TUGAS AKHIR – TI 141501

PERANCANGAN MANAJEMEN RISIKO DENGAN MENGGUNAKAN METODE FUZZY FMEA PADA DEPARTEMEN PRODUKSI PT. CHAROEN POKPHAND TBK – PAKAN TERNAK KRIAN, SIDOARJO

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Surabaya 2015

FINAL PROJECT – TI 141501

DESIGNING FUZZY FMEA RISK MANAGEMENT AT PRODUCTION DEPARTMENT PT. CHAROEN POKPHAND TBK – POULTRY FEED KRIAN, SIDOARJO

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APPROVAL SHEET

DESIGNING FUZZY FMEA RISK MANAGEMENT AT PRODUCTION DEPARTMENT PT. CHAROEN POKPHAND TBK – POULTRY FEED KRIAN, SIDOARJO

FINAL PROJECT

Proposed to Fulfill the Requirement to Obtain
The Bachelor Degree of Engineering in
Bachelor Program of Industrial Engineering Department
Faculty of Industrial Technology
Institut Teknologi Sepuluh Nopember

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JULY 2015

PERANCANGAN MANAJEMEN RISIKO DENGAN MENGGUNAKAN METODE FUZZY FMEA *PADA DEPARTEMEN PRODUKSI* PT. CHAROEN POKPHAND TBK *– PAKAN TERNAK KRIAN, SIDOARJO*

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ABSTRAK

PT. Charoen Pokphand *adalah perusahaan manufaktur pembuatan pakan ternak terbesar di Indonesia. Perusahaan ini memproduksi pakan ternak, bibit ayam, dan aneka olahan makanan berbahan daging ayam. Melihat permintaan dari pakan ternak yang tinggi dari tahun ke tahun, perusahaan harus mendorong dirinya untuk berinovasi dan menungkatkan kualitas dan performansi dari bisnis proses. Bisnis proses yang dominan dimiliki perusahaan ini adalah pembuatan pakan ternak. Departemen produksi dalam hal ini memiliki wewenang untuk mengatur seluruh proses produksi pakan ternak. Beberapa aktivitas didalam departemen ini memiliki banyak kondisi ketidakpastian yang dapat terjadi di lantai produksi. Ketidakpastian ini dapat mengganggu tujuan strategis dari perusahaan. Semua hal yang dapat menghambat ketercapaian tujuan dari bisnis proses dapat dikatakan sebagai risiko. Saat ini perusahaan belum memiliki data risiko secara detail. Oleh karena itu penelitian ini akan mengidentifikasi risiko apa saja yang dapat menganggu berjalannya bisnis proses produksi pada* PT. Charoen Pokphand. *Identifikasi risiko menggunakan metode Fault Tree Analysis. FTA digunakan untuk mendapatkan akar permasalahan dalam sebuah aktivitas. Penilaian risiko menggunakan metode* Fuzzy FMEA. *Metode ini dipalikasikan untuk mengurangi tingkat subjektifitas dari para ahli dalam memberikan skor pada setiap risikonya. Output dari penelitian ini yaitu dashboard risiko yang menggunakan makro excel. Output ini dapat membantu user dalam mengakses risiko bisnis proses perusahaan dengan mudah.*

Kata kunci: Proses Bisnis, Manajemen Risiko,* Fault Tree Analysis (FTA), Fuzzy FMEA*, Pemetaan Risiko, Mitigasi Risiko, Dashboard Risiko, Macro Excel

DESIGNING FUZZY FMEA RISK MANAGEMENT AT PRODUCTION DEPARTMENT PT. CHAROEN POKPHAND TBK – POULTRY FEED KRIAN, SIDOARJO

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ABSTRACT

PT. Charoen Pokphand is the largest poultry feed manufacturing company in Indonesia. It produces animal feed, day-old chick, and chicken processing products. Seeing the demand of poultry feed is increasingly higher by year, this company should push itself to innovate and improve its business process and performance. The biggest business process of this company is poultry feed production. Production department is authorized department that manage the whole production process. Some activities inside will bring a lot of uncertainties that will be occured on the production floor. These uncertainties may block the strategy objectives. All things that can interfere the success of business objectives can be considered as a risk. Currently, they do not have risk data in detail. Therefore, this research will identify risks that may be a failure cause of activity in PT. Charoen Pokphand. The risk identification method is done by using Fault Tree Analysis. FTA is used to obtain root cause problems in each activities. The risk assessment method is done by using Fuzzy FMEA. This method is applied to reduce the expert subjectivity in giving risk score. The output of this research is risk dashboard using Macro Excel. This tool helps user to access the business process risk of PT. Charoen Pokphand.

Keywords: Business Process, Risk Management, Fault Tree Analysis (FTA), Fuzzy FMEA, Risk Map, Risk Mitigate, Risk Dashboard, Macro Excel

PREFACE

Praise the Mighty Lord, Allah SWT, for His blessing, guidance, and empowerment in helping the author finished this research report by the time this book had published.

With joyous heart, the author would like to thank to those who have supported and helped in finishing this final project. They are as the following:

1. The beloved author's family; Mother, Father, Bima, and all of big family for their prayer, hope, affection, and support.
2. Mrs. Naning Aranti Wessiani, S.T., M.M. as the supervisor for her knowledge, patience, and generous affection so that this research went on the right path.
3. All lecturers of Industrial Engineering Department, Prof. Budi Santosa, PhD, as the Head of Industrial Engineering Department; Dr. Ir. I Ketut Gunarta M.T, as the Head of PSMI Laboratory; Yudha Andrian Saputra, ST., MBA, as the author's Academic Advisor, and all of lecturers there for their knowledge and support during these courses.
4. Mr. Lucky, Mr. Anang, and others from PT. Charoen Pokphand Tbk. for assistance and supporting data for the research.
5. All member of Veresis Q-Class Family which could not be mentioned one by one as the family in campus for these four years. Thanks for being author's family, filling, supporting, the author during in campus life, and cheering up in good and bad time.
6. The PSMI Family as the family in campus for these two years; Veresis PSMI; Sandy, Ayu, Dean, Reza, Anies, Farid, Galih, Qisthy, Yanda, and Burhan; Kavaleri PSMI; Niela, Khanifah, Deailova, Asriyanthi, Wieka, Haga, Delina, Ghina, Alex, Dina, and Kiki. And also Provokasi PSMI; Mbak Zulvah, Mbak Vinda, Mbak Chikita, Mbak Atikah, Mas Agyl, Mbak Riri, and Mbak Adis. And also Mas Jefi.
7. The Mami's Children (Farid, Sandy, Ayu, Anies, Rinda, and Dhandi) thanks for the support and help each other.

8. All PI-1 Assisstants which could not be mentioned one by one. Thanks for support and help each other during doing the final project.
9. Gengbun Family (Bahalwan, Willy, Troy, Echa, Nabila Silmina, Fathia, and Mbak Bita), thanks being family for the author when in Malaysia for doing student exchange at Universiti Teknikal Malaysia Melaka for one semester. And thanks for the support for the author
10. D'Lors Family (Shiro, Ines, AR, Mbak Nyes, Ovita, and Kuntoro). Thanks for support and help each other during doing the final project.
11. Inalumers Family (Resa, Martian, Dhana, Feny, Tyas, Vivi, and Soraya). Thanks for support and help each other during doing the final project.
12. Thanks to Khalida and Mas Rino for helping authors in teaching Visual Basic for making dashboard.
13. Thanks to IEYC (Industrial Engineering Youth Club) member for giving support author for doing the final project.
14. Thanks to Afan Abdul J, Fadhila Inas, Guntur Sadhiea, Uranio Hario, Widya Ari, and high schools friends for giving support author for doing the final project.
15. And all to those who have helped the author to complete this final project which could not be mentioned one by one.

Overall, without any help from them, there would be no inspiration for today. Because of them, the author could learn something; those who inspired him were great mentors of life. The only thing he could do was thank you for how they shaped him the way he is today. With this research, he hopes it could help the society and develop the knowledge of mankind.

Surabaya, July 2015

Author

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CHAPTER 1
INTRODUCTION

This chapter explains reasons for doing this final project and problem raised in PT. Charoen Pokphand, Tbk. This chapter describes about background, problem formulation, and research objectives that is used in this final project.

