppliers in Tuban & Rembang
		S.2	Quality Checking of Raw Material
		S.3	Negotiation of Raw Material's Price
		S.4	Checking the Availability of Dry Raw Material (Dried Fish)
		S.5	Delivery Process of Dry Raw Materials (Dried Fish) From Supplier to PT ICS
		S.6	Raw Materials (Fresh Fish) Received
		S.7	Dry Raw Materials (Dried Fish) Received
		S.8	Supporting Raw Materials (Salt, Master Carton, Plastics) Received
3	MAKE	M.1	Washing Process
		M.2	Cooking Process
		M.3	Drying Process
		M.4	1st Sorting
		M.5	Sizing

Table 4.1 Business Process Mapping Using SCOR (Cont.)

Level 1		Level 2	
No.	**SCOR Process**	**Code**	**Process**
		M.6	1st Packing
		M.7	2nd Sorting
		M.8	Metal Magnet Sorting Process
		M.9	Final Packing
		M.10	Movement/Inter-station Transport
		M.11	Refrigeration Process Using Cold Storage (Pre-cooling and Final Storage)
4	DELIVERY	D.1	Place Order For Container
		D.2	Export
5	RETURN	R.1	Customer's Review

4.3 Risk Identification

Risk identification is the early process of conducting Failure Mode and Effect Analysis or FMEA. In this step, failure modes are identified in each of the process in the company since this research is using FMEA process. Each process in PT ICS is observed to find the potential failure mode. There are 49 failure modes that are identified from the supply chain processes.

4.3.1 Identification of Potential Failure Mode

This research is using process FMEA as the method of conducting the risk assessment. FMEA begins by identifying the failure modes in each process in the company. Based on the business process mapping in the previous section, there are 25 processes that will be observed in this research. The identification is done according to the processes under the main SCOR Process. The failure modes are obtained through several interviews with the employees and operators in the company. Direct observation in the production site is also done to better understand and identify the potential failure modes in each of the process. There are 49 potential failure mode that have been identified. Among them, 13 risks are not related to human factor. All potential failure modes are shown in table 4.2.

Table 4. 2 List of Potential Failure Mode

No.	SCOR Process	Code	Process	Risk Code	Potential Failure Mode
1	PLAN	P.1	Plan Sales Target and Production Target	P.1.1	Sales target is not achieved
				P.1.2	Production target is not achieved
		P.2	Offer Product to Customer	P.2.1	Customers bid low prices
		P.3	Receive The Sales Confirmation	P.3.1	The final product (ready-to-deliver product) is not in accordance with the sales confirmation (regarding the product assortment and shipment schedule)
2	SOURCE	S.1	Visit Raw Material (Fresh Fish) Suppliers in Tuban & Rembang	S.1.1	Raw material is unavailable
				S.1.2	The amount of the raw material is only a few
		S.2	Quality Checking of Raw Material	S.2.1	The quality score given by the procurement team is not in accordance with the actual fish condition
				S.2.2	The quality of the dry raw material is not the same (worse) as what the suppliers promised
		S.3	Negotiation of Raw Material's Price	S.3.1	The price demanded by suppliers increases (more expensive)
				S.3.2	The price of dry raw materials is too high compared to the quality
		S.4	Checking the Availability of Dry Raw Material (Dried Fish)	S.4.1	Dry Raw material is unavailable
		S.5	Delivery Process of Dry Raw Materials (Dried Fish) From Supplier to PT ICS	S.5.1	Raw materials are damaged during the delivery process

Table 4.2 List of Potential Failure Mode (Cont.)

No.	SCOR Process	Code	Process	Risk Code	Potential Failure Mode
		S.6	Raw Materials (Fresh Fish) Received	S.6.1	There are many mixtures on the raw materials
		S.7	Dry Raw Materials (Dried Fish) Received	S.7.1	Raw material condition is not good (yellowish color, bad odor)
		S.8	Supporting Raw Materials (Salt, Master Carton, Plastics) Received	S.8.1	Product information is written incorrectly on the MC
3	MAKE	M.1	Washing Process	M.1.1	The raw material spills during the washing process
				M1.2	Workers slip on the slippery floor
		M.2	Cooking Process	M.2.1	Boiling process is too long
				M.2.2	Boiling process is too short
				M.2.3	Work accident (exposed to hot water, exploding stove, etc)
		M.3	Drying Process	M.3.1	Rain falls during the drying process
				M.3.2	The result of drying process is too dry or the water content of the fish is below standard
		M.4	1st Sorting	M.4.1	Result of sorting process is not clean
				M.4.2	Operators are more concerned with the quantity of sorting result rather than the quality of it
		M.5	Sizing	M.5.1	The speed of pouring the product into the sizing machine is too fast

Table 4.2 List of Potential Failure Mode (Cont.)

No.	SCOR Process	Code	Process	Risk Code	Potential Failure Mode
				M.5.2	Supply of products to be sized has an uneven size
				M.5.3	Products to be sized is too dry
				M.5.4	Product is placed on container of the wrong size group
				M.5.5	The size of the product resulted from the sizing process is uneven
				M.5.6	The product in the container drops and spills when it is poured into the sizing machine
				M.5.7	Fan blower on the sizing machine is broken
		M.6	1st Packing	M.6.1	Running out of Master Carton (MC)
		M.7	2nd Sorting	M.7.1	The previous sorting result is not clean yet
				M.7.2	Result of sorting process is not clean
				M.7.3	(Dry raw materials) Products to be sorted contain a lot of mixtures/not clean
		M.8	Metal Magnet Sorting Process	M.8.1	The magnet is not working properly
		M.9	Final Packing	M.9.1	Operator incorrectly stamped codes on an MC
		M.10	Movement/Inter-station Transport	M.10.1	Products (MCs) fall when they're moved from one place to another
				M.10.2	The packaging of the product is damaged

Table 4.2 List of Potential Failure Mode (Cont.)

No.	SCOR Process	Code	Process	Risk Code	Potential Failure Mode
		M.11	Refrigeration Process Using Cold Storage (Pre-cooling and Final Storage)	M.11.1	The product is damaged when stored in the cold storage
				M.11.2	The packaging of the product is damaged when stored in the cold storage
				M.11.3	Temperature of cold storage is unstable
				M.11.4	The cold storage is full
4	DELIVERY	D.1	Place Order For Container	D.1.1	The available schedule is not anytime soon
		D.2	Export	D.2.1	Production team fails to achieve the production targets on the delivery schedule
				D.2.2	Delivery schedule (from shipping company) is not due anytime soon
				D.2.3	The product is damaged when stored in the container
5	RETURN	R.1	Customer's Review	R.1.1	Complaints From Customers
				R.2.2	Customers Request Claim

4.3.2 Identification of Risk Effect, Risk Cause, and Current Control

After the risks are obtained, the next process is to determine the risk effect, risk cause, and the current control of each risk. Risk effect is the impact or consequence of risk event. It is what happen if a particular risk is failed to be avoided. In contrast, risk cause is the reason why such risk might happen. Moreover, current control is the mechanism or strategy to avoid or eliminate risk which is already established within the company. The list of the risk effect, risk cause, and current control are provided in the following table.

Table 4. 3 Effect, Cause, and Current Control of Each of the Risk/Potential Failure Mode

Code	Process	Risk Code	Potential Failure Mode	Potential Effect(s) of Failure	Potential Cause(s) of Failure	Current Control
P.1	Plan Sales Target and Production Target	P.1.1	Sales target is not achieved	The company's revenue decreases	Low demand from customer and there's no new customer	The marketing team is targeted to bring two new customers each month
		P.1.2	Production target is not achieved	Delivery to customer is delayed	Insufficient supply of raw material due to seasonal constraints	
P.2	Offer Product to Customer	P.2.1	Customers bid low prices	There will be lost sales if the requested price is below the company's standard and if the price can't be negotiated	The price of the product in the international market is lower than the company's price	Benchmark with other companies to know the market price

Table 4.3 Effect, Cause, and Current Control of Each of the Risk/Potential Failure Mode (Cont.)

Code	Process	Risk Code	Potential Failure Mode	Potential Effect(s) of Failure	Potential Cause(s) of Failure	Current Control
P.3	Receive The Sales Confirmation	P.3.1	The final product (ready-to-deliver product) is not in accordance with the sales confirmation (regarding the product assortment and shipment schedule)	Additional waiting time for the customer's confirmation	Availability of the products depends on the fish catch (which is seasonal) therefore the product assortment and the shipment schedule cannot be ascertained	Giving a comprehensive explanation to the customers about the main challenge in dried-anchovy production which is the season of fish
				Price may change according to the new product assortment		
S.1	Visit Raw Material (Fresh Fish) Suppliers in Tuban & Rembang	S.1.1	Raw material is unavailable	Inhibits several production processes, especially the process of washing, boiling, and drying	There is no catch from the fishermen due to low season and / or the suppliers did not manage to buy fish from the fisherman	Procurement is done through several suppliers in two regions (Tuban and Rembang), using dry raw materials as substitute
		S.1.2	The amount of the raw material is only a few	Increases the procurement costs and the production costs	The catch of fish is low due to location and seasonal constraints, the suppliers sell the fish to more than one buyer (ICS has to share the fish with other companies)	Procurement is done through several suppliers in two regions (Tuban and Rembang), using dry raw materials as substitute

Table 4.3 Effect, Cause, and Current Control of Each of the Risk/Potential Failure Mode (Cont.)

Code	Process	Risk Code	Potential Failure Mode	Potential Effect(s) of Failure	Potential Cause(s) of Failure	Current Control
S.2	Quality Checking of Raw Material	S.2.1	The quality score given by the procurement team is not in accordance with the actual fish condition	The raw materials received by the company is not as good as the quality score which results in the lower final product quality	Negligence of workers in charge of checking the quality of raw materials (fresh fish)	Workers who are in charge of checking the quality are those who are experts in their field so that mistakes can be minized
		S.2.2	The quality of the dry raw material is not the same (worse) as what the suppliers promised	Quality of raw material decreases (quality downgrade) which results in the declining quality of the final product	Differences in quality standards between company and suppliers, differences in production system / working system between company and suppliers	Providing education on quality standards and production system to assisted suppliers
				Less amount of final product		
				Sorting process takes more time		
S.3	Negotiation of Raw Material's Price	S.3.1	The price demanded by suppliers increases (more expensive)	Raw material costs increases and cost of goods manufactured also increases	Scarcity of raw materials	
		S.3.2	The price of dry raw materials is too high compared to the quality	Price negotiation process with the suppliers becomes more complicated	Differences in (dry raw materials) quality standards between company and suppliers	Providing education on quality standards and production system to assisted suppliers

Table 4.3 Effect, Cause, and Current Control of Each of the Risk/Potential Failure Mode (Cont.)

Code	Process	Risk Code	Potential Failure Mode	Potential Effect(s) of Failure	Potential Cause(s) of Failure	Current Control
S.4	Checking the Availability of Dry Raw Material (Dried Fish)	S.4.1	Dry Raw material is unavailable	Inhibits the production process causing the production line to be stopped	Low catch of fish due to location and seasonal constraints	Procurement is done through several suppliers in various regions
S.5	Delivery Process of Dry Raw Materials (Dried Fish) From Supplier to PT ICS	S.5.1	Raw materials are damaged during the delivery process	Quality of raw material decreases (quality downgrade) which results in the declining quality of the final product	The delivery takes a long time and the cold storage on the truck is inadequate	Delivery is done at night to avoid traffic jam, PT ICS collects the raw materials with its own truck
				Requires a re-cooking and re-drying process		
S.6	Raw Materials (Fresh Fish) Received	S.6.1	There are many mixtures on the raw materials	Less amount of final product	The conditions of the sea, weather, and season of fish	
				Sorting process takes more time		
S.7	Dry Raw Materials (Dried Fish) Received	S.7.1	Raw material condition is not good (yellowish color, bad odor)	Quality of raw material decreases (quality downgrade) which results in the declining quality of the final product	Inaccuracy when checking the raw material's quality	
				Requires a re-cooking and re-drying process		
S.8	Supporting Raw Materials (Salt, Master Carton, Plastics) Received	S.8.1	Product information is written incorrectly on the MC	Might cause misunderstandings with the customers	Mistake in printing process	Checking each order made and review the usual order

Table 4.3 Effect, Cause, and Current Control of Each of the Risk/Potential Failure Mode (Cont.)