1.1 Background

The Poultry Industry in Indonesia continued to show solid growth in 2013 although facing strong headwinds in the last quarter of the year because of Rupiah's depreciation against US Dollar. Based on research conducted by the Poultry Breeding Association (GPPU), the consumption of chicken meat in Indonesia rose to 8.08 kg/capita in 2013 from 6.97 kg/capita in 2012. For the year of 2014, GPPU estimates that chicken meat consumption in Indonesia will increase by 15.47% compared to 2013. This strong growth of chicken meat is attracting new players to enter Indonesia's poultry industry, not only as producers of feed and DOC (Day Old Chicks), but also as operators of commercial poultry farms.

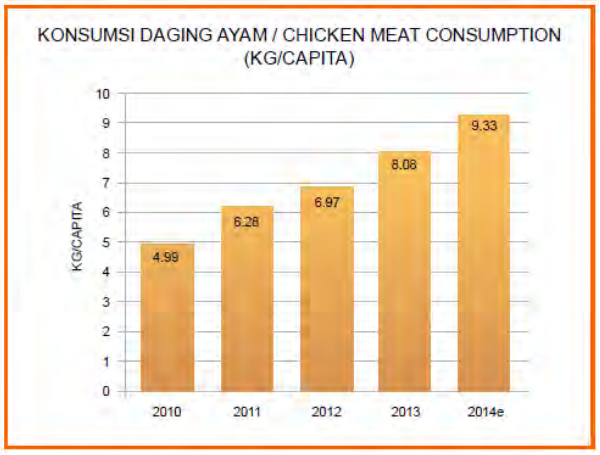

Figure 1.1 Chicken Meat Consumption (kg/capita) (Gabungan Perusahaan Pembibitan Unggas (GPPU) / Poultry Breeding Association)

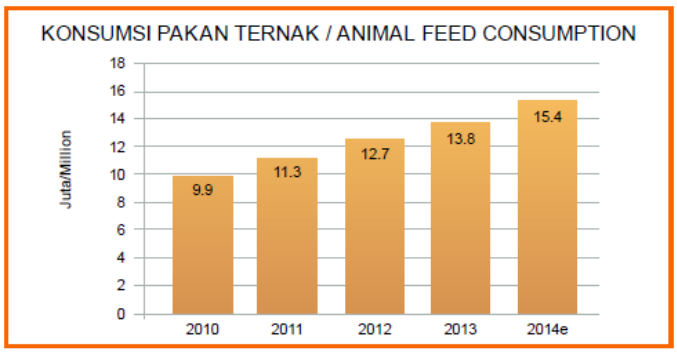

Figure 1.2 Animal Feed (Fodder) Consumption (Gabungan Perusahaan Pembibitan Unggas (GPPU) / Poultry Breeding Association)

According to the Association of Fodder Producers (GPMT), poultry feed production grew 8.7% to 13.8 million tons in 2013 from 12.7 million tons in the previous year. The total production capacity of the company's poultry feed mills in Indonesia increased by 16.1% from 3.1 million in tons 2012 to 3.6 million tons in in the following year. (GPPU, 2013)

The intensity of competition has pushed company to innovate and improve its business process and performance. The successfulness of a company can be viewed from the achievement of the strategic objectives of a company while maintaining the business processes running smoothly or vice versa. One of the competitive fodder producers in Indonesia is PT. Charoen Pokphand Indonesia, Tbk. This company can be called superior due to the number of feed sales of 16.047.021 (in millions) in 2012 and it is increased to 18,651,805 in 2013 compared to the other fodder industry competitors (Pokphand, 2013). It means that they can increase sales of fodder reached to 16.23%.

Produk Products	Nilai Penjualan Sales Value		Proporsi Penjualan Proportion of Sales		% Peningkatan (Penurunan) Increase (Decrease)
	2013	2012	2013	2012	
Pakan Ternak Feed	18.651.805	16.047.021	72,68%	75,30%	16,23%
Anak Ayam Usia Sehari DOC	3.868.560	3.116.761	15,07%	14,63%	24,12%
Daging Ayam Olahan Processed Chicken	2.312.072	1.898.367	9,01%	8,91%	21,79%
Lain-lain Others	830.555	248.776	3,24%	1,17%	233,86%
Jumlah Total	25.662.992	21.310.925	100,00%	100,00%	20,42%

Figure 1.3 Charoen Pokphand Sales Summary

Source: Annual Report PT. Charoen Pokphand Indonesia, Tbk.

The activities that are carried out in the business process should be well maintained in order to respond the customer needs. The existing customer should be maintained and enhanced. PT Charoen Pokphand Tbk, Krian should continue to make innovations and improvements of its business processes and performances to sustain their competitive advantages.

There are three main products produced by this company such as, Fodder, DOC (Day Old Chick), and Processed Chicken (Nugget, Sausage, and etc). Between those products that has some problems on the business process is producing fodder. Uncertainty condition may disturb the business process to be run well. One of department that will bring a lot of uncertainty conditions is Production Department. Production Department is the department which focuses on the manufacture of fodder production process, where this department will bring a lot of uncertainties that will occur on the production floor. These uncertainties may block the company in achieving the strategy objectives.

The failure of the business objectives may be caused by various causes in the activities of the business processes that are running. The cause of the activities carried on business processes is a risk that the possibility of failure in the business objectives can be due to various causes in the activities of the business processes that are running. (Monahan, 2008). So the company needs risk management process in order to business processes can run well in dealing with the company's goals.

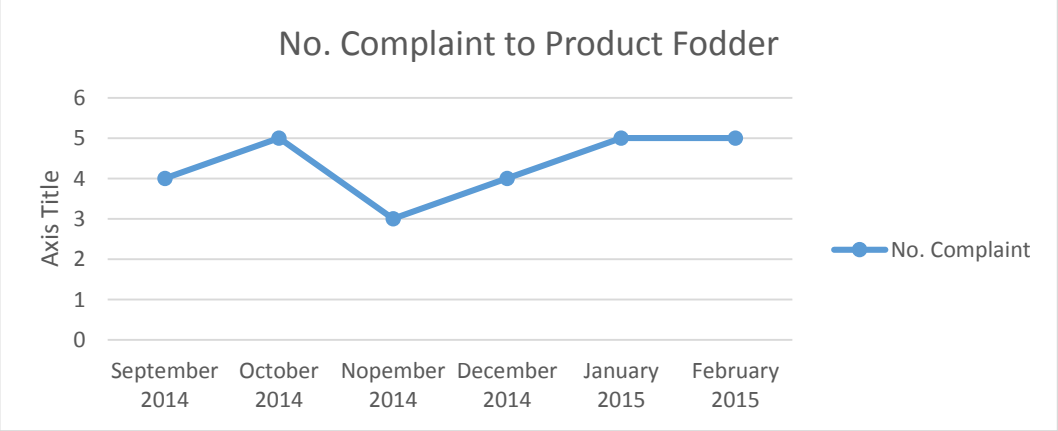

Figure 1.4 Number of customer's complaint to Fodder product (Company Data, 2015)

Currently, the existing condition in this company, they do not yet fully implement risk management. Actually, they already have a risk data generally. Some examples are the work accidents, the number customer complaint still higher,

and weather factors. Based on Table 1.4, the number of complaints of animal feed products in PT Charoen Pokphand in the last 6 months shows that the numbers are still high. This may be caused by several factors, one of them is the volume of some products which are delivered to consumers are not appropriate with the volume stated in the packaging. All the things that can interfere the success of the business objectives can be considered as a risk. But until now they do not have the data risks in detail. So it is necessary for doing research related to operational risk management for the operation of fodder production.

Institute of Risk Management (IRM), et al (2002) stated that the risk management not only identify and assess the risks but also the need to analyze and mitigate risks in order to reduce the possibility of an impact. Besides, the study of environmental risks that exist only assess the consequence (impact) with a variety of criteria, whereas Bramanti (2007) revealed that assess risks also need to consider the likelihood (probability) of risk events. Once known consequence and likelihood of each risk, risk analysis required by using the Root Cause Analysis in order to can be known root causes of risk. The results of this analysis can be used as a reference for risk mitigation. Therefore this study conduct environmental risk management by identify and assess the impact and probability of risk as well as to analyze and mitigate the risk.

From the description above shows a lot of criteria should be considered in assessing risk, it shows every possible risks need to be assessed massive impact with some criteria so that it makes decision-making to determine which risks need to be mitigated preferred. Fuzzy logic can help the environmental to do risk assessment more accurate. Therefore this study uses fuzzy logic to assess the impact. The more accurate assessment of environmental impacts, the environmental risks can be mitigated better, so that the protection the environment from human activities that destroy can be improved.

Therefore, this research will identify risks that may arise from each activity in PT. Charoen Pokphand Indonesia, Tbk's business process. The identification is done by the Fuzzy Logic approaches. This approach risk assessment enables qualitative risk assessment descriptions to be modelled mathematically. Linguistic terms such as high probability, minor impact or low risk cannot be defined

meaningfully with a precise single value. Fuzzy set theory provides a means by which these terms may be formally defined in mathematical logic (Chan, 2013). The next step is mapping the risk and mitigation measures to minimize the occurrence of failures in the activities that occur in business processes in the PT. Charoen Pokphand Indonesia. In order to allow a user to monitor risks occur, this research provides the output of the risk profile dashboard using Excel macros (visual basic). So, by using the output of this research the company is expected to minimize the existence of risks that occur in business processes PT. Charoen Pokphand Indonesia, Tbk.

1.2 Problem Identification

Based on the background that has been done, the formulation of the problems to be solved in this final project are:

1. How to develop risk profile based on business processes of PT. Charoen Pokphand Indonesia Tbk – branch of Krian, Sidoarjo.
2. How to develop the risk assessment method on the identified risk event.
3. How to evaluate the risks and mitigation process on the identified risk event.

1.3 Research Objective

The research objectives of this final project are:

1. Risk identifying and assessment of the failure causes of a business process in business processes PT. Charoen Pokphand Indonesia, Tbk by using Fuzzy FMEA Analysis.
2. Determining risk mitigations causing the failure of PT. Charoen Pokphand Indonesia, Tbk's business processes.
3. Designing company risk profile dashboard by using Macro Excel of PT. Charoen Pokphand, Tbk.

1.4 Research Benefits

The research benefits of this final project are:

1. Can be as a business process evaluation consideration on PT. Charoen Pokphand Indonesia, Tbk.

2. Help the company to identify the cause of the failure risk based on business processes.
3. Suggest the company regarding risk mitigation of failure of business processes.

1.5 Research Scope

The limitations of this research are:

1. This research is conducted on fodder production at PT. Charoen Pokphand Indonesia, Tbk.
2. This research is conducted on production department of fodder production.
3. In this research, business process that will be focused on identifying risks starts from receiving raw material of fodders from supplier until becoming finished goods and ready to distribute to distributors.
4. The identified risk is the risk that is generated on each activities carried out by performers of business processes.

The assumptions of this research are:

1. In this research weather factor is not used to identify the risk.
2. There were no changes the policies established in Charoen Pokphand Indonesia during doing the research.

1.6 Writing Systematic

This sub-chapter gives the whole writing systematic process of the research. The writing systematic that is used by the writer consists of:

CHAPTER 1: INTRODUCTION

This chapter explains the research background, problem identification, research objectives, research benefits, research scopes, and writing systemic of this research.

CHAPTER 2: LITERATURE REVIEW

This chapter contains theoretical and conceptual literatures which are used as the thinking framework for this research.

CHAPTER 3: RESEARCH METHODOLOGY

This chapter contains an overview and description of the structured framework or plot and systematic way of doing this research.

CHAPTER 4: DATA COLLECTION AND PROCESSING

This chapter explains how data will be collected and how it will be processed with some approaches which are already determined before. The result of the data processing data will be analyzed later in the next chapter.

CHAPTER 5: DATA ANALYSIS AND INTERPRETATION

This chapter contains the analysis and interpretation of the results data collecting and processing which is done in the previous chapter.

CHAPTER 6: CONCLUSION AND RECOMMENDATION

This chapter contains the results obtained from implementation of the conclusion of this research. The conclusion contains information that the research goals have been set previously. In addition, this chapter also contains suggestions for improvement regarding the company and for development of further research.

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CHAPTER 2
LITERATURE REVIEW

In this chapter is described the literature theory related to the Final Project. The theory that will be explained, includes Company Profile, Business Process, Risk, Enterprise Risk Management, Risk Management ISO 31000 Model, Fuzzy Logic Approach Analysis, Validity Test, Risk Mapping, and Risk Mitigation.

2.1 Business Process

A business process consists of a set of activities that are performed in coordination in an organizational and technical environment. These activities jointly realize a business goal. Each business process is enacted by a single organization, but it may interact with business processes performed by other organizations. (Weske, 2007). The process consists of a set of activities performed in a coordinated manner. The coordination between the activities is achieved by an explicit process representation using execution constraints. The process starts with the company receiving an order, followed by activities in concurrent branches. In one branch, the invoice is sent and the payment is received; in the other branch, the products are shipped. When both branches complete their activities, the order is archived, and the business process terminates.

Based on Harrington (1991) defines a process as a transformation of inputs into outputs where inputs can be either resources or requirements, while the output can be either the product or the results. The resulting output can be a value-added and also can be inputted to the next process. Based on several understanding of the process of the above, business process is defined as a group of related work that uses the resources of the company to produce an output to support the company's goals (Tinnilä, 1995). The alignment between corporate strategies must be able to address the problems and needs of the business processes that are at the level below which is designed so that any decision can provide added value to the improvement of business processes.

2.2 Risk

Risk is considered to have a double meaning that the risk to the positive effects and risks with negative effect (Hillson, 2001). Although the terms risk and uncertainty are often used interchangeably, they are not the same. Risk is defined as the "cumulative effect of the probability of uncertain occurrences that may positively or negatively affect project objectives" (Ward 2000). The traditional view says that risk is a situation where an event may happen, and the frequency of occurrence can be evaluated based on a probability distribution of past occurrences or environmental considerations.

Determining risk in this manner requires using some judgment. For example, although an event may have a low likelihood of occurring, the consequences, if it does occur, can be catastrophic. The nature of any given risk is composed of three fundamental elements: the event, the probability (likelihood), and the severity (or impact). Likelihood is the possibility of a risk will arise, usually used historical data to estimate the possibility. Calculation possibilities or opportunities that will be used is the frequency. Consequence is a result of an event that is usually expressed as the loss of an event or risk.

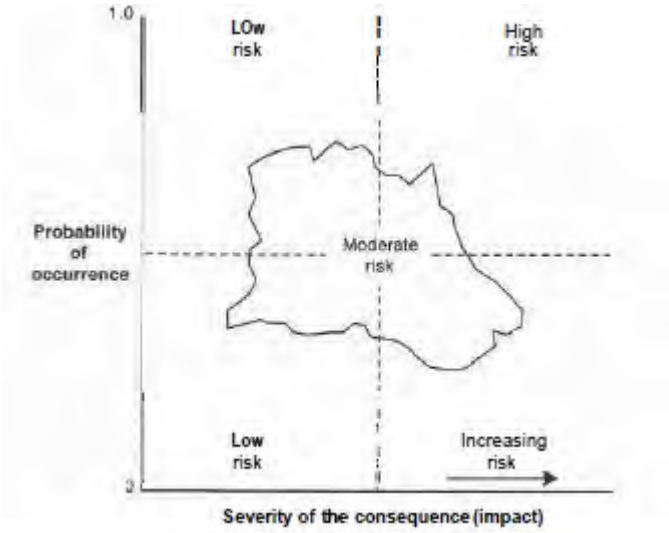


Figure 2.1 Concept of Risk (Pritchard, 2001)

Once the probability must be considered when risk event has been defined. Statistical data and probability theory play important roles in determining this variable. The remaining issue is the severity of the consequence if the event occurs. Again, statistics and probability help determine the degree of impact after it is

identified. Then these factors are evaluated to establish the relative level of risk associated with any given risk event. Quantitatively, risk can be stated as follows.

$Risk = Likelihood\ x\ Consequences$……..(2.1)

Based on Anityasari (2011) explains that the risks covered by the company can be grouped into four. Those are Financial Risk, Operational Risk, Strategic Risk, and External Risk.

a. Financial Risk

Financial risk covers some risk as follows:

1. Financial Risk is fluctuations in financial targets or manometer size of the company because of the turmoil of various macro variables.
2. Liquidity Risk is uncertainty or the possibility that the company cannot meet short-term payment obligations or unexpected expenses.
3. Credit Risk is the risk that a borrower or buyer credit cannot pay debt and obligations as set out in the agreement.
4. Market Risk is related with the storage potential financial results for movements in market variables during the period of liquidation and the company must regularly make adjustments to the market (mark to market). Market risk can be classified become four kinds, namely: Interest Rate Risk, Exchange Rate Risk, Commodity Risk, and Equity Risk.
5. Capital Risk is risks faced by the company in the form of possibility cannot cover the losses.

b. Operational Risk

Potential deviations from expected results due to a system malfunction, human, or other technical factors. Operational risk can be classified as five risks, namely:

1. Productivity Risk related to the deviation results or desired level of productivity for the deviation of the variables that affect productivity, including the technology, equipment, material, and human resources.
2. Technology Risk is potential deviation results due the technology used does not match the condition.