Code	Process	Risk Code	Potential Failure Mode	Potential Effect(s) of Failure	Potential Cause(s) of Failure	Current Control
M.1	Washing Process	M.1.1	The raw material spills during the washing process	The weight of the raw material (fish) decreases resulting in reduced final output and increased raw material costs	Carelessness of the operators in charge of washing the fish, the condition in the washing room is slippery	Adding anti-slip pads
		M.1.2	Workers slip on the slippery floor	Endangers workers' safety and causes minor to serious injuries	The floor in the washing room tends to be wet and quite slippery	Adding anti-slip pads, using boots
M.2	Cooking Process	M.2.1	Boiling process is too long	Fish becomes easily crumbled	Negligence of workers in charge of cooking the fish	Creating a standard of how many times the operator needs to stir the fish before it can be lifted
		M.2.2	Boiling process is too short	Fish has bad odor	Negligence of workers in charge of cooking the fish	Creating a standard of how many times the operator needs to stir the fish before it can be lifted
		M.2.3	Work accident (exposed to hot water, exploding stove, etc)	Endangers workers' safety and causes minor to serious injuries	The cooking process uses a high-temperature stove and is done manually	

Table 4.3 Effect, Cause, and Current Control of Each of the Risk/Potential Failure Mode (Cont.)

Code	Process	Risk Code	Potential Failure Mode	Potential Effect(s) of Failure	Potential Cause(s) of Failure	Current Control
M.3	Drying Process	M.3.1	Rain falls during the drying process	Fish become spoiled/bad and it requires a re-cooking process	The rain is unpredictable, the drying process is done outdoor so it takes time to collect the fish when it rains	
		M.3.2	The result of drying process is too dry or the water content of the fish is below standard	The weight of the raw material (fish) decreases resulting in reduced final output and increased raw material costs	Negligence of workers assigned to supervise the drying process	Improving controls by checking the dryness of fish periodically
M.4	1st Sorting	M.4.1	Result of sorting process is not clean	The product still contains other types of fish and foreign objects	The process of Sorting 1 aims to remove objects that are dark, which is why foreign objects with identical colors to fish are difficult to identify	Perform additional sorting process
		M.4.2	Operators are more concerned with the quantity of sorting result rather than the quality of it	Output of the 1st Sorting Process is still below standard because it still has a lot of mixture or it is not clean yet	The 1st Sorting process is performed by 'pekerja borongan' or casual workers who are paid on the basis of the quantity of sorting result for each person	Checking is done each time one operator hands out sorting result to ensure the sorting quality follows the company standards

Table 4.3 Effect, Cause, and Current Control of Each of the Risk/Potential Failure Mode (Cont.)

Code	Process	Risk Code	Potential Failure Mode	Potential Effect(s) of Failure	Potential Cause(s) of Failure	Current Control
M.5	Sizing	M.5.1	The speed of pouring the product into the sizing machine is too fast	The size of the product resulted from the sizing process is inaccurate	Fish tend to fall on large size despite its small size	Sizing process is repeated 2-3 times depending on the condition of the fish so that the size is more accurate
		M.5.2	Supply of products to be sized has an uneven size	Sizing process takes a longer time	The conditions of the sea, weather, and season of fish affect the size of the catch of fish	Sizing process is repeated 2-3 times depending on the condition of the fish so that the size is more accurate
		M.5.3	Products to be sized is too dry	The size of the product resulted from the sizing process is inaccurate because the weight of the fish is too light	The result of the drying process is too dry, the product is obtained from the supplier so that sometimes the water content doesn't meet the company standards	Tighter control on drying process and dry raw materials procurement process
		M.5.4	Product is placed on container of the wrong size group	Repeat the sizing process for the particular container	Negligence of workers in charge of collecting the sizing result	

Table 4.3 Effect, Cause, and Current Control of Each of the Risk/Potential Failure Mode (Cont.)

Code	Process	Risk Code	Potential Failure Mode	Potential Effect(s) of Failure	Potential Cause(s) of Failure	Current Control
M.5	Sizing	M.5.5	The size of the product resulted from the sizing process is uneven	Product of the sizing process is returned by the next processes (packing and sorting) and requires a resizing process	Operator is less observant when doing the job	Sizing process is repeated 2-3 times depending on the condition of the fish so that the size is more accurate
		M.5.6	The product in the container drops and spills when it is poured into the sizing machine	Increases processing time due to having to collect the scattered products	Negligence of workers in charge of pouring the product to the sizing machine	
				Products might be mixed with the already sized one so it requires a resizing process		
		M.5.7	Fan blower on the sizing machine is broken	Product (that has been sized) has uneven and inaccurate size	Improper fan blower speed makes the fish fall on the wrong size group	
M.6	1st Packing	M.6.1	Running out of Master Carton (MC)	Operator needs to work twice to replace the temporary MC	Late supply from the MC's supplier	Using other existing MCs so as not to impede the next process
M.7	2nd Sorting	M.7.1	The previous sorting result is not clean yet	Sorting process takes more time	Season of fish affects the quality of fish catch which affects the result of sorting process	Result of 1st Sorting process is checked before it is given to the next process (2nd Sorting)

Table 4.3 Effect, Cause, and Current Control of Each of the Risk/Potential Failure Mode (Cont.)

Code	Process	Risk Code	Potential Failure Mode	Potential Effect(s) of Failure	Potential Cause(s) of Failure	Current Control
M.7	2nd Sorting	M.7.2	Result of sorting process is not clean	Foreign objects are still found in the product	Negligence of operators assigned to sort the fish due to fatigue	Each MC is checked by an inspector before proceeding to the next station
		M.7.3	(Dry raw materials) Products to be sorted contain a lot of mixtures/not clean	Sorting process takes more time	Season of fish affects the mixture in fish	
				Target of sorting process is not achieved	The sorting result of the (dry raw materials) suppliers are not the same as or as clean as the company (PT ICS)	
				Late delivery due to insufficient stock		
M.8	Metal Magnet Sorting Process	M.8.1	The magnet is not working properly	The finished products still contain metal	Excessive and hasty use of metal magnet device	Periodic Inspection on the device
M.9	Final Packing	M.9.1	Operator incorrectly stamped codes on an MC	The information provided on the MC is incorrect	Negligence of workers assigned to stamp the MC	Re-checking by the next operator
M.10	Movement/Inter-station Transport	M.10.1	Products (MCs) fall when they're moved from one place to another	Injuries to workers nearby or to those who get hit by the MC	Too many stacks of MC during the product transfer process	Applying maximum stacking level rule
		M.10.2	The packaging of the product is damaged	The product is scattered due to damaged packaging	Too many stacks of MC during the product transfer process	Applying maximum stacking level rule
				Requires a repacking process		

Table 4.3 Effect, Cause, and Current Control of Each of the Risk/Potential Failure Mode (Cont.)

Code	Process	Risk Code	Potential Failure Mode	Potential Effect(s) of Failure	Potential Cause(s) of Failure	Current Control
M.11	Refrigeration Process Using Cold Storage (Pre-cooling and Final Storage)	M.11.1	The product is damaged when stored in the cold storage	Requires special treatment depending on the conditions of damage (re-sorting, re-cooking, etc.)	Product is stored for too long in the cold storage since it doesn't use FIFO (First In First Out) system	
				Increases production time and costs		
		M.11.2	The packaging of the product is damaged when stored in the cold storage	Requires a repacking process	Too many stacking level in the cold storage	Limit the number of stacks in the cold storage
				Increases production time and costs		
		M.11.3	Temperature of cold storage is unstable	Product quality declines (pre-cooling process aims to inhibit microbial growth)	Failure of the cold storage system	Periodic Inspection
		M.11.4	The cold storage is full	Stacking does not meet the standards	Capacity of cold storage is limited	
D.1	Place Order For Container	D.1.1	The available schedule is not anytime soon	Postponement of shipment schedule and there will be waiting time for confirmation to customer and production team	The demand for container services is high so the schedule is often full	Placing orders for containers to several companies at once

Table 4.3 Effect, Cause, and Current Control of Each of the Risk/Potential Failure Mode (Cont.)

Code	Process	Risk Code	Potential Failure Mode	Potential Effect(s) of Failure	Potential Cause(s) of Failure	Current Control
D.2	Export	D.2.1	Production team fails to achieve the production targets on the delivery schedule	Delivery schedule must be postponed	The availability of raw materials is uncertain and the speed of production depends on the quality of the raw materials	Applying overtime working hours to achieve production targets
		D.2.2	Delivery schedule (from shipping company) is not due anytime soon	There will be a buildup of products in cold storage	Availability of containers and shipping schedules to the destination countries	Placing orders for containers to several companies at once
		D.2.3	The product is damaged when stored in the container	Quality of the product decreases as the temperature inside the container is unstable	The shipping conditions are beyond the control of the company which makes it difficult to anticipate	Company checks the container related to its physical conditions and its temperature prior to shipment date
R.1	Customer's Review	R.1.1	Complaints From Customers	Company must make improvements to the production process	Customers feel dissatisfied with the product which is caused by the production process	Ensuring that the customers understand the company's standards of product so that any special requirements or additions may be notified to the company beforehand (before the finalization of sales confirmation)

Table 4.3 Effect, Cause, and Current Control of Each of the Risk/Potential Failure Mode (Cont.)

Code	Process	Risk Code	Potential Failure Mode	Potential Effect(s) of Failure	Potential Cause(s) of Failure	Current Control
R.1	Customer's Review	R.2.2	Customers Request Claim	Company must give compensation to the customer	Customers feel dissatisfied with the product because it does not conform to the promised specification	Both the company and the customer's representative check the product right before it is shipped to make sure final condition of the product

The table above contains the list of the potential failure modes accompanied by the potential effect of failures, potential cause of failures, and the current control of the failure. The risk effect is useful to help decide the severity score of the risk. The risk cause will be used to score the occurrence score of the risk and the current control can be used to determine the detection score of the risk.

4.4 Risk Assessment

Risk assessment process is the process where severity, occurrence, and detection score is given. The score is given by the respondents through a FMEA questionnaire. The respondents of the questionnaire are those who are the experts of this field or in this company. There are three questionnaires that are distributed to the Director of Operational, Head of Production, and QC of Production. Each of the respondent fills the questionnaire by giving scores to the severity, occurrence, and detection of the failure modes.

Risk assessment is also the process where RPN is acquired by multiplying the severity, occurrence and detection. RPN or Risk Priority Number will be ranked from the largest to the smallest to see which risk that generates the highest RPN and also as the basis of risk evaluation process. RPN indicates how important the risk should be mitigated and handled. Risk assessment can be used to help decide which risk that will be mitigated and which risk that should be accepted. Usually, risk with low RPN will be neglected since the impact is not significant. However, the risk is still monitored to see if the impact and frequency of risk changes and becomes worse.

4.4.1 Severity, Occurrence, and Detection Scoring

Assigning severity, occurrence, and detection score is one of the steps of conducting FMEA. The scores will be used to determine the Risk Priority Number for each of the risks. The score of severity and occurrence is in the range of 1-10 with 1 being the lowest score or least severe and least possibility to happen while 10 is the biggest score. Detection score is also in the range of 1-10, but 1 indicates a better detection mechanism than 10 unlike the severity and occurrence. The scoring criteria uses likert scale of 1-10. Hence, the final score of the severity, occurrence, and detection is not found through the mean of the three questionnaire results but through the median of the results. The data from likert scale is classified as ordinal data, therefore the appropriate parameter that should be used is median or mode instead of mean. The median is chosen because some of the data don't have mode when the three results produce different values. The criteria used in the scoring of severity is displayed in table 4.4.

Table 4. 4 Severity Criteria

Likelihood of Failure	Criteria: Occurrence of Cause - Incidents per Items	Rank
Very High	>= 1 (failure) in 10 (processes)	10
High	1 in 20	9
	1 in 50	8
	1 in 100	7
Moderate	1 in 500	6
	1 in 2,000	5
	1 in 10,000	4
Low	1 in 100,000	3
	1 in 1,000,000	2
Very Low	Failure is eliminated through preventative control	1

(Source: Potential Failure Mode and Effects Analysis (FMEA): Reference Manual, 2008)

The following table displays the criteria used in the scoring of occurrence which consists of 10 different scores.

Table 4. 5 Occurrence Criteria

Rank	Effect	Criteria: Severity of Effect on Process	Rank
10	Failure to meet safety and/or regulatory requirements	May endanger operator (machine or assembly) without warning.	10
9		May endanger operator (machine or assembly) with warning.	9
8	Major Disruption	Or 100% of product may have to be scrapped. Line shutdown or stop ship.	8
7	Significant Disruption	A portion of the production run may have to be scrapped. Deviation from primary process including decreased line speed or added manpower.	7
6	Moderate Disruption	100% of production run may have to be reworked off line and accepted.	6
5		A portion of production run may have to be reworked off line and accepted.	5

(Source: Potential Failure Mode and Effects Analysis (FMEA): Reference Manual, 2008)

Table 4.5 Occurrence Criteria (Cont.)

Rank	Effect	Criteria: Severity of Effect on Process	Rank
4	Moderate Disruption	100% of production run may have to be reworked in-station before it is processed.	4
3		A portion of production run may have to be reworked in-station before it is processed.	3
2	Minor Disruption	Slight inconvenience to process, operation, or operator.	2
1	No Effect	No discernible effect	1

(Source: Potential Failure Mode and Effects Analysis (FMEA): Reference Manual, 2008)

Similar to previous table, the following table displays the criteria used in the scoring of detection.

Table 4. 6 Detection Criteria

Degree	Degree in %	Description	Rank
Detection is not possible	0	Control method(s) cannot or will not detect the existence of a problem	10
Very Low	0-50	Control method(s) probably will not detect the existence of a problem	9
Low	50-60 60-70	Control method(s) has a poor chance of detecting the existence of a problem	7-8
Moderate	70-80 80-85	Control method(s) may detect the existence of a problem	5-6
High	85-90 90-95	Control method(s) has a good chance of detecting the existence of a problem	3-4
Very High	95-100	Control method(s) will almost certainly detect the existence of a problem	1-2

(Source: Curkovic et al., 2013)

Table 4.7 shows the severity, occurrence, and detection score for each of the risk. It is the result of the recapitulation from three respondents.

Table 4. 7 The Result of Severity, Occurrence, and Detection Scoring

Code	Process	Risk Code	Potential Failure Mode	Severity	Occurrence	Detection
P.1	Plan Sales Target and Production Target	P.1.1	Sales target is not achieved	2	1	2
		P.1.2	Production target is not achieved	3	4	10
P.2	Offer Product to Customer	P.2.1	Customers bid low prices	2	3	3
P.3	Receive The Sales Confirmation	P.3.1	The final product (ready-to-deliver product) is not in accordance with the sales confirmation (regarding the product assortment and shipment schedule)	3	3	3
S.1	Visit Raw Material (Fresh Fish) Suppliers in Tuban & Rembang	S.1.1	Raw material is unavailable	5	4	2
		S.1.2	The amount of the raw material is only a few	5	3	2
S.2	Quality Checking of Raw Material	S.2.1	The quality score given by the procurement team is not in accordance with the actual fish condition	4	3	2
		S.2.2	The quality of the dry raw material is not the same (worse) as what the suppliers promised	4	4	4
S.3	Negotiation of Raw Material's Price	S.3.1	The price demanded by suppliers increases (more expensive)	5	4	10
		S.3.2	The price of dry raw materials is too high compared to the quality	3	4	3

Table 4.7 The Result of Severity, Occurrence, and Detection Scoring (Cont.)

Code	Process	Risk Code	Potential Failure Mode	Severity	Occurrence	Detection
S.4	Checking the Availability of Dry Raw Material (Dried Fish)	S.4.1	Dry Raw material is unavailable	3	3	3
S.5	Delivery Process of Dry Raw Materials (Dried Fish) From Supplier to PT ICS	S.5.1	Raw materials are damaged during the delivery process	2	2	2
S.6	Raw Materials (Fresh Fish) Received	S.6.1	There are many mixtures on the raw materials	4	3	10
S.7	Dry Raw Materials (Dried Fish) Received	S.7.1	Raw material condition is not good (yellowish color, bad odor)	5	4	2
S.8	Supporting Raw Materials (Salt, Master Carton, Plastics) Received	S.8.1	Product information is written incorrectly on the MC	2	2	2
M.1	Washing Process	M.1.1	The raw material spills during the washing process	3	2	1
		M.1.2	Workers slip on the slippery floor	2	2	2
M.2	Cooking Process	M.2.1	Boiling process is too long	2	2	2
		M.2.2	Boiling process is too short	2	2	2
		M.2.3	Work accident (exposed to hot water, exploding stove, etc.)	3	1	10
M.3	Drying Process	M.3.1	Rain falls during the drying process	4	3	10
		M.3.2	The result of drying process is too dry or the water content of the fish is below standard	3	3	2
M.4	1st Sorting	M.4.1	Result of sorting process is not clean	3	4	3

Table 4.7 The Result of Severity, Occurrence, and Detection Scoring (Cont.)

Code	Process	Risk Code	Potential Failure Mode	Severity	Occurrence	Detection
M.4	1st Sorting	M.4.2	Operators are more concerned with the quantity of sorting result rather than the quality of it	4	3	3
M.5	Sizing	M.5.1	The speed of pouring the product into the sizing machine is too fast	3	3	3
		M.5.2	Supply of products to be sized has an uneven size	3	3	3
		M.5.3	Products to be sized is too dry	3	2	3
		M.5.4	Product is placed on container of the wrong size group	2	2	10
		M.5.5	The size of the product resulted from the sizing process is uneven	3	3	3
		M.5.6	The product in the container drops and spills when it is poured into the sizing machine	3	3	10
		M.5.7	Fan blower on the sizing machine is broken	2	2	10
M.6	1st Packing	M.6.1	Running out of Master Carton (MC)	1	1	2
M.7	2nd Sorting	M.7.1	The previous sorting result is not clean yet	3	3	2
		M.7.2	Result of sorting process is not clean	3	4	3
		M.7.3	(Dry raw materials) Products to be sorted contain a lot of mixtures/not clean	3	3	10
M.8	Metal Magnet Sorting Process	M.8.1	The magnet is not working properly	1	2	2
M.9	Final Packing	M.9.1	Operator incorrectly stamped codes on an MC	2	2	2

Table 4.7 The Result of Severity, Occurrence, and Detection Scoring (Cont.)

Code	Process	Risk Code	Potential Failure Mode	Severity	Occurrence	Detection
M.10	Movement/Inter-station Transport	M.10.1	Products (MCs) fall when they're moved from one place to another	2	2	2
		M.10.2	The packaging of the product is damaged	2	2	2
M.11	Refrigeration Process Using Cold Storage (Pre-cooling and Final Storage)	M.11.1	The product is damaged when stored in the cold storage	3	3	10
		M.11.2	The packaging of the product is damaged when stored in the cold storage	2	2	2
		M.11.3	Temperature of cold storage is unstable	3	2	2
		M.11.4	The cold storage is full	2	2	10
D.1	Place Order For Container	D.1.1	The available schedule is not anytime soon	2	3	3
D.2	Export	D.2.1	Production team fails to achieve the production targets on the delivery schedule	2	3	3
		D.2.2	Delivery schedule (from shipping company) is not due anytime soon	3	2	3
		D.2.3	The product is damaged when stored in the container	2	2	2
R.1	Customer's Review	R.1.1	Complaints From Customers	3	2	2
		R.2.2	Customers Request Claim	4	2	2

4.4.2 Calculation of Risk Priority Number (RPN)

Risk Priority Number is one of the output of conducting FMEA. This number can be used to prioritize mitigation action that should be taken by the company. The higher the RPN shows a higher urgency for a risk to be mitigated. RPN is obtained by multiplying the score of severity, occurrence, and detection. The formula to calculate RPN is written in the equation below:

$$RPN = Severity\ x\ Occurrence\ x\ Detection$$

The calculation is done for each of the identified failure modes. The result of the calculation of RPN is shown in the table below.

Table 4. 8 The Result of the RPN Calculation

Risk Code	Potential Failure Mode	Severity	Occurrence	Detection	RPN
P.1.1	Sales target is not achieved	2	1	2	4
P.1.2	Production target is not achieved	3	4	10	120
P.2.1	Customers bid low prices	2	3	3	18
P.3.1	The final product (ready-to-deliver product) is not in accordance with the sales confirmation (regarding the product assortment and shipment schedule)	3	3	3	27
S.1.1	Raw material is unavailable	5	4	2	40
S.1.2	The amount of the raw material is only a few	5	3	2	30
S.2.1	The quality score given by the procurement team is not in accordance with the actual fish condition	4	3	2	24
S.2.2	The quality of the dry raw material is not the same (worse) as what the suppliers promised	4	4	4	64
S.3.1	The price demanded by suppliers increases (more expensive)	5	4	10	200
S.3.2	The price of dry raw materials is too high compared to the quality	3	4	3	36
S.4.1	Dry Raw material is unavailable	3	3	3	27

Table 4.8 The Result of the RPN Calculation (Cont.)

Risk Code	Potential Failure Mode	Severity	Occurrence	Detection	RPN
S.5.1	Raw materials are damaged during the delivery process	2	2	2	8
S.6.1	There are many mixtures on the raw materials	4	3	10	120
S.7.1	Raw material condition is not good (yellowish color, bad odor)	5	4	2	40
S.8.1	Product information is written incorrectly on the MC	2	2	2	8
M.1.1	The raw material spills during the washing process	3	2	1	6
M.1.2	Workers slip on the slippery floor	2	2	2	8
M.2.1	Boiling process is too long	2	2	2	8
M.2.2	Boiling process is too short	2	2	2	8
M.2.3	Work accident (exposed to hot water, exploding stove, etc.)	3	1	10	30
M.3.1	Rain falls during the drying process	4	3	10	120
M.3.2	The result of drying process is too dry or the water content of the fish is below standard	3	3	2	18
M.4.1	Result of sorting process is not clean	3	4	3	36
M.4.2	Operators are more concerned with the quantity of sorting result rather than the quality of it	4	3	3	36
M.5.1	The speed of pouring the product into the sizing machine is too fast	3	3	3	27
M.5.2	Supply of products to be sized has an uneven size	3	3	3	27
M.5.3	Products to be sized is too dry	3	2	3	18
M.5.4	Product is placed on container of the wrong size group	2	2	10	40
M.5.5	The size of the product resulted from the sizing process is uneven	3	3	3	27
M.5.6	The product in the container drops and spills when it is poured into the sizing machine	3	3	10	90

Table 4.8 The Result of the RPN Calculation (Cont.)

Risk Code	Potential Failure Mode	Severity	Occurrence	Detection	RPN
M.5.7	Fan blower on the sizing machine is broken	2	2	10	40
M.6.1	Running out of Master Carton (MC)	1	1	2	2
M.7.1	The previous sorting result is not clean yet	3	3	2	18
M.7.2	Result of sorting process is not clean	3	4	3	36
M.7.3	(Dry raw materials) Products to be sorted contain a lot of mixtures/not clean	3	3	10	90
M.8.1	The magnet is not working properly	1	2	2	4
M.9.1	Operator incorrectly stamped codes on an MC	2	2	2	8
M.10.1	Products (MCs) fall when they're moved from one place to another	2	2	2	8
M.10.2	The packaging of the product is damaged	2	2	2	8
M.11.1	The product is damaged when stored in the cold storage	3	3	10	90
M.11.2	The packaging of the product is damaged when stored in the cold storage	2	2	2	8
M.11.3	Temperature of cold storage is unstable	3	2	2	12
M.11.4	The cold storage is full	2	2	10	40
D.1.1	The available schedule is not anytime soon	2	3	3	18
D.2.1	Production team fails to achieve the production targets on the delivery schedule	2	3	3	18
D.2.2	Delivery schedule (from shipping company) is not due anytime soon	3	2	3	18
D.2.3	The product is damaged when stored in the container	2	2	2	8
R.1.1	Complaints From Customers	3	2	2	12
R.2.2	Customers Request Claim	4	2	2	16

4.5 Risk Evaluation

Risks are ranked based on their RPN from the largest to the smallest to find the highest risk among all of them. The larger the RPN means that the risk should be handled first and become the priority in the mitigation strategy. Risk with the risk code of S.3.1 is known to have the highest RPN recorded at 200. The risk is the price demanded by suppliers increases (more expensive) which resulted in the increase of the price of goods manufactured due to high material cost. All of the 49 risks are ranked based on their RPN in the following table.

Table 4. 9 The Ranking of the Risk

No.	Risk Code	Potential Failure Mode	RPN
1	S.3.1	The price demanded by suppliers increases (more expensive)	200
2	P.1.2	Production target is not achieved	120
3	S.6.1	There are many mixtures on the raw materials	120
4	M.3.1	Rain falls during the drying process	120
5	M.5.6	The product in the container drops and spills when it is poured into the sizing machine	90
6	M.7.3	(Dry raw materials) Products to be sorted contain a lot of mixtures/not clean	90
7	M.11.1	The product is damaged when stored in the cold storage	90
8	S.2.2	The quality of the dry raw material is not the same (worse) as what the suppliers promised	64
9	S.1.1	Raw material is unavailable	40
10	S.7.1	Raw material condition is not good (yellowish color, bad odor)	40
11	M.5.4	Product is placed on container of the wrong size group	40
12	M.5.7	Fan blower on the sizing machine is broken	40
13	M.11.4	The cold storage is full	40
14	S.3.2	The price of dry raw materials is too high compared to the quality	36
15	M.4.1	Result of sorting process is not clean	36
16	M.4.2	Operators are more concerned with the quantity of sorting result rather than the quality of it	36

Table 4.9 The Ranking of the Risk (Cont.)