3. Innovation Risk is potential deviation results due the renewal, modernization, or transformation in several aspects of the business.
4. System Risk is part of process risk of deviation results due to defects or nonconformities in the company's operating system.

c. Strategic Risk

Strategic risks are risks that could affect the exposure of corporate and strategic exposure as a result of strategic decisions which are not in accordance with the external and internal environment of business. Strategic risk could be classified into three kinds of risk, namely:

1. Business Risk is potential deviation results corporate (enterprise value and shareholder) and the financial results due the company to enter into a particular business environment with typical industry and use certain technologies.
2. Strategic Transaction Risk is deviation potential corporate and strategic outcomes as a result of the company strategic transactions.
3. Investor Relationship Risk is risk that related to potential deviations result from financial exposure due to imperfections in developing relationships with investors, both shareholders and creditors.

d. Externality Risk

Externality risk is the potential deviation results in exposure to corporate and strategic impact on the potential closure of the business due to the influence of external factors. Externality risk can be classified into four kinds, namely:

1. Reputation Risk is potential loss or destruction of the company's reputation as a low acceptance of the external environment, even missing.
2. Environment Risk is potential deviation results even potential closure of the company because the company's inability to manage pollution and its impact posed in managing pollution and the impact caused by company.
3. Social Risk is potential deviation results because companies are not familiar with the environment in which the company is located.

4. Law Risk is deviations possibility due to the company does not comply with applicable regulations

2.3 Risk Management

Risk management is a process to determine, analyze and control the risks in any activity aimed at the company's activities or applied for to the higher management effectiveness in dealing with potential opportunities and losses arising (ISO 31000, 2009). Risk management is not new and has been part of the management activities required. The objective of risk management is an invaluable tool for the company to achieve its goals through the allocation of resources for planning, decision-making and carrying out productive activities.

In some organizations, risk management is sufficiently well entrenched that there are standard forms and formats for risk management plans. Organizational risk practices should be distilled to a methodology specific to the project. Such a methodology may include a variety of types of information, but at a minimum, should include the frequency of risk reviews, tools to be deployed, and a list of valid resources for project risk data (Pritchard, 2001).

2.4 Risk Management Model (ISO 31000, 2009)

International Organization for Standardization (ISO) is a worldwide federation of national standards bodies. ISO 31000 was prepared by a working group of ISO Technical Management Board on risk management. In the guidelines explained that the ISO 31000 standard can be used by any company public, private or public, association, group or individual. Therefore, ISO is not specific to any industry or sector. The guidelines also provide that the specifications of ISO 31000 that can be applied throughout the life of the organization, and a variety of activities, including strategies and decisions, operations, processes, functions, projects, products, services, and assets.

This standard is used to align the existing risk management processes and future standards as it provides a common approach to supporting standards relating to specific risks or sectors, and does not replace the standard. Described by Purwanti (2009) that ISO 31000 is applied in all organizations, all kinds of risks without exception and in all the countries. Contents of ISO 31000 includes definitions,

principles, risk management framework, risk management processes and attributes of excellence in risk management. The process of risk management in ISO 31000 is equal to the risk management process in AS / NZS 4360: 2004, as well as the definitions and risk management diagram.

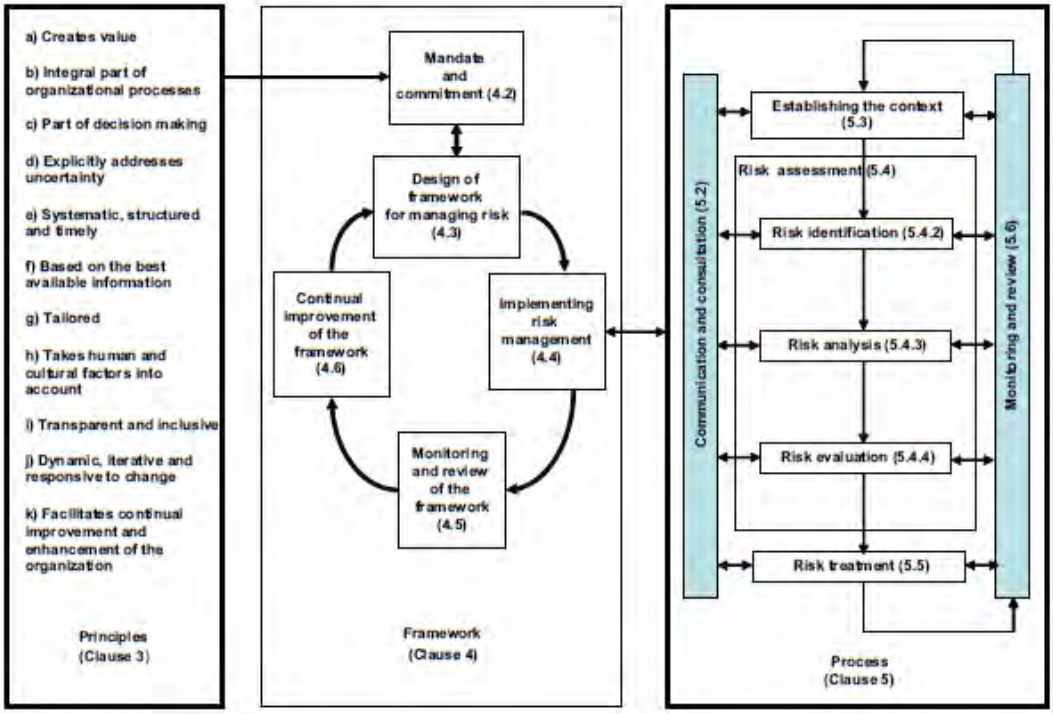


Figure 2.2 ISO 31000, 2009 Framework (ISO 31000, 2009)

Based on Figure 2.2 above, it can be said that the framework used in the ISO 31000 risk management is same as AS / NZS 4360: 2004. ISO 31000 as the latest new framework published in 2009. ISO 31000 is an improved version of AS / NZS 4360: 2004 which includes the existence of a feedback loop and monitor continuously, also for communication and consultation, in addition there is also the stage at which the decision-makers and analysts do early initiation called "context", the application of criteria regarding risk as to what will be analyzed first defined, and separates between acceptable risk and not, as well as provide treatment options for unacceptable risks.

Here is a brief explanation of the steps in implementing risk management according to ISO 31000.

1. Determination of the scope

   At this stage, the determination of the scope of the organization, the organization's relationship with the external and internal environment, objectives and strategies of the organization. Then define the scope of the object of risk management that includes targets, goals, strategies, and activities of the organization so that the parameters of risk management processes can run more focused and targeted. In general, the determination of the scope of this contains a description of the company observed, the products and services produced by the company, the critical factors in the environment that are participating

2. Establish the context

   Conducted determination of the organization's relationship with the external and internal environment, risk management scope, objectives, and strategies of the organization. Then set the object scope of risk management that includes targets, goals, strategies, and organizational activities of the parameters so that the risk management process can run more focused and targeted. In general, the determination of the scope of this contains a description of the company observed, the products / services produced by the company, the critical factors that would exist in an environment that contributed to the company, the company stakeholders, as well as risk evaluation criteria.

3. Risk Identification

   At this stage will be identified risks faced and how the risks that may occur. Risk identification can be done with a question where, why, and how events that may impede or affect the achievement of the objective. Risks can come from things such as: human behavior, technology and technical issues, occupational health and safety, legal, political, property, and equipment, environmental, financial / market, and natural events.

4. Risk Analysis

   This stage aims to separate the risk of major and minor risks. At this stage aims to prepare the data and prepare for the next stage of the

evaluation and management of risk. Analysis can take the form of qualitative, semi quantitative, and quantitative or a combination of all them. In some cases, more than one numeric value is used to specify Consequences for time, place, group or different situations. Likelihood is usually expressed in terms of probability, frequency, or a combination of both. Risk can be analyzed by using the assessments of opportunities for the consequences if it occurs. When the chance (likelihood) and impact (consequence) has been in the identification, evaluation and prioritize the most significant risk to be addressed first. To avoid subjective assessment of the likelihood and Consequences of determining value, use the best resources and competent tool.