No.	Risk Code	Potential Failure Mode	RPN
17	M.7.2	Result of sorting process is not clean	36
18	S.1.2	The amount of the raw material is only a few	30
19	M.2.3	Work accident (exposed to hot water, exploding stove)	30
20	P.3.1	The final product (ready-to-deliver product) is not in accordance with the sales confirmation (regarding the product assortment and shipment schedule)	27
21	S.4.1	Dry Raw material is unavailable	27
22	M.5.1	The speed of pouring the product into the sizing machine is too fast	27
23	M.5.2	Supply of products to be sized has an uneven size	27
24	M.5.5	The size of the product resulted from the sizing process is uneven	27
25	S.2.1	The quality score given by the procurement team is not in accordance with the actual fish condition	24
26	P.2.1	Customers bid low prices	18
27	M.3.2	The result of drying process is too dry or the water content of the fish is below standard	18
28	M.5.3	Products to be sized is too dry	18
29	M.7.1	The previous sorting result is not clean yet	18
30	D.1.1	The available schedule is not anytime soon	18
31	D.2.1	Production team fails to achieve the production targets on the delivery schedule	18
32	D.2.2	Delivery schedule (from shipping company) is not due anytime soon	18
33	R.2.2	Customers Request Claim	16
34	M.11.3	Temperature of cold storage is unstable	12
35	R.1.1	Complaints From Customers	12
36	S.5.1	Raw materials are damaged during the delivery process	8
37	S.8.1	Product information is written incorrectly on the MC	8
38	M.1.2	Workers slip on the slippery floor	8
39	M.2.1	Boiling process is too long	8
40	M.2.2	Boiling process is too short	8
41	M.9.1	Operator incorrectly stamped codes on an MC	8
42	M.10.1	Products (MCs) fall when they're moved from one place to another	8
43	M.10.2	The packaging of the product is damaged	8
44	M.11.2	The packaging of the product is damaged when stored in the cold storage	8

Table 4.9 The Ranking of the Risk (Cont.)

No.	Risk Code	Potential Failure Mode	RPN
45	D.2.3	The product is damaged when stored in the container	8
46	M.1.1	The raw material spills during the washing process	6
47	P.1.1	Sales target is not achieved	4
48	M.8.1	The magnet is not working properly	4
49	M.6.1	Running out of Master Carton (MC)	2

Other than RPN ranking, risk matrix is also commonly used to determine the priority of risk mitigation. However, risk matrix only considers the severity and the occurrence of the risks and neglects the detection. Risks are usually classified into three or more categories that indicates the urgency of the risk. In this research, the risks are grouped into three categories which are high risk, medium risk, and low risk. The result of the risk matrix is displayed in figure 4.2.

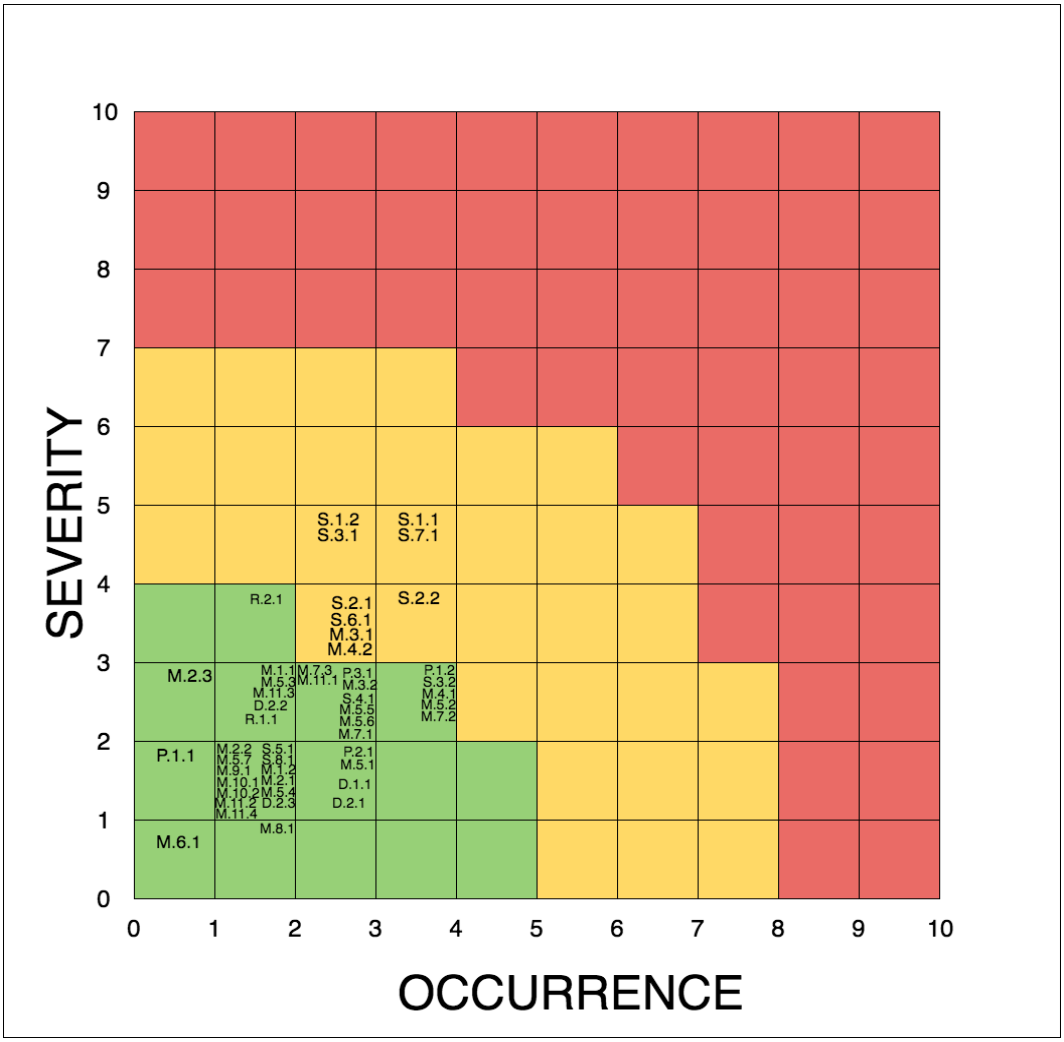

Figure 4. 2 Risk Matrix

The figure shows the location of the risks based on the severity and occurrence score. It can be noticed that there is no risk found in the category of high risk. Most of the risks are located in the low risk area and nine risks are included in the medium risk area.

4.6 Risk Mitigation

The risks that are going to be mitigated are those who are in the medium risk area and those whose RPN exceed 100 since not all the high RPN (RPN more than 100) risks are included in the medium risk area. The risk mitigation is classified into four kinds of risk responses which are reduce, transfer, avoid, and accept risk. The table below shows the mitigation strategy for each of the risk that is being mitigated.

Table 4. 10 Risk Mitigation Strategy

Risk Code	Failure Mode	Risk Response			
		Reduce	Transfer	Avoid	Accept
S.3.1	The price demanded by suppliers increases (more expensive)	Create a contract with suppliers to set a maximum price boundary			Use dry raw materials instead of fresh raw materials when the catch of fish is low
P.1.2	Production target is not achieved	Find new suppliers to gain more raw materials			
S.6.1	There are many mixtures on the raw materials			Compare with other suppliers before buying the raw material	Use dry raw materials instead of fresh raw materials when the condition of the sea is not suitable
M.3.1	Rain falls during the drying process				Wait until the rain stops
S.2.2	The quality of the dry raw material is not the same (worse) as what the suppliers promised		Return the product to the supplier when the quality is below the standard of the company		

Table 4.10 Risk Mitigation Strategy (Cont.)

Risk Code	Failure Mode	Risk Response			
		Reduce	Transfer	Avoid	Accept
S.1.1	Raw material is unavailable	Find new suppliers to gain more raw materials			Wait until the catch of fish increases
S.7.1	Raw material condition is not good (yellowish color, bad odor)	Make a quality checking form to help sourcing staff decide whether to buy the raw material or not			
M.4.2	Operators are more concerned with the quantity of sorting result rather than the quality of it	Give evaluation to all 'pekerja borongan' or casual workers about their performance related to the quality of sorting result			
S.1.2	The amount of the raw material is only a few				Use dry raw materials instead of fresh raw materials when the catch of fish is low
S.2.1	The quality score given by the procurement team is not in accordance with the actual fish condition	Make a quality checking form to help sourcing staff determine the raw material's quality			

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CHAPTER V
ANALYSIS AND INTERPRETATION

This chapter consists the analysis and interpretation of this research. The data that are collected and processed in the previous chapter will be analyzed and interpreted to give better explanation about the result of the research.

5.1 Analysis of Supply Chain Activity Mapping Using SCOR

In order to classify and map the supply chain activity of PT ICS, this research uses supply chain operation reference or commonly known as SCOR. SCOR divides the activity into six major categories; namely plan, source, make, deliver, return, and enable. However, after conducting an observation and discussion with the company representatives, there is no activity that can be classified as enable. Enable process is mainly about the management of supply chain such as management of supply chain risk and performance. Unfortunately, this company still hasn't acknowledged the importance of managing supply chain. Thus, the business process mapping will only show five classifications of activity which are plan, source, make, deliver, and return.

Plan is the first SCOR process in the classification. The process of planning the whole supply chain activity is involved in plan. There are three activities of plan that are found in this company. The activities include plan sales target and production target, offer product to customer, and receive the sales confirmation. Plan sales target and production target will determine supply chain planning indirectly by aggregating the supply chain resource. In planning sales target, the company must be aware of the capacity of production and availability of the resource which in the end will result in production target. Offer product to customer is included in plan because this activity is done prior to the production process and is needed to plan the production process as well as supply chain activity. Receive the sales confirmation is also included in this process because this is actually the continuation of the previous process which is offer product to customer.

In source process, there are 8 activities involved in it. Source process is all processes that related to the sourcing of raw materials to the receiving of the raw materials. In PT ICS, the sourcing process is begun by visiting the raw materials suppliers and checking the quality of raw materials directly. Besides that, the process of price negotiation and raw materials receiving process in the factory are also included in sourcing process. There are two kinds of raw materials that are used by the company, dry raw materials and fresh raw materials. Fresh raw material is obtained through direct visitation to the suppliers to get the recently caught fish, while the dry raw materials is bought from suppliers in other area outside Tuban and Rembang. The cooking and drying process is done in the suppliers' plant for the dry raw materials to avoid spoilage. PT ICS usually provides assistance and education to the dry raw material's suppliers in order to have the same understanding regarding the cooking and drying process of the fish. In this way, the quality of dry raw materials from the suppliers are as good as the quality that are produced by the company.

Most of the activities in PT ICS are found in make process. In total, there are 11 activities in this process. Make process is basically the production process that happens in the factory. The process is started by washing the fresh fish which is continued directly to the process of cooking. After that, the fish is dried under the sun until it reaches a specific dryness. The fish that is already dried should be at the level of 39%-42% of water/moisture content. The next process is several steps of sorting process, sizing, and weighing as well as packing process. Refrigeration process is needed after finishing every process, so after the fish goes through drying process it should be stored in the cold storage before it can continue its process to sorting process. It is applied to every process during the production of dried anchovy. The refrigeration process is done to prevent bacteria to grow and to avoid quality degradation due to fungus and germ.

The fourth SCOR process is delivery process. There are two activities found in delivery process. Delivery process is done in the head office of PT ICS which is located in Waru, Sidoarjo. The first process is to place order for the container. This process is done if the head office already receives a notification that the production plant is ready to ship the product according to the requested amount. The container

is booked and an expedition company is also added to bring the container to the factory in Tuban. A representative from PT ICS would check the container beforehand prior to the shipment. It is to make sure that the condition of the container is appropriate for the product. Making sure of the container's condition is important to avoid product being damaged while it is shipped to the destination. The second activity is the export process itself. As mentioned earlier, the condition of the container is very important to guarantee the quality of the product while it is stored in the container.

The last SCOR process is the return process. The return process in this company is not the actual product return but it is in the form of customer's review of the product. There are two possible outcome related to negative feedback, which are complaints and claims. Complaint happens if the customer is not satisfied with the product but the product actually already fulfills the standards. However, customer demands some improvement in terms of production process for a better quality. In the other hand, claim happens when the customer demands compensation because the product is not in accordance with the requested specification. However, PT ICS says that compensation is rarely happen.

5.2 Analysis of Risk Identification Process

By using the result of business process mapping that has been done previously, risk identification process is conducted. Based on the business process mapping, there are 25 processes in the supply chain of PT ICS starting from planning the sales and production target until getting the customers' review of the products. From those processes, 49 potential failure modes are identified. The identification process is done by interviewing the people who are involved in the daily production process and the experts in the field. Beside that, direct observation is also done to see the production process of dried anchovy on the production site.

The identification process is started by observing a particular process and looking for something that can be an obstacle or disruption to the process. After that, discussion with the employees and the operators is done to confirm the identified failure modes. Furthermore, employees and operators also give some inputs about the risks of that particular activity through interview. The interview is

done with operators and staffs both from the factory and the head office of PT ICS. It is to make sure that all risks contained in the process can be identified thoroughly.

Out of the 49 potential failure modes, 28 of them are found in the Make process. Source process also contains a lot of risks with 11 failure modes. The rest of them are found in Plan process which has 4 failure modes, Delivery process with 4 failure modes, and Return process as the least risky process with 2 failure modes. In the Make process, the Sizing activity alone counts for 7 of the failure modes.

Among the 49 potential failure modes, 13 of them are not related to human factor. So, 73.5% of the risk is related to human factor while the rest is not related to human. The risks that are not related to human factor are P.3.1, S.4.1, S.5.1, S.6.1, M.3.1, M.5.7, M.8.1, M.11.1, M.11.3, M.11.4, D.1.1, D.2.2, and D.2.3. However, risk S.1.1 and S.1.2 might be partially caused by human even though the main cause is due to natural phenomenon. S.1.1 is the risk of the unavailability of raw material and S.1.2 is the risk of having only a little amount of raw material. These two risks are mostly caused by the low catch of fish due to seasonal and area constraints, however it can also be caused by the suppliers. When the catch of fish is low, suppliers might be failed in securing the fish from the fishers against other suppliers.

In the identification process; the risk effect, risk cause, and current control are also determined. The risk effect is the impact or consequence of the risk when it happened. In contrast, what causes the risk to happen is called risk cause. While current control is a mechanism or method to prevent and avoid the risk from happening and is associated with the detection level of the risk. The risk effect will be used to determine the severity of the risk while the risk cause can determine the occurrence of the risk. Similar with the failure mode identification, the interview with the employees and staffs also becomes the main input of the risk cause, risk effect, and current control identification. Some of the processes in the company are yet to have current controls. This is because the risks are usually associated with natural constraints, human error, and limited resources.

5.3 Analysis of Risk Assessment Process

In the risk assessment process; all of the identified risks, risk causes, risk effects, and current controls are used as the input in this process. The risk

assessment process consists of two parts which are the scoring of severity, occurrence, and detection and also the calculation of RPN. In assigning the score of severity, occurrence, and detection; three respondents are asked to fill out a questionnaire which consists of the potential failure modes along with the risk cause, risk effect, and current control. The scoring criteria, which is given in the questionnaire, uses likert scale of 1-10. Hence, the final score of the severity, occurrence, and detection is not found through the mean of the three questionnaire results but through the median of the results. The data from likert scale is classified as ordinal data, therefore the appropriate parameter that should be used is median or mode instead of mean. The median is chosen because some of the data don't have mode when the three results produce different values.

The figure below is the representation of the severity score that is obtained from this research.

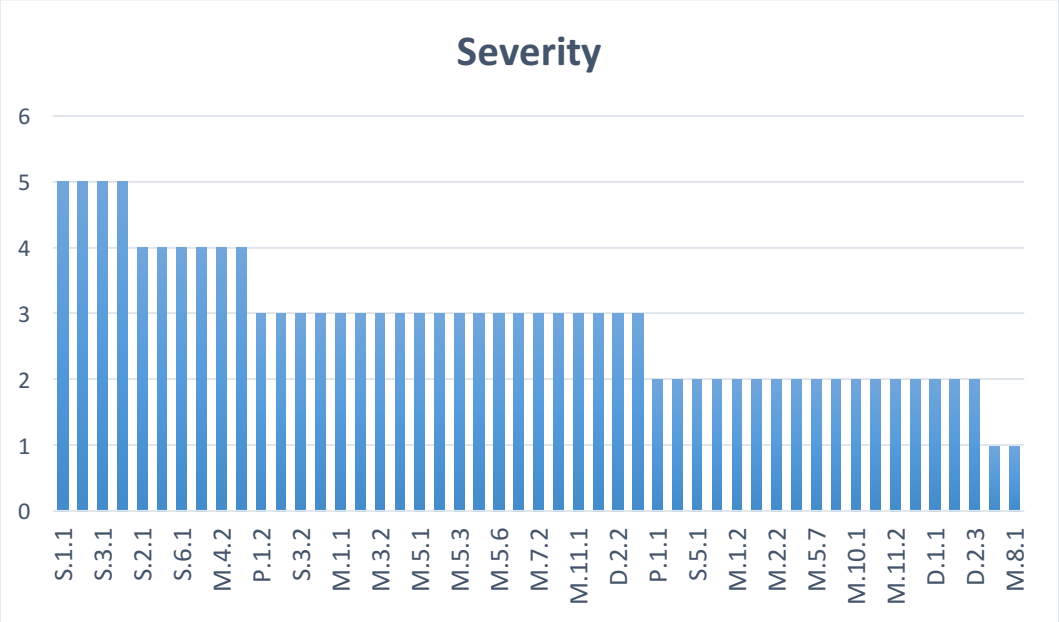

Figure 5. 1 Recapitulation of the Severity Score

According to figure 5.1, the highest severity is in the scale of 5 which is found in S.11, S.1.2, S.3.1, and S.7.1. In contrast, the lowest severity is recorded at the scale of 1 which is found in M.6.1 and M.8.1. The majority of the risks have severity score of 3 with 20 risks and the score of 2 with 17 risks. Severity rating is

aimed to measure the impact of the risk when it happens. In assigning severity score, the value of 1 indicates the smallest impact while the value of 10 means that the impact of the risk is huge. It can be seen that all four of the risks with highest severity is found in the source process. It means that any disruption to the process of sourcing can create a significant impact to the process. Sourcing is important in the production of dried anchovy because the raw materials of this product is very dependent to the nature and is very hard to predict in terms of the availability and quality.

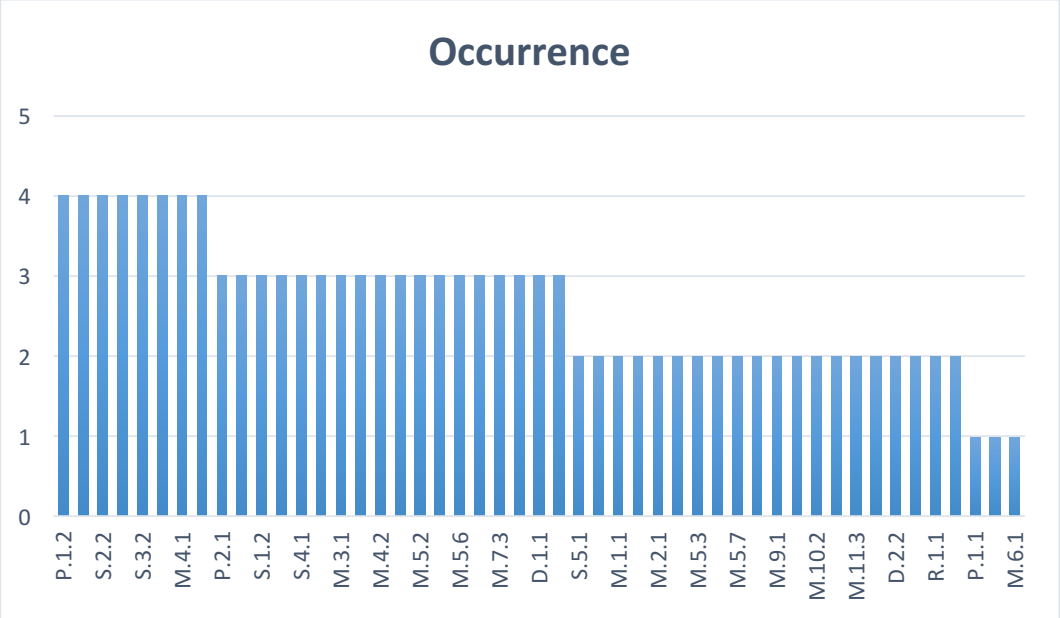

Figure 5. 2 Recapitulation of the Occurrence Score

The second risk parameter that is assessed in FMEA is occurrence. Occurrence indicates how often a failure mode happens or becomes an event. The higher the score means that the risk happens more frequently. In this research, the highest occurrence score is 4 which is found in eight risks. The risks that score the highest occurrence value are P.1.2, S.1.1, S.2.2, S.3.2, S.7.1, M.4.1, M.5.2, and M.7.2. Similar with previous parameter, the source process's risk dominates the highest occurrence rating. This indicates that the process of sourcing is frequently disrupted by several problems. The main problems in the source process is related to the availability, quality, and price of the raw material. In planning process, the

production target is sometimes unachieved. This is due to the limited resource of raw material rather than the problem of production capacity. For make process, the biggest problem is about the sorting result. Unclean sorting result happen several times and it can affect the performance of the production process. Unclean sorting process can cause repeated working when the operators needs to clean the product again.

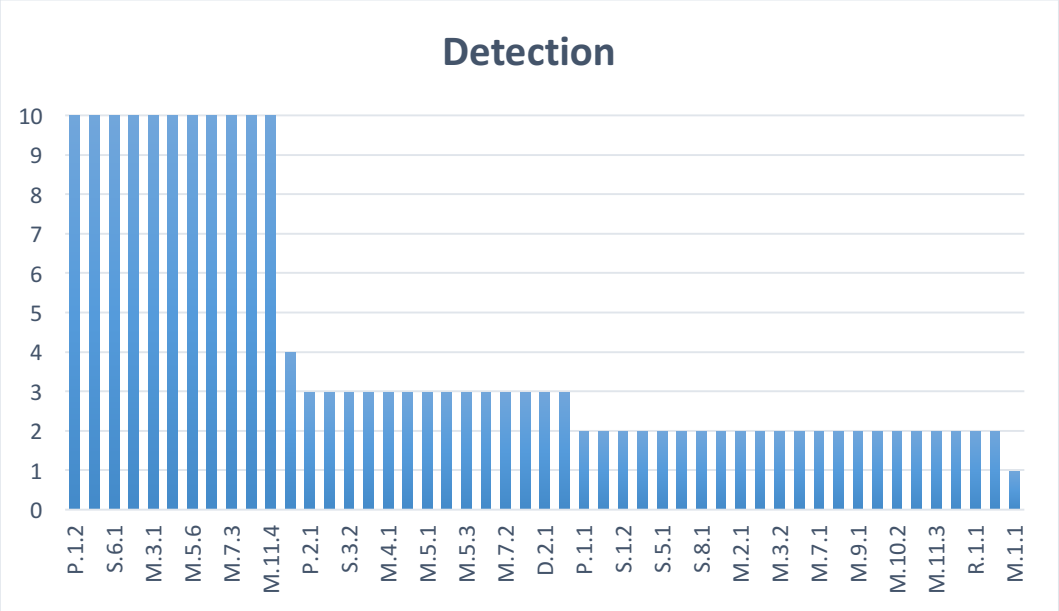

Figure 5. 3 Recapitulation of the Detection Score

Beside the previous two parameters, FMEA also assesses the detection level of a risk. Detection is related to whether the risk can be detected before it happens. It also shows how effective the prevention method in detecting and preventing the risk to happen. The score of 10 indicates that there is no tools or signs which can be used to detect the risk and that the prevention method failed to stop the risk. There are ten risks that has the detection score of 10. These risks are those which have no current controls to prevent the risk, thus the scores are 10. The risks with highest detection score are P.1.2, S.3.1, S.6.1, M.2.3, M.3.1, M.5.4, M.5.6, M.5.7, M.7.3, M.11.1, and M.11.4.

After all of the parameters scores are achieved through the questionnaire., the calculation of RPN can be done. Risk priority number is obtained by multiplying

each score of the severity, occurrence, and detection. Thus, the maximum or the highest RPN can reach up to 1000. However, the highest RPN found in this case is 200. Risk with higher RPN should be attended first because that risk might have severe impact or might be frequently happen or it might be undetected.