Here is a technique that can be used for the determination of likelihood and consequences namely:

a. Structured interviews with experts on the object under investigation.
b. Evaluation of individuals with questioner.
c. Mathematical modeling, computer, etc.
d. Use the vault tree and event tree.

The analysis should consider the term of potential consequences and how it can happen. Risk can be analyzed using the opportunities and consequences in the event. When the chance (likelihood) and impact (Consequences) has been identified, then the evaluation and prioritize the most significant risks to be addressed first. Likelihood used in Table 2.1 as follows.

Table 2.1 Likelihood Information

Likelihood	Possibility of Occurrence
Rare	Possibility to happen less than 5%
Unlikely	Possibility to happen between 5% - 25%
Possible	Possibility to happen between 25% - 50%
Likely	Possibility to happen between 50% - 75%
Almost Certain	Possibility to happen more than 75%

Meanwhile, the consequence being used can be seen in Table 2.2 as follows.

Table 2.2 Consequence Information

Consequence	Information
Insignificant	Low financial loss, no accident
Minor	Medium financial loss, need first aid treatment
Moderate	High financial loss, need medical treatment
Major	Higher financial loss, production capability loss, get serious injured
Catastrophic	The highest financial loss, causing the death

5. Risk Evaluation

   At this stage, the comparison between the levels of risk are expected to occur with the establishment of the previous criteria. Results of the evaluation of risk is a list of priority for further action. In evaluating risks also need to consider the purpose of the organization and the opportunities that may arise. If there is in the category of low risk, then the risk is acceptable and handled optimally. This allows decisions to be made wide enough and nature of treatment necessary and sufficient priority. Results of the evaluation of risk is a list of priority for further action. In evaluating risk, it also needs to consider the purpose of the organization and the opportunities that may arise. If there is in the category of low risk, then the risk is acceptable and handled by means of a minimum.

6. Risk Treatment

   At this stage will be conducted to determine the measures to be undertaken to address the risks identified. Some options may be done for risk control according to ISO 13000 namely:

   a. Avoid risk (avoid)
   b. Accept risk (accept)

c. Transfer risk (transfer)

d. Reducing opportunities or impacts that occur (mitigate)

7. Risk Monitor and Review

   This stage is necessary to monitor the effectiveness at each stage of the risk management process. It is necessary for continuous improvement. Risks and effectiveness measurement should be monitored for changes in circumstances ensured not change the priority. At each stage should be documented so that it can be used as a further improvement.

2.5 Fault Tree Analysis

Fault tree analysis is a systematic safety analysis tool that proceeds deductively from the occurrence of an undesired event (accident) to the identification of the root causes of that event. Fault tree analysis starts with a ‘‘top event’’ that generally display with rectangular and related events based on logical relations with the top event that are drown below, branching downward as in a tree.

In most cases, the top event is chosen based on its criticality. In addition, intermediate events based on the reasons for their occurrence are divided into the following branches. The analysis continues at each level, until basic causes or the analysis boundary conditions are reached. Branches of failure that require no further development are known as basic event, which are shown with a circle. If the failure data is not available, they event is called an ‘‘undeveloped event’’ and a diamond symbol is used to represent it. These events reflect the initial conditions, which are cause the main accident. Also a triangle symbol is used to show ‘‘transfer’’ in FTA which indicates the tree is developed further at other trees.

Six basic steps used to develop a fault tree analysis:

I. System configuration understanding.

II. Logic model generation.

III. Qualitative evaluation of the logic model.

IV. Equipment failure analysis and obtain basic data.

V. Quantitative evaluation of the logic model.

VI. Recommended appropriate corrective actions.

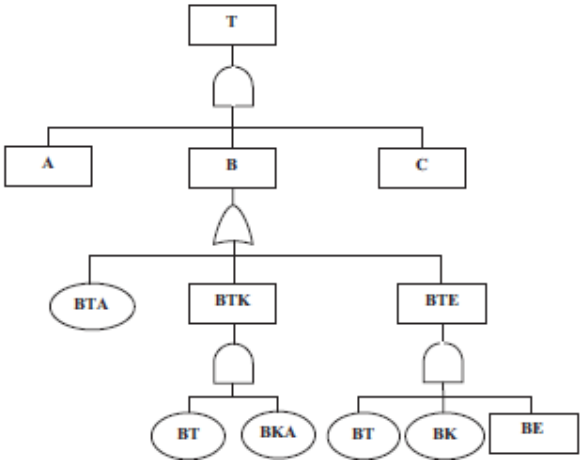


Figure 2.3 Fault Tree Diagram

The fault tree is constructed by using several symbols that represent various events and describe relationships. In the following, we only explain the ones used in the context of this study. AND gate is used when the output event will occur only if all of the input events exist simultaneously. OR gate is used when the event will occur if only one or any combination of the input events exists. Rectangle and circle are two symbols used to represent different types of events. A rectangle represents a negative main event that can be broken down into further input events. It can be located anywhere in the tree. It is only the rectangle that can have a logic gate and input events. A circle represents a base event in the tree and is found at the bottom tiers of the tree. A base event is not broken down into further events.

2.6 Fuzzy Logic Analysis

Fuzzy set theory is a mathematical framework that is used to represent uncertainty, vagueness, inaccuracy, lack of information, and partial truth (Tettamanzi, 2001). Lack of information in solving the problems often encountered in various fields of life. Ambiguity can also be used to describe something that relate to uncertainties given in the form of linguistic information or intuition.

There are several reasons why people use fuzzy logic, among others:

1. The concept of fuzzy logic is easy to understand.
2. Fuzzy logic is very flexible.
3. Fuzzy logic can tolerate data imprecise.
4. Fuzzy logic is able to model nonlinear functions are very complex.

5. Fuzzy logic can work with the techniques of conventional control.

According to Pedrycz, Ekel, and Parreiras (2011), the fuzzy set theory, designed by Zadeh (1965), is one of the most fundamental concepts of science and engineering, because it can manage inaccurate information by manipulating mathematical terms. The concept of a fuzzy set manages the representation of classes/categories that has boundaries that are ill-defined or flexible by means of characteristic functions taking values in an ordered set of membership values (Dubois & Prade, 1998).

Therefore, fuzzy set A is, by definition, the membership function that maps the elements of the universe X to the unit interval [0, 1], as follows (Zadeh, 1975):

$A : X \rightarrow [0, 1]$ ……(2)

A fuzzy set A in X is therefore characterized by a membership function $f_A(x)$, which associates each point X with a real number in the interval [0, 1] with a value of $f_A(x)$ representing the association level of x with the set A. Therefore, the closer to one the value of $f_A(x)$ is assumed to be, the greater the membership of the element x is to the set A.

The main contribution of fuzzy logic is a methodology for computing with words, which is a necessity when the available information is too imprecise to justify the use of numbers and is useful when there is a tolerance for imprecision that can be exploited to achieve tractability, robustness, a low solution cost, and a better rapport with reality. For the reasons presented, the use of fuzzy theory and, more precisely, the use of linguistic variables can be justified.

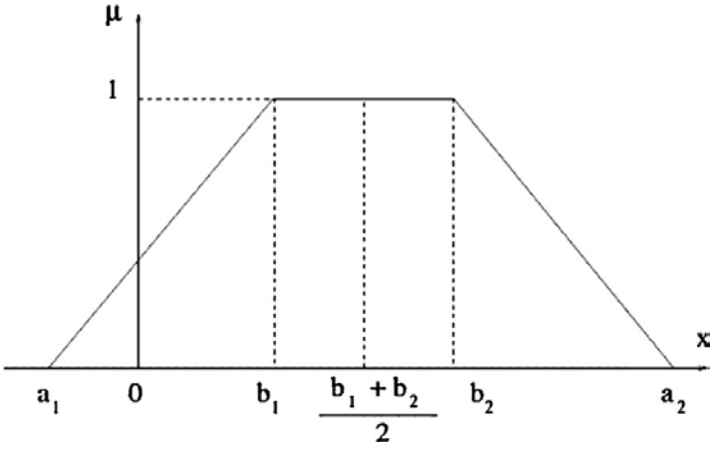


Figure 2.4 Trapezoidal Fuzzy Number (Silva et all, 2014)

This step determines the RP fuzzy number for each failure mode using the trapezoidal fuzzy numbers that were used to evaluate the failure modes regarding the risk factors: occurrence, severity, and detection. Let O_{ij}, S_{ij}, and D_{ij} be the trapezoidal fuzzy numbers that represent the occurrence, severity, and detection evaluations for dimension i and failure mode j. Then, the RP fuzzy number is the product of these risk factors:

RP fuzzy number$_{ij}$ = $O_{ij} \otimes S_{ij} \otimes D_{ij}$ ……...…….(3)

It can now calculate the total RP fuzzy numbers for the dimensions to compare and rank them with respect to the risks. They are evaluated by the expert for dimension I and failure mode j, with respect to economic and operational consequences. Finally, let I_{ij} be the influence (or impact) of each failure mode j on each dimension$_i$. Here is the linguistics scale and trapezoidal fuzzy numbers for evaluation of performance and impact.