5.4 Analysis of Risk Evaluation Process

The evaluation of the risk is done through two ways. The first is to rank the available risk from the largest RPN to the smallest RPN. This process can show the which risk that has the highest risk priority number. The risk that has RPN more than 100 will be mitigated in the next step of FMEA. There are four risks with RPN exceeding 100 which are S.3.1, P.1.2, S.6.1, and M.3.1. The first risk is about the increase of price demanded by the suppliers which has severity score of 5, occurrence score of 4, and detection score of 10. The detection score is high since it doesn't have any current controls that can be applied to avoid the risk. The second until the fourth highest RPN risks have the same RPN which is 120. P.1.2 is the risk of not achieving the production target. The severity score is 3, the occurrence score is 4, while the detection score is 10. Again, the high number of detection makes this risk included in the high risk classification which is due to not having a prevention/detection method to avoid the risk. The third high risk is there are many mixtures on the raw materials (fresh raw materials). The same as the previous high risk, this risk also has no current controls thus making the score of detection become so high in the level of 10. The severity and occurrence is relatively medium in the range of 4 and 3 respectively. The last high risk is found in the make process which is the risk of rain when drying process is conducted. This risk also has high detection score due to unavailability of prevention method since rain is natural phenomenon that can't be avoided. The score of severity and occurrence is the same as the previous risk since they have the exact same RPN.

Beside RPN ranking, the evaluation is also done by mapping the risk using risk matrix. Risk matrix divides the risks into several categories, this research decides to classify the risks into 3 categories which are high risk indicated by red color, medium risk indicated by yellow color, and low risk indicated by green color. If the RPN ranking is done by sorting the RPN of all the risks from the largest to

the smallest, risk matrix is done by mapping the risks based on their severity and occurrence score. The X axis indicates the occurrence score while the Y axis indicates the severity score. The area is divided into high risk, medium risk, and low risk based on the score of both the severity and the occurrence. The result of this risk matrix is shown in figure 4.2. It can be seen that there is no risk that falls in the high risk area. The yellow area or the medium risk area is occupied by nine risk which are S.1.1, S.1.2, S.2.1, S.2.2, S.3.1, S.6.1, S.7.1, M.3.1, and M.4.2. the first two risks are from the same activity which is visiting the raw material (fresh fish) suppliers in Tuban and Rembang. This activity is vital to the whole process of dried anchovy production because without raw materials, the whole production process will be disrupted. S.2.1 and S.2.2 are also from the same activity which is quality checking of raw materials. The risk of having bad raw material will affect the production process especially the activity of sorting. Beside affecting the process of sorting, bad quality of raw material also has an impact in the final product in terms of the quality and the amount. Bad raw material produces fewer final product since there are many objects that should be removed from it. Bad raw material can also make the quality of the product to be downgraded and resulted in the lower price of the product.

5.5 Analysis of Risk Mitigation Process

After conducting a risk evaluation process, it is decided that there will be ten risks that are going to be mitigated in the mitigation process. The risks that are going to be mitigated are those whose RPN exceeds 100 and also those which falls in the medium risk area. Among the ten risks, seven of them are from the process of sourcing. The risks which will be mitigated are P.1.2, S.1.1, S.1.2, S.2.1, S.2.2, S.3.1, S.6.1, S.7.1, M.3.1, and M.4.2.

In mitigating the risks, there are four alternatives to be used. Risk response or mitigation strategy is divided into reduce risk, transfer risk, avoid risk, and accept risk. Risk reduction is defined as an effort to reduce the impact of risk by creating actions that can decrease the frequency of the risk. Transfer risk means that the impact of risk is transferred to other party such as the insurance company, expedition company, suppliers, etc.; while in this case the risk of getting a bad

quality of raw material is transferred to the supplier by returning raw material with low quality back to the supplier. The third form of mitigation strategy is to avoid risk. Avoiding risk is aimed to lessen the impact of a risk by performing an action that could eliminate the cause of the risk. The last alternative, which is accept risk, is used when the risk is unavoidable and can't be prevented. In this research, accept risk is used as a mitigation strategy for several risks such as the risk of rain falls during the drying process. Since rain is a natural phenomenon that can't be avoided and prevented, the only mitigation strategy is to wait until the rain to stop. Actually, drying process can be done using machine and located indoor, however it is not common and not appropriate for dried anchovy production. Indoor drying process using artificial sunlight affects the final product of dried anchovy in terms of quality. That's why PT ICS keeps using the natural sunlight to dry the anchovy even though some problems such as rain might disrupt the production process. The risk of getting many mixtures in the fish is also accepted since the company can use dry raw materials when the condition of the sea is not good. Unavailability of raw materials is also accepted by waiting until the catch of fish increases. The limited amount of raw material is also accepted since the company can use dry raw material instead of fresh fish when the catch of fish is low. The risk of increasing price demanded by suppliers is also accepted even though the impact of this risk is among the highest. It is due to the fact that PT ICS can use dry raw material instead of fresh raw material. When the price of fish is high, dry raw material can be used as an alternative. Besides that, the risk should also be reduced by creating a contract with the suppliers to set the maximum price boundary. Aside from that risk, the risk of unachieved production target and unavailability of raw material should also be reduced by finding new suppliers to gain more raw materials. Risk number S.7.1 and S.2.1 which concerns about the condition of the raw material can be reduced by making a quality checking form that can be used by the procurement staff to determine the raw material's quality. Reducing risk is also applicable to the risk number M.4.2 by giving evaluation to *'pekerja borongan'* or casual workers regarding their performance of sorting result.

In the mitigation strategy, there are five methods of risk reduction, five methods of risk acceptance, one risk transfer, and one risk avoidance. One of the

proposed action to reduce the risk is to create a quality checking form that is helpful for the sourcing staff to assess the raw material's quality.

5.6 Analysis of Human Factor in Supply Chain Process

Human factor plays a big role in the process of supply chain in this company. From the early process of planning until the last process of customer's review all involved human as the actor to determine the process. The process of planning the sales target and production target is obviously done by human since it requires analytical thinking and discussions among the staffs. The process of offering product to customer also involves human as the actor who markets the product as well as doing a negotiation in terms of price and other requirements. Sales confirmation is received and reviewed by the staff and it is can not be done automatically without the help of human.

The process of sourcing also involves human as the main actor to find and buy the raw materials. The raw material, which is fish, is obtained by the fishers manually. Even the quality control of the raw material is also done by human and it depends fully on the capability of the sourcing staff. However, the judgment of human can not be 100% accurate, sometimes the sourcing staff are failed to assess the quality accurately. In sourcing process, the role of human is very important especially in the process of finding the raw material and checking the quality of the raw material.

Since the production process of PT ICS is using manual labor, the involvement of human is very significant in the production process or make process. The process of washing, cooking, until the sorting process always involve human as the main actor. In some activities such as metal magnet sorting and sizing, equipment is used to help operator done its job, however the role of human is still needed to make the process run smoothly. The process of sorting, which is the main process in dried anchovy production, is highly dependent on the skill of the operator. Sorting process, the process of removing the foreign objects from the product, is impossible to be done without the involvement of human. PT ICS said that until now there is no machine/technology that can replace human in this process. The importance of human factor is undeniable in the process of make.

Delivery process requires operator to place order for the container and make sure that the condition of the container is appropriate for transporting food. The last process, which is customer's review, is undoubtedly done by human. The review of the product is done by the customer and PT ICS as the producer will receive the feedback and uses it to improve the production. These process is only possible to happen if human is involved in it.

Human factor cannot be separated from the supply chain process of seafood industry, especially PT ICS. In Indonesia, where most of the fishers still catch fish manually, human factor plays an important role in the sector. Human involvement cannot be eliminated from the production process of dried anchovy since most of the process are using manual labor. However, the problem of unstable productivity always arises in the industry. Innovation and technology are urgently needed to tackle the problem related to productivity of human. This research is indirectly aimed to increase the productivity by eliminating and reducing the risk in the supply chain in order to have a more efficient and effective process. The assessment of risk and implementation of mitigation strategy is also very dependent on the human resource. The staffs and operators' willingness to improve is the key to achieve an established risk management which can help to solve the problem of productivity.

CHAPTER VI
CONCLUSION AND SUGGESTION

In this chapter, the conclusion and suggestion will be given based on the result of the research. The conclusion will be drawn from the analysis of the research while the suggestion will be given in order to improve the next research.

6.1 Conclusion

After conducting the research of risk assessment using failure mode and effect analysis (FMEA) in PT ICS, the research resulted in several conclusions which will be shown in the list below.

1. The risk identification process is conducted by observing the supply chain process of PT ICS and also through some interviews with the staffs and operators that works in the production facility as well as the head office. From the direct observation and discussions, the total of 49 risks are found in the supply process of PT ICS. Among them, nine risks are classified as medium risk while the others are classified as low risk. The risks are classified based on the SCOR process mapping since the supply chain process is already mapped out beforehand. The result of the risk identification is used as an input for the next step of FMEA which is risk assessment, risk evaluation, and risk mitigation process.
2. Human factor is involved in all the processes in the supply chain activity of PT ICS from the plan until the return process. Human factor cannot be separated from the supply chain process of seafood industry, especially PT ICS. The importance of human involvement is felt even since the process of fish catching by the fishers. In the supply chain of PT ICS, human factor is involved the most in the make process or the production process of dried anchovy. This activity, especially sorting process, is impossible to be done without the involvement of manual labor.

3. Mitigation strategy is given to 10 risks that are in the category of medium risk and for risks that have RPN more than 100. These risks are mitigated by four different risk responses which are risk reduction, risk transfer, risk avoidance, and risk acceptance. For risk reduction and risk acceptance, there are five methods obtained for each of them to mitigate the risks. Risk avoidance and risk transfer are accounted for only one method each for the mitigation strategy. The highest risk is reduced by creating a contract with the suppliers to set a maximum price boundary. Reducing risk is also done to risk number S.7.1 and S.2.1 by making a quality checking form that will be helpful to the procurement staff in determining the quality of raw materials and in deciding whether to buy the raw materials or not.

6.2 Suggestion

Based on the research, there are several suggestions that will be given for the next research. The suggestions are as follows.

1. The risk assessment should be conducted for the whole company in order to make the business process runs more effectively and efficiently.
2. The risk management in PT ICS should be collaborated with the existing HAZOP (Hazard and Operability Study) to create a better production process and to prevent operational hazard from the source.

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APPENDIX
KUESIONER FMEA

Dengan hormat,

Bersama dengan ini saya,

Nama	: Nisrina Gianindya Poer
NRP	: 02411440000129
Universitas	: Institut Teknologi Sepuluh Nopember
Program Studi	: Teknik Industri

memohon kesediaan Bapak/Ibu untuk meluangkan waktu untuk mengisi kuesioner penelitian tugas akhir yang menjadi syarat untuk menyelesaikan pendidikan S1. Kuesioner tersebut akan digunakan sebagai data dalam penelitian tugas akhir dengan judul:

"Assessment of Risk Related to Human Factor in Supply Chain Process of PT ICS Using FMEA"

Kuesioner ini bertujuan untuk mengukur tingkat risiko pada setiap proses/aktivitas yang terdapat pada proses *supply chain* atau rantai pasok. Dengan kuisioner ini, risiko-risiko yang terjadi pada proses *supply chain* dapat dicegah dan diantisipasi sehingga dampak yang ditimbulkan berkurang atau probabilitas terjadinya dapat dikurangi. Penilaian risiko akan didasarkan pada tiga aspek yaitu *Severity* (keparahan dampak risiko), *Occurrence* (probabilitas terjadinya risko), dan *Detection* (deteksi terhadap risiko).

Kuesioner ini ditujukan untuk karyawan PT Insan Citraprima Sejahtera yang memahami aktivitas-aktivitas pada proses *supply chain* perusahaan. Mohon kiranya Bapak/Ibu dapat memberikan jawaban yang jujur dan sesuai dengan kondisi yang sebenarnya. Dimohon Bapak/Ibu untuk mengisi kuesioner dengan selengkap-lengkapnya pada bagian yang telah ditentukan. Kuesioner ini terdiri dari tiga bagian, yaitu Bagian 1: Identitas Responden; Bagian 2: Skala *Ranking Severity*, *Occurrence*, dan *Detection*; dan Bagian 3: Kuesioner Penelitian.

Data-data yang dicantumkan dalam kuisioner ini akan dijaga kerahasiaannya oleh peneliti dan hanya akan digunakan untuk kepentingan penelitian. Terima kasih atas kesediaan Bapak/Ibu untuk mengisi kuesioner ini.

Bagian 1: Identitas Responden

Pada bagian ini Bapak/ibu dimohon untuk mengisi biodata sesuai dengan kolom yang tersedia dibawah. Pengisian dilakukan dengan mengisi kolom yang kosong serta mencoret pilihan jawaban yang tidak sesuai.

Nama :
Jenis Kelamin : Perempuan / Laki-laki
Jabatan :
Lama Bekerja : Bulan / Tahun

Surabaya, …….

(Tanda tangan dan nama terang)

Bagian 2: Skala *Ranking Severity, Occurrence*, dan *Detection*

Pada bagian ini tercantum kriteria *ranking* yang dijadikan acuan untuk mengisi kuesioner penelitian. Kriteria ranking berisi keterangan nilai dari 1 sampai 10 untuk setiap aspek *(severity, occurrence, detection)*. Bapak/Ibu dimohon untuk mengacu pada *ranking* dibawah ini dalam mengisi kuesioner.

1. *Severity* (Keparahan Dampak Risiko)

Brikut ini adalah tabel keterangan *ranking severity* dimana semakin besar *ranking* maka dampak yang ditimbulkan semakin negatif.

Tabel 1 Kriteria Keparahan dari Efek/Dampak Risiko

Efek	Kriteria: Keparahan *(Severity)* dari Efek/Dampak Pada Proses	*Rank*
Gagal Memenuhi Persyaratan dan/atau Peraturan Keselamatan	Dapat membahayakan operator (mesin atau rakitan) tanpa peringatan.	10
	Dapat membahayakan operator (mesin atau rakitan) dengan peringatan.	9
Gangguan Besar	100% hasil produk dari proses produksi harus diganti. Proses produksi berhenti toatl atau pengiriman *(shipment)* berhenti.	8
Gangguan Signifikan	Sebagian hasil produk dari proses produksi harus diganti. Deviasi dari proses ideal/primer seperti penurunan kecepatan produksi atau perlunya tenaga kerja tambahan.	7
Gangguan Moderat	100% dari hasil produksi harus dikerjakan ulang diluar proses yang semestinya *(reworked)*.	6
	Sebagian dari hasil produksi harus dikerjakan ulang diluar proses yang semestinya *(reworked)*.	5
Gangguan Moderat	100% dari hasil produksi harus dikerjakan ulang sebelum diproses lebih lanjut (*return* dari proses selanjutnya).	4
	Sebagian dari hasil produksi harus dikerjakan ulang sebelum diproses lebih lanjut (*return* dari proses selanjutnya).	3
Gangguan Kecil	Sedikit ketidaknyamanan pada proses, operasi, atau operator.	2
Tidak Berpengaruh	Tidak ada efek yang berarti.	1

(Sumber: Potential Failure Mode and Effects Analysis (FMEA): Reference Manual, 2008)

2. *Occurrence* (Probabilitas Terjadinya Risiko)

Brikut ini adalah tabel keterangan *ranking occurrence* dimana semakin besar *ranking* maka semakin sering risiko tersebut terjadi.

Tabel 2 Kriteria Terjadinya Penyebab Risiko

Kemungkinan Terjadi Kegagalan	Kriteria: Terjadinya Penyebab (*Occurrence of Cause*) - Kejadian per Item	*Rank*
Sangat Tinggi	>= 1 (kegagalan) dari 10 (proses)	10
Tinggi	1 dari 20	9
	1 dari 50	8
	1 dari 100	7
Moderat	1 dari 500	6
	1 dari 2.000	5
	1 dari 10.000	4
Rendah	1 dari 100.000	3
	1 dari 1.000.000	2
Sangat Rendah	Kegagalan tidak terjadi dengan adanya upaya pencegahan.	1

(Sumber: Potential Failure Mode and Effects Analysis (FMEA): Reference Manual, 2008)

3. *Detection* (Deteksi Terhadap Risiko)

Brikut ini adalah tabel keterangan *ranking detection* dimana semakin besar *ranking* menggambarkan kondisi bahwa sistem control atau pencegahan yang ada saat ini belum mampu mendeteksi/mengontrol dengan baik risiko tersebut.

Tabel 3 Kriteria Tingkat Deteksi Risiko

Tingkat Deteksi	Tingkat Deteksi dalam %	Deskripsi	Rank
Tidak Mungkin Terdeteksi	0	Metode pencegahan tidak dapat atau tidak akan mendeteksi adanya masalah.	10
Sangat Rendah	0-50	Metode pencegahan kemungkinan tidak akan mendeteksi adanya masalah.	9
Rendah	50-60 60-70	Metode pencegahan memiliki peluang rendah untuk dapat mendeteksi adanya masalah.	7-8

(Sumber: Curkovic et al., 2013)

Tabel 3 Kriteria Tingkat Deteksi Risiko (Lanjutan)

Tingkat Deteksi	Tingkat Deteksi dalam %	Deskripsi	Rank
Moderat	70-80 80-85	Metode pencegahan dapat mendeteksi keberadaan masalah.	5-6
Tinggi	85-90 90-95	Metode pencegahan memiliki peluang bagus untuk mendeteksi adanya masalah.	3-4
Sangat Tinggi	95-100	Metode pencegahan hampir pasti akan mendeteksi adanya masalah.	1-2

(Sumber: Curkovic et al., 2013)

Bagian 3: Kuesioner Penelitian

Pada bagian ini Bapak/ibu diminta untuk mengisi kolom yang kosong pada kuesioner dengan angka antara 1 sampai 10 yang merupakan ranking sesuai acuan pada bagian sebelumnya. Setiap kolom risiko memiliki kriteria dan penjelasan yang berbeda sesuai dengan efek dan penyebab masing-masing risiko. Bapak/Ibu dimohon untuk memberikan penilaian ranking tersebut berdasrkan penilaian pribadi terhadap kondisi nyata yang terjadi bukan kondisi ideal atau kondisi yang Bapak/Ibu harapkan.

Tabel 4 Daftar Risiko

No.	Proses	Potensi Risiko (Failure Mode)	Potensi Efek yang Ditimbulkan Risiko	Severity	Potensi Penyebab dari Risiko	Occurrence	Current Controls	Detection
1	Membuat Target Penjualan dan Target Produksi	Target penjualan tidak tercapai	Pendapatan perusahaan berkurang		Permintaan dari customer rendah dan tidak ada customer baru		Tim marketing ditargetkan untuk mendapatkan dua customer baru setiap bulan	
		Target produksi tidak tercapai	Pengiriman kepada customer mundur		Supply bahan baku tidak mencukupi karena kendala musim			
2	Memberikan Penawaran Produk Kepada Customer	Customer menawar harga terlalu rendah	Lost sales jika harga yang diminta dibawah standar perusahaan dan customer sulit diajak bernegosiasi		Harga produk di pasar internasional lebih rendah		Melakukan benchmark harga dengan perusahaan lain	

Tabel 4 Daftar Risiko (Lanjutan)

No.	Proses	Potensi Risiko (Failure Mode)	Potensi Efek yang Ditimbulkan Risiko	Severity	Potensi Penyebab dari Risiko	Occurrence	Current Controls	Detection
3	Penerimaan sales confirmation	Produk yang jadi tidak sesuai dengan sales confirmation (jadwal shipment dan assortment)	Ada waktu tunggu konfirmasi dari buyer		Produk bergantung dengan musim tangkapan ikan di laut sehingga assortment dan jadwal shipment (yang tidak berhubungan dengan ketersediaan kapal) tidak bisa 100% pasti		Memberikan pemahaman kepada customer mengenai tantangan utama pada produksi produk yaitu musim tangkapan ikan	
			Harga bisa berubah sesuai assortment yang baru					
4	Mendatangi Supplier Bahan Baku Basah di Tuban & Rembang	Bahan baku tidak tersedia	Menghambat proses produksi terutama proses pencucian, perebusan, dan penjemuran		Tidak ada tangkapan dari nelayan karena musim, supplier tidak berhasil membeli ikan dari nelayan		Pengadaan melalui beberapa supplier pada dua daerah (Tuban dan Rembang), menggunakan bahan baku kering	
		Jumlah bahan baku yang ada hanya sedikit	Meningkatkan biaya pengadaan dan biaya produksi		Hasil tangkapan nelayan rendah karena pengaruh musim dan lokasi, supplier melayani lebih dari satu pembeli (kompetitor/perusahaan lain) sehingga hasilnya dibagi		Pengadaan melalui beberapa supplier pada dua daerah (Tuban dan Rembang), menggunakan bahan baku kering	

Tabel 4 Daftar Risiko (Lanjutan)

No.	Proses	Potensi Risiko (Failure Mode)	Potensi Efek yang Ditimbulkan Risiko	Severity	Potensi Penyebab dari Risiko	Occurrenc	Current Controls	Detection
5	Pengecekan Kualitas Bahan Baku	Nilai kulaitas yang diberikan tim pengadaan tidak sesuai dengan kondisi ikan sesungguhnya	Bahan baku yang diterima perusahaan lebih jelek sehingga menurunkan kualitas final product		Kelalaian pekerja yang bertugas mengecek kualitas bahan baku basah		Pekerja yang bertugas untuk mengecek kualitas merupakan orang yang sudah ahli dibidangnya sehingga kesalahan dapat diminimalisir sekecil mungkin	
		Kualitas tidak sesuai (lebih jelek) dengan yang dijanjikan supplier bahan baku kering	Kualitas bahan baku turun (downgrade) berpengaruh pada menurunnya kualitas produk akhir		Perbedaan standar kualitas antara perusahaan dan supplier, cara kerja/sistem produksi yang berbeda antara perusahaan dan supplier		Memberikan edukasi mengenai standar mutu dan cara kerja kepada supplier binaan	
			Hasil akhir produksi lebih sedikit					
			Proses sortasi memakan lebih banyak waktu					
6	Melakukan Negosiasi Harga	Harga yang diminta supplier naik (lebih mahal)	Biaya bahan baku naik dan Cost of Goods Manufactured meningkat		Kelangkaan bahan baku			
		Harga bahan baku kering tidak sesuai dengan kualitasnya	Proses negosiasi harga dengan supplier lebih rumit		Perbedaan standar kualitas bahan baku kering antara perusahaan dan supplier		Memberikan edukasi mengenai standar mutu dan cara kerja kepada supplier binaan	

Tabel 4 Daftar Risiko (Lanjutan)

No.	Proses	Potensi Risiko (Failure Mode)	Potensi Efek yang Ditimbulkan Risiko	Severit	Potensi Penyebab dari Risiko	Occurr	Current Controls	Detecti
7	Mengecek Ketersediaan Bahan Baku Kering	Bahan baku tidak tersedia	Menghambat proses produksi sehingga harus menghentikan kegiatan di lantai produksi		Kelangkaan bahan baku karena rendahnya hasil tangkapan laut yang dipengaruhi oleh musim dan lokasi		Pengadaan bahan baku kering melalui beberapa supplier di berbagai daerah	
8	Proses Pengiriman Bahan Baku Kering dari Supplier ke PT ICS	Bahan baku rusak dalam perjalan	Kualitas bahan baku turun (downgrade) berpengaruh pada menurunnya kualitas produk akhir		Proses pengiriman yang terlalu lama dan cold storage pada truck kurang memadai		Pengiriman dilakukan malam hari untuk menghindari macet, PT ICS melakukan pengambilan bahan baku dengan truck milik perusahaan	
			Perlu dilakukan proses pemasakan dan penjemuran ulang					
9	Penerimaan Bahan Baku Basah	Terdapat banyak campuran pada bahan baku basah	Hasil akhir produksi lebih sedikit		Kondisi laut, cuaca, dan musim			
			Proses sortasi memakan lebih banyak waktu					
10	Penerimaan Bahan Baku Kering	Kerusakan bahan baku (bau tidak sedap, warna menguning)	Kualitas bahan baku turun (downgrade) berpengaruh pada menurunnya kualitas produk akhir		Kurang teliti pada saat pengecekan bahan baku			
			Perlu dilakukan proses pemasakan dan penjemuran ulang					

Tabel 4 Daftar Risiko (Lanjutan)

No.	Proses	Potensi Risiko (Failure Mode)	Potensi Efek yang Ditimbulkan Risiko	Severity	Potensi Penyebab dari Risiko	Occurrenc	Current Controls	Detection
11	Penerimaan Bahan Baku Penunjang (Garam, Master Carton, Plastik)	Kesalahan penulisan informasi pada Master Carton	Bisa menyebabkan kesalah pahaman dengan pihak customer		Kesalahan pada proses percetakan		Melakukan pengecekan terhadap setiap pemesanan yang dilakukan dan me-review pesanan yang sudah biasa dilakukan	
12	Pencucian	Bahan baku tumpah saat proses pencucian	Tonase bahan baku (ikan) berkurang menyebebkan berkurangnya hasil akhir dan bertambahnya biaya bahan baku		Kecerobohan operator (pekerja yang bertugas mencuci ikan), kondisi tempat pencucian licin		Menambahakan alas anti selip	
		Pekerja terpeleset lantai yang licin	Membahayakan keselamatan pekerja bahkan hingga menyebabkan luka ringan maupun berat		Lantai di tempat pencucian cenderung basah dan cukup licin		Menambahakan alas anti selip, menggunakan sepatu boot	
13	Perebusan	Proses perebusan terlalu lama	Ikan menjadi mudah hancur		Kelalaian operator/pekerja yang bertugas melakukan perebusan		Membuat standar berapa kali operator harus mengaduk ikan sebelum ikan bisa diangkat	
		Proses perebusan terlalu sebentar	Ikan menjadi bau		Kelalaian operator/pekerja yang bertugas melakukan perebusan		Membuat standar berapa kali operator harus mengaduk ikan sebelum ikan bisa diangkat	