Table 2.3 Fuzzy Scale Risk Assessment

Likelihood	**Impact**
Very Low (VL): (0;0;1.5;2)	Absolutely little influence (LI): (0;0;0.15;0.2)
Low (L): (1.5;2;3.5;4)	Little influence (LI): (0.15;0.2;0.35;0.4)
Moderate (M): (3.5;4;5.5;6)	Moderate influence (MI): (0.35;0.4;0.55;0.6)
High (H): (5.5;6;7.5;8)	Influential (I): (0.55;0.6;0.75;0.8)
Very High (VH): (7.5;8;9.5;10)	Very Influential

There are some steps to conduct fuzzy logic for doing this research. The first step of the approach consists of expert identification. The expert is the person who knows the enterprise systems and their vulnerabilities. This step could also identify a group of experts and accomplish the analysis by considering their judgment. The second next step is determining and evaluating of potential failure modes, then next step is determining the RP fuzzy number, then next step is evaluating dimension, and then next step is dimension ordering.

2.7 Validity Test

Validity performs after the calculation of the RPN (Risk Priority Number). Validity test is a statistical test used to determine how valid a question items measuring variables studied. Here is an explanation of validity test.

According to Sekaran (2003), quoted in Reza (2010) is test that shows how well the instruments used to collect data that will be assessed. Some types of test validity expressed by Sekaran (2003) among others as follows.

- Content Validity aims to ensure that the items used have questions represent the basic concepts of research (Sekaran, 2013). Validity contents test subjective done with the help of expert. Content validity indicates the extent to which the items in the test can cover the entire area of the contents that will be measured by those tests. To determine the validity of the contents can be done by looking at whether the items in accordance with the test has been dropped into the blue print where the purpose is in accordance with the domain boundary was determined and in accordance with the size of the behavioral indicators described.
- Construct Validity aims to ensure compatibility between the theoretical researches instruments that has been used. Pearson correlation can be used to test the construct validity (Sekaran, 2013). Construct validity is the validity of which shows the extent to which a test measures trait or theoretical constructs to be measured. Construct validity testing can be done with the statistical analysis, such as factor (Anwar, 1996).

2.8 Risk Mapping

Risk Mapping is a diagram of a risk evaluation based on the results of the calculation of severity and occurrence. The purpose of risk mapping is to prevent inefficiency or increase the risk. Risk Mapping provides some grading scale alternatives in prioritizing potential risk. This matrix displays occurrence or likelihood scale vertical and horizontal shows impact or consequences scale. Risk mapping consists of x-axis and y-axis. X-axis shows the likelihood or probability to happen of each risk factor. And Y-axis shows the consequences or impact that

will be occurred. The limits contained in the matrix to identify high priority, medium and low.

The level of risk can be classified as extreme, high, moderate, and low risk. The level of risk and treatment measurement can be seen in Table 2.4 as follows.

Table 2.4 Risk Rating (Anityasari & Wessiani, 2011)

Risk Rating	Treatment Action
Extreme Risk	Need fast treatment
High Risk	Need treatment from senior management
Moderate Risk	Management responsibilities should be set
Low Risk	Managed by routine procedures

Based on Table 2.4, there are some treatments that have to be done. For example, when certain risk is classified as extreme risk, the management should do fast treatment based on the company regulation. Then those risk rating can be known from risk map. It can be searched from a meeting between likelihood and consequence of a risk on the risk map as shown in Figure 2.3 below.

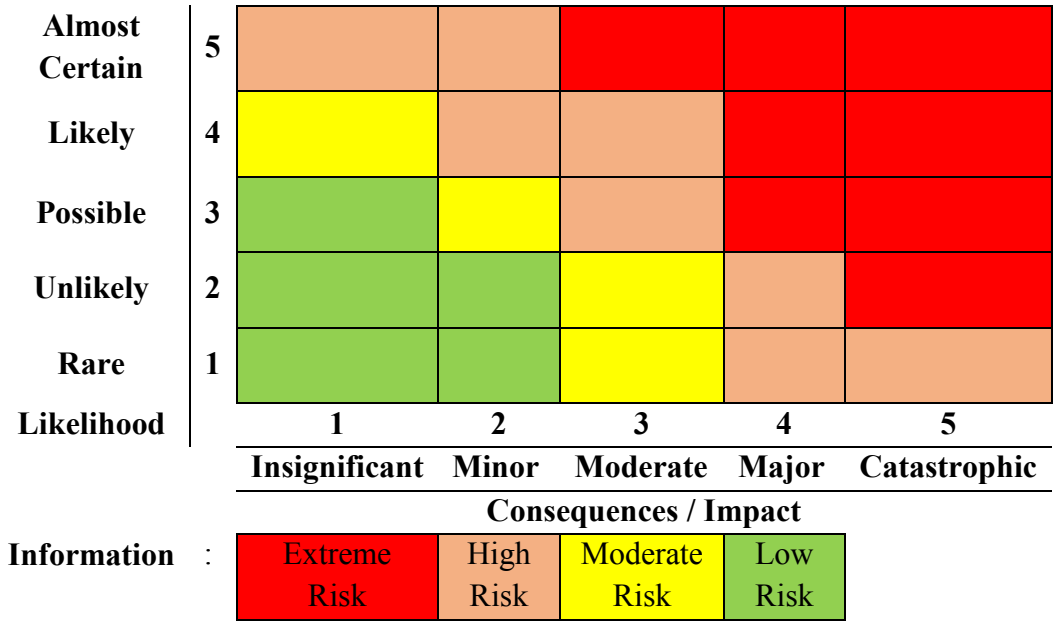


Figure 2.5 Risk Map (Anityasari & Wessiani, 2011)

Figure 2.5 shows the risk classification based on matrix between likelihood and consequences. For example risk A has likelihood score is four and also has consequence score is four, then that risk can be classified as extreme risk.

2.9 Risk Mitigation

Mitigation processes are some of the actions that should be taken prior to the occurrence of a risk reduction plan in order to use a system of integrated sustainable development (Haifani, 2006). In this study, the determination of the mitigation plan aims to reduce the impact of the risks and precautions to reduce the probability of risk. Each risk has a different treatment. According to (Hasan, 2010), there are 5 types of treatment on the risk, ie.

- Avoid
- Transfer
- Mitigate
- Accept

The treatment is the determination of risk mitigation plans are carried out based on the priority risk. For example, for those risks that include in extreme risk, they will get mitigate treatment from company in order to the impact of extreme risk can be reduced. Risk mitigation plan is based current control or attempt to prevent or detect the occurrence of risk. So the risk mitigation plan is expected to reduce the possibility or even eliminate the possibility of occurrence of the risks of and the impact of those risks. Ideally, the determination of the mitigation plan will be carried out on the results of risk mapping with high and medium category in which to do corrective action on the part.

2.10 Risk Monitoring

It is important to perform continuous improvement and do not change the priority. At each stage should be documented so that it can be used as a further improvement. Both monitoring and review should be a planned part of the risk management process and involve regular checking or surveillance. It can be periodic. The company will probably make dashboard to monitor risk management process. The organization's monitoring and review processes should encompass all aspects of the risk management process for the purposes of:

- Ensuring that controls are effective and efficient in both design and operation.
- Obtaining further information to improve risk assessment.

- Analyzing and learning lessons from events, changes, trends, successes, and failures.
- Detecting changes in the external and internal context, including changes to risk criteria and the risk itself which can require revision of risk treatments and priorities.
- Identifying emerging risks.