Tabel 4 Daftar Risiko (Lanjutan)

No.	Proses	Potensi Risiko (Failure Mode)	Potensi Efek yang Ditimbulkan Risiko	Severity	Potensi Penyebab dari Risiko	Occurrenc	Current Controls	Detection
13	Perebusan	Kecelakaan kerja (terkena air panas, kompor meledak, etc)	Membahayakan keselamatan pekerja bahkan hingga menyebabkan luka ringan maupun berat		Proses perebusan menggunakan kompor bersuhu tinggi dan dilakukan secara manual			
14	Penjemuran	Hujan pada saat penjemuran	Ikan menjadi bau sehingga diperlukan proses perebusan ulang		Hujan yang datang tidak bisa diprediksi, proses penjemuran outdoor sehingga memerlukan waktu untuk mengambil ikan yang dijemur			
		Bahan baku yang selesai dijemur terlalu kering	Tonase bahan baku (ikan) berkurang menyebebkan berkurangnya hasil akhir dan bertambahnya biaya bahan baku		Kelalaian operator yang bertugas mengawasi proses penjemuran		Peningkatan kontrol dengan melakukan pengecekan berkala untuk melihat tingkat kekeringan ikan	
15	Sortasi 1	Sortir tidak bersih	Masih terdapat jenis lokal dan benda asing pada produk		Sortasi 1 bertujuan utama menghilangkan benda yang berwarna gelap, sehingga benda asing yang berwarna mirip ikan sulit teridentifikasi		Dilakukan proses sortasi tambahan	

Tabel 4 Daftar Risiko (Lanjutan)

No.	Proses	Potensi Risiko (Failure Mode)	Potensi Efek yang Ditimbulkan Risiko	Severity	Potensi Penyebab dari Risiko	Occurrenc	Current Controls	Detection
15	Sortasi 1	Operator lebih mementingkan kuantitas daripada kualitas hasil sortir	Hasil sortir masih dibawah standar karena masih memiliki banyak campuran atau belum bersih		Proses sortasi 1 menggunakan pekerja borongan sehingga upah didapatkan berdasarkan kuantitas hasil sortir per orang		Dilakukan pengecekan setiap kali satu orang menyetorkan hasil sortir untuk memastikan kualitas mengikuti standar perusahaan	
16	Sizing	Kecepatan saat menuang produk ke mesin sizing terlalu cepat	Ukuran produk hasil sizing tidak tepat		Ukuran tidak tepat karena ikan cenderung terjatuh pada size besar walaupun ukurannya kecil		Sizing diulang 2-3 kali tergantung kondisi ikan supaya ukuran lebih akurat	
		Supply produk yang akan di-sizing memiliki ukuran tidak rata	Proses sizing membutuhkan waktu lebih lama untuk menghasilkan produk dengan size yang rata		Kondisi musim tangkapan di laut mempengaruhi ukuran ikan dan campuran pada ikan		Sizing diulang 2-3 kali tergantung kondisi ikan supaya ukuran lebih akurat	
		Produk yang akan di-sizing terlalu kering	Ikan yang terlalu ringan akan jatuh pada size yang tidak tepat dengan ukurannya		Proses penjemuran yang terlalu kering, produk didapatkan dari supplier sehingga terkadang kadar air tidak sesuai standar perusahaan		Kontrol yang lebih tinggi pada proses penjemuran dan proses pengadaan bahan baku kering melalui supplier	
		Menaruh produk pada kontainer dengan size yang salah	Mengulangi proses sizing pada kontainer yang salah		Kelalaian operator yang bertugas mengambil hasil sizing			

Tabel 4 Daftar Risiko (Lanjutan)

No.	Proses	Potensi Risiko (Failure Mode)	Potensi Efek yang Ditimbulkan Risiko	Severity	Potensi Penyebab dari Risiko	Occurrence	Current Controls	Detection
16	Sizing	Ukuran produk hasil sizing tidak rata	Return product dari proses selanjutnya (packing atau sortir) sehingga proses sizing perlu diulang		Operator kurang jeli saat melakukan sizing		Sizing diulang 2-3 kali tergantung kondisi ikan supaya ukuran lebih akurat	
		Produk pada kontainer terjatuh dan tumpah saat dituang ke mesin sizing	Menambah waktu proses karena harus mengambil produk yang tercecer,		Kelalaian operator yang bertugas menuang produk kedalam mesin sizing			
			Produk bisa tercampur dengan yang sudah di-sizing sehingga perlu dilakukan proses sizing ulang					
		Fan blower pada mesin sizing rusak	Produk yang telah di-sizing ukurannya tidak rata dan tidak tepat		Kecepatan blower yang tidak sesuai membuat ikan tidak jatuh pada size yang sesuai			
17	Packing 1	Kehabisan Master Carton (MC)	Harus bekerja dua kali untuk memindahkan produk yang diberi MC pengganti sementara		Keterlambatan supply dari supplier MC		Menggunakan MC lain yang ada supaya tidak menghambat proses berikutnya	

Tabel 4 Daftar Risiko (Lanjutan)

No.	Proses	Potensi Risiko (Failure Mode)	Potensi Efek yang Ditimbulkan Risiko	Severity	Potensi Penyebab dari Risiko	Occurrence	Current Controls	Detection
18	Finishing/Sortasi 2	Hasil sortasi sebelumnya belum bersih	Proses sortasi memakan lebih banyak waktu		Kualitas tangkapan ikan (dipengaruhi oleh musim dan cuaca) sangat berpengaruh pada kebersihan ikan		Pengecekan pada hasil sortasi 1 sebelum diserahkan pada proses berikutnya	
		Sortir tidak bersih	Masih terdapat benda asing pada produk		Kelelahan mata operator		Dilakukan proses checking oleh inspector untuk setiap MC produk	
		Supply produk yang akan disortir memiliki banyak campuran/tidak bersih	Proses sortasi memakan lebih banyak waktu		Kondisi musim tangkapan di laut mempengaruhi campuran pada ikan			
			Tidak mencapai target sortasi		Kebersihan ikan kering dari supplier tidak selalu sama seperti dari perusahaan (PT ICS)			
			Late delivery					
19	Metal Magnet	Magnet tidak berfungsi dengan baik	Produk jadi masih mengandung logam		Penggunaan metal magnet yang berlebihan dan terlalu cepat		Melakukan pengecekan metal magnet secara berkala	
20	Final Packing	Kesalahan saat memberikan stempel kode pada MC	Informasi yang diberikan tidak sesuai		Kelalaian operator (pekerja yang bertugas memberikan stempel pada MC)		Pengecekan ulang	

Tabel 4 Daftar Risiko (Lanjutan)

No.	Proses	Potensi Risiko (Failure Mode)	Potensi Efek yang Ditimbulkan Risiko	Severity	Potensi Penyebab dari Risiko	Occurrence	Current Controls	Detection
21	Pemindahan	Produk terjatuh saat proses pemindahan dari satu tempat ke tempat lain	Cedera bagi pekerja yang berada disekitarnya atau bagi yang tertimpa		Terlalu banyak tumpukan MC ketika proses pemindahan produk		Memberikan aturan tumpukan maksimal	
		Kemasan rusak	Produk tercecer karena kemasan rusak		Tumpukan terlalu tinggi saat memindahkan produk		Memberikan aturan tumpukan maksimal	
			Perlu re-packing dan meningkatkan cost					
22	Penyimpanan Cold Storage (pre-cooling dan final storage)	Barang rusak saat berada di Cold Storage	Membutuhkan perlakuan khusus tergantung kondisi kerusakan (sortir ulang, pemasakan ulang, etc)		Terlalu lama berada di dalam Cold Storage karena tidak menggunakan sistem FIFO (First In First Out)			
			Meningkatkan waktu dan biaya produksi					
		Kemasan rusak saat berada di Cold Storage	Membutuhkan proses re-packing		Tumpukan di dalam Cold Storage terlalu banyak		Membatasi jumlah tumpukan pada cold storage	
			Meningkatkan waktu dan biaya produksi					

Tabel 4 Daftar Risiko (Lanjutan)

No.	Proses	Potensi Risiko (Failure Mode)	Potensi Efek yang Ditimbulkan Risiko	Severity	Potensi Penyebab dari Risiko	Occurrence	Current Controls	Detection
22	Penyimpanan Cold Storage (pre-cooling dan final storage)	Suhu Cold Storage tidak stabil	Kualitas produk menurun (proses pre-cooling bertujuan untuk menghambat pertumbuhan mikroba)		Kerusakan pada sistem Cold Storage		Pengecekan secara berkala	
		Cold Storage penuh	Penumpukan yang tidak sesuai standar		Kapasitas cold storage yang terbatas			
23	Pemesanan Kontainer	Jadwal yang tersedia tidak dalam waktu dekat	Mundurnya jadwal shipment dan harus menunggu konfirmasi dari pihak produksi dan customer		Penggunaan kontainer sedang ramai sehingga jadwal sering penuh		Melakukan pemesanan ke beberapa perusahaan kontainer	
24	Ekspor	Tim produksi tidak mencapai target saat jadwal pengiriman	Jadwal pengiriman harus diundur		Ketersediaan bahan baku yang tidak menentu dan kecepatan produksi yang bergantung pada kualitas bahan baku		Menerapkan lembur untuk mencapai target produksi	
		Jadwal pengiriman produk terlalu lama	Terjadi penumpukan produk pada cold storage		Ketersediaan kontainer dan jadwal shipping ke negara tujuan		Melakukan pemesanan kontainer ke beberapa perusahaan sekaligus	

Tabel 4 Daftar Risiko (Lanjutan)

No.	Proses	Potensi Risiko (Failure Mode)	Potensi Efek yang Ditimbulkan Risiko	Severity	Potensi Penyebab dari Risiko	Occurrence	Current Controls	Detection
24	Ekspor	Produk rusak selama berada di kontainer	Kualitas produk menurun karena suhu didalam kontainer tidak stabil		Kondisi saat dilakukan pengiriman menggunakan kontainer diluar kontrol perusahaan sehingga sulit untuk diantisipasi		Perusahaan melakukan pengecekan kontainer terkait dengan ketersediaan, kondisi, dan suhu pada kontainer yang akan digunakan	
25	Customer's Review	Komplain dari customer	Perusahaan harus melakukan perbaikan pada proses produksi		Customer merasa tidak puas atas produk yang dikirimkan yang berhubungan dengan proses produksi		Memastikan bahwa customer mengetahui standar produk perusahaan sehingga jika mereka menginginkan tambahan khusus pada produk mereka dapat menginformasikan sebelum sales confirmation jadi	
		Customer Meminta Klaim	Perusahaan harus memberikan kompensasi kepada customer		Customer merasa tidak puas atas produk yang dikirimkan karena tidak sesuai dengan spesifikasi yang dijanjikan		Perusahaan melakukan checking sebelum shipping dilakukan dan customer juga melakukan checking di pabrik sesaat sebelum produk dikirimkan	

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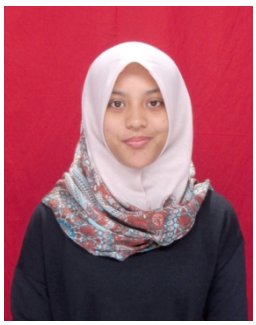
BIOGRAPHY



The author, Nisrina Gianindya, was born on 11 December 1995 in Magetan, Indonesia. The author had completed her formal studies at SDN Pucang I Sidoarjo (2002-2008) for the elementary school, SMPN 1 Sidoarjo (2008-2011) for the junior high school, and SMAN 1 Sidoarjo (2011-2014) for the senior high school. In 2014, the author started to continue her study in Industrial Engineering Department of Institut Teknologi Sepuluh Nopember (ITS).

During the study, the author had actively participated in several activities both inside and outside Intitut Teknologi Sepuluh Nopember. In 2016, the author was involved in a global volunteering activity conducted by AIESEC. The author volunteered for one month in Guangzhou, China to teach english to the migrant workers. Besides that, the author also participated in events held by student organization in department, INCHALL, as one of the committee. In 2017, the author was doing an internship at PT General Electric Power Solutions Indonesia in Surabaya, Indonesia. For further discussion and suggestion regarding to this research, the author can be reached through email at nisrinagianindya@gmail.com.