2.11 Previous Research

The research related to business processes and risk management has been done by some researcher. But, there is no research that has the same assessment method with the research that will be done. Several researches have the same topic but different assessment method. Mostly they are using FMEA method for risk assessment. But this research, the assessment method that will be used by using Fuzzy Logic Trapezoidal Number.

The nearest research that has the same topic which is risk management in a company is conducted by (Utami, 2014). It has a similar research approach that is identifying risk factors from business processes. And it analyzes business processes on GRAPARI Surabaya. But her risk assessment method is using FMEA. It is different with this research. Its risk assessment method used by the author using Fuzzy Logic. Here are the other relevant researches that has same approach with this final project.

Table 2.5 Previous Research

No	Author	Year	Category	Methods	Discussion Topics					
					Business process	FTA Analysis	Risk Management	Risk Mapping	Risk Mitigation	Dashboard
1	Kristika Dewanti	2010	Final Project	Risk Management AS/NZS 4360	V		V	V		V
2	Aghni Mayvinna	2010	Final Project	Value At Risk			V	V	V	
3	Heidy Anggraini	2012	Final Project	Severity Index and Probability Impact Grid			V	V	V	
4	Nurul Rizki Utami	2014	Final Project	FMECA	V	V	V	V	V	V
5	Satria Oktaufanus S	2015	Final Project	Fuzzy FMEA	V	V	V	V	V	V

CHAPTER 3
RESEARCH METHODOLOGY

This chapter will explain the stages of the undertaken in conducting research. Stages are contained in research methodology will be used as a guide in order to conduct research in a systematic and purposeful. So it can achieve the purpose of research. Overview of the research methods used are shown in Figure 3.1.

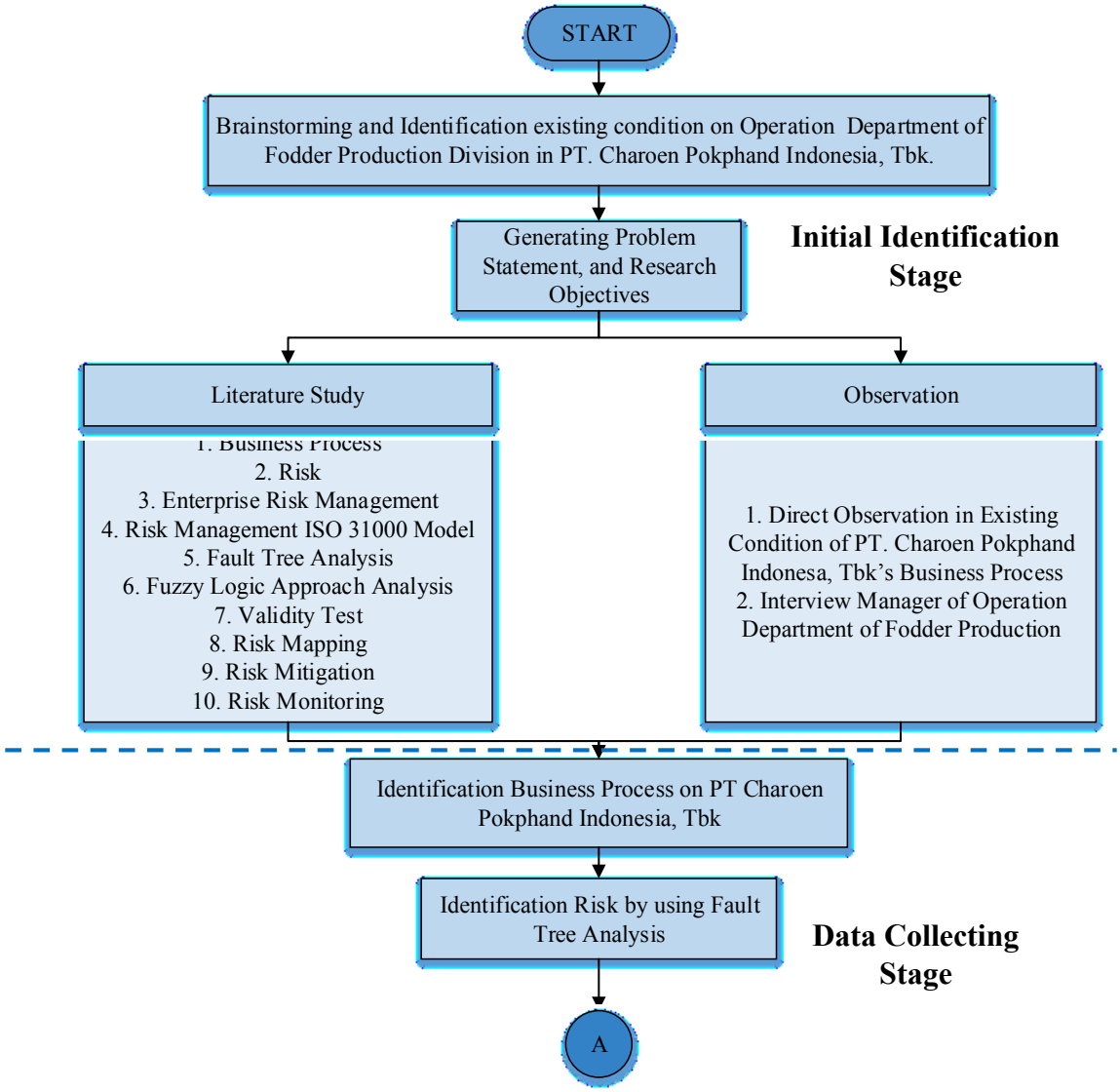


Figure 3.1 Research Methodology Flowchart

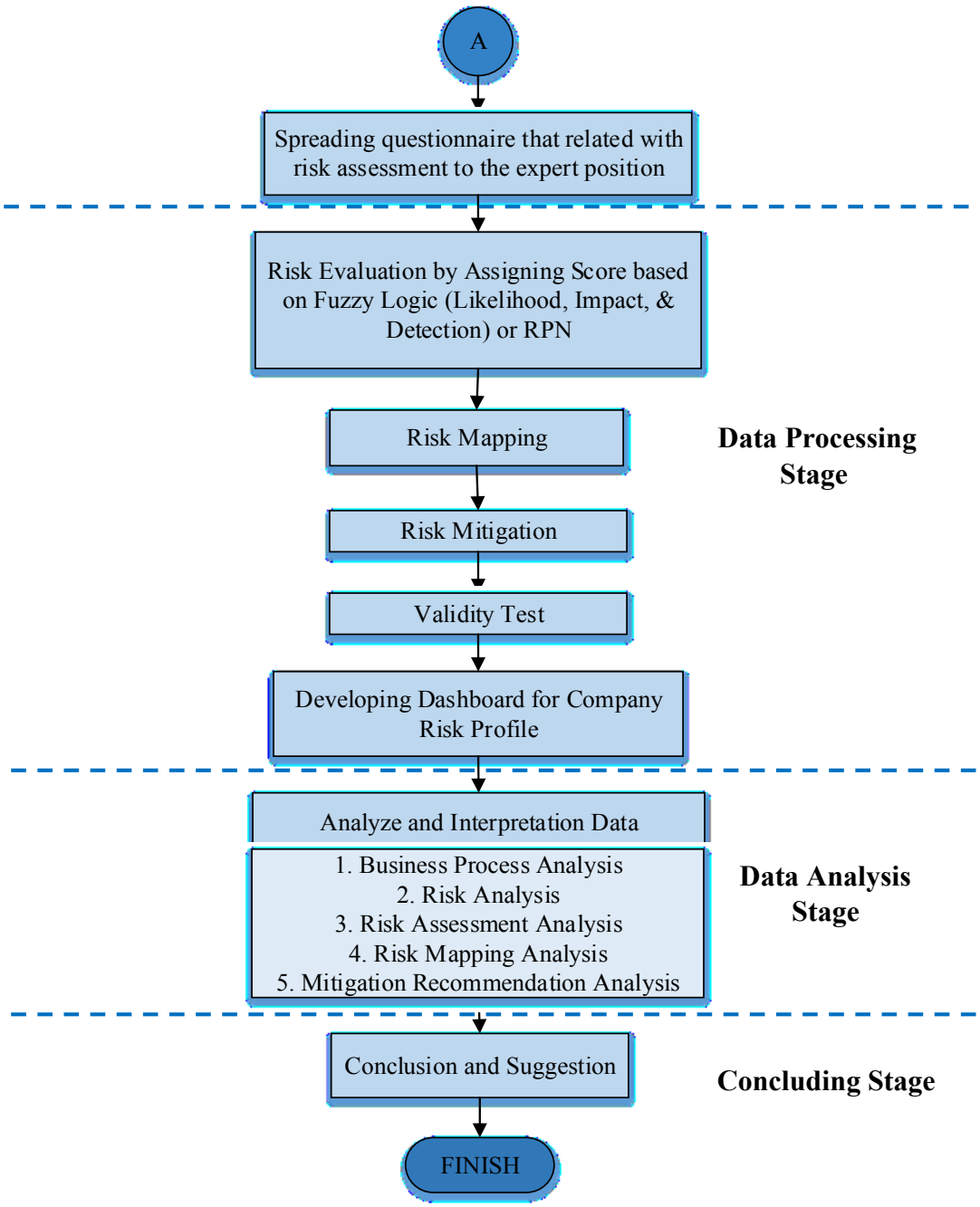


Figure 3.2 Research Methodology Flowchart (Continue)

3.1 Research Flowchart Description

This subchapter will explain about the research methodology flowchart description that consists of some steps of doing this research.

3.1.1 Initial Identification Stage

This step consists of identifying stage. This stage consists of brainstorming, generating problem description, and literature – field study.

3.1.1.1 Brainstorming and Identification Existing Condition on Operation Department Fodder Production

This step starts with brainstorming with Operation and Quality Assurance Manager of PT. Charoen Pokphand Indonesia, Tbk. That department as the party that understands and is responsible for the running of the business processes in the production of animal feed in PT Charoen Pokphand Krian Sidoarjo. Brainstorming is done by looking at the current condition of operation and quality assurance department which is the main focus on.

3.1.1.2 Problem Generation and Determining Research Purposes

After knowing the existing condition from those business process, the next step is formulating the problem. And subsequently determined research objectives of this study in order goes with having a clear direction.

3.1.1.3 Literature and Field Study

After determined the purpose of the research and the problems to be solved, it is conducted this study of existing conditions, through literature study, to learn the methods and theories that will be used in this study, namely business process, Risk, Risk Management, Risk Management Model of ISO 13000, Risk Mapping, FTA (Fault Tree Analysis), Fuzzy Logic. In this study, the method used in evaluating risk is Fuzzy Logic. Field studies conducted to study about condition of existing companies related to the strategic objectives and business processes fodder production PT Charoen Pokphand Krian, Sidoarjo. In addition, interviews were conducted with related parties implementing that company's business processes.

3.1.2 Data Collecting Stage

At this stage of data collection was done to reflect the condition of the Company. Here is the data that must be collected in order to analyze the condition of the Company.

3.1.2.1 Company's Business Process Identification

At the stage of identification Business Process PT. Charoen Pokphand Krian, it is done by making its business process mapping activity through direct observation and interviews with relevant stakeholders implementing business processes.

3.1.2.2 Risk Identification by Fault Tree Analysis (FTA)

At this stage it will be the identification of the cause the failure risk of each activity in a business process PT. Charoen Pokphand Krian, Sidoarjo. Which previously has been adapted to the strategic objectives department, performance indicators (KPI) of the existing, and expert judgment of the parties concerned. At this stage of risk identification, carried out by observation of business processes that occur during office hours. The risk occurs when a business process is not running as well that affect the objectives of the operation department itself.

3.1.2.3 Spreading Questionnaire to Expert

At this stage, it is required data which is coming from employee. The data is related to assessing risk score on each risks. The questionnaire contains some questions that related to how much the score of each impact and detection level of a risk. The questionnaire is needed in this methodology because to get the score of impact and detection is also require voice of employee.

3.1.3 Data Processing Stage

Based on the data that has been obtained previously, the next will be processing the data. Here are the steps performed on the data processing.

3.1.3.1 Risk Evaluation by Using Fuzzy Logic

At this stage, it will be evaluating the results of the previous stage of risk identification. Risk evaluation is done by using Fuzzy Logic. With this method, the risk is evaluated and classified by 4 points trapezoidal fuzzy numbers. So Likelihood, Impact, and Detection can be captured more accurately. From each of these criteria are identified based on the failure of the business process activities Pokphand. After the identification of each criteria, assessment through

questionnaires distributed to the parties concerned implementing the Pokphand business process.

3.1.3.2 Risk Mapping

At this stage, it will be mapping risk. Risk mapping process is done by plotting the severity and occurrence value first to the matrix and then do the mapping results of each. Based on the results of the risk mapping company can classify the risk into 4 level risk, namely extreme risk, high risk, medium risk and low risk.

3.1.3.3 Risk Mitigation

This stage is carried out by the Risk Priority determination by performing the calculation of the RPN (Risk Priority Number). RPN is calculated by multiplying the value of severity, occurrence and detection. After getting the RPN it will be evaluated in advance to determine the priority risks to be addressed. And also it requires to develop risk ranking table to classify risks. So it will be able to know the risks that must be addressed first and then given advance mitigation efforts. Because the likelihood is quite small and the effect of the occurrence of the risk is small. Each risk priority causes of risk mitigation action will be taken. Determination of the mitigation efforts is made by the concerned parties brainstorming implementing business processes and expert.

3.1.3.4 Validity test

At this stage, there will be validity test for questionnaire. The validity test is conducted to the expert. The expert will validate the questionnaire.

3.1.3.5 Risk Profile Dashboard Making by Using Macro Excel

At this stage, it will be making Dashboard risk profile based on the results of data processing carried out previously. The purpose of this dashboard is to make easily to manage and monitor the risks inherent in the implementation of business process PT Charoen Pokphand Krian, Sidoarjo.

3.1.4 Analysis and Interpretation Data Stage

At this stage there will be an analysis of the data processing which has been obtained previously. The analysis consists of description of risk assessment

analysis, risk mapping analysis, risk mitigation analysis, and risk profile dashboard analysis.

3.1.5 Concluding Stage

At this stage will be drawn conclusions and suggestions. Conclusions and suggestions are given to the analysis and interpretation of the results that have been defined previously. Conclusions are formulated to answer the purpose of research. And suggestions formulated a proposal for the company in the preparation of risk mapping of business processes that run the company in the company's operational risk mitigation efforts.

CHAPTER 4
DATA COLLECTING AND PROCESSING

This chapter will explain the data collection of observed objects at. Charoen Pokphand Indonesia Tbk which then will be processing the data that will be input in the execution of the next chapter.

4.1 Company Profile

This section will explain the company's history, vision, mission, organizational structure, work schedule, labor, product, production machinery and production processes.

4.1.1 Company History

PT. Charoen Pokphand was founded in 1972 in Jakarta as the first animal feed mill. This company is a manufacturer of animal feed, day-old chick, and the largest chicken processing in Indonesia. Currently the market share can be achieved business company founded by entrepreneurs from Thailand is more than 40% of market share in Indonesia. Every company will continue to grow and expand their business opportunities to face the challenges in the market, as well as PT. Charoen Pokphand, from a factory in Jakarta, then build more facilities in Balaraja (West Java), Semarang (Central Java), During and Krian (East Java), Bandar Lampung (Lampung), Medan (North Sumatra), and Makassar (South Sulawesi).

At the time when it was first established, the company's production capacity is only 20000 tons per year. Then, because of the demand for animal feed continues to increase, the company decide to build the facility in 1976.

In addition, the company is also dominant in producing and supplying day-old chick (DOC) in the form of laying hens and broilers with high quality for farmers in Indonesia. The company continues to develop its business to build facilities in Cikande (West Java) and Surabaya (East Java) in the manufacture or processing of chicken meat into food for the community such as nuggets, sausages, and other value-added.

4.1.2 Company's Vision and Mission

Here is the vision of PT. Charoen Pokphand Indonesia:

Vision : "To be the world class feed manufacturer"

Then there are three missions of PT. Charoen Pokphand Indonesia. Those are:

Mission :

1. To produce good quality at competitive cost.
2. To develop competent and dedicated team member.
3. To create healthy and safe environment for employee and community.

And also the company has some strategic values, those are:

Value :

1. Integrity.
2. Excellence.
3. Simplicity.
4. Boldness.
5. Humanity.
6. Fun.

4.1.3 Company's Structure Organization

Here is the Organizational Structure of Production Plant of poultry feed at PT. Charoen Pokphand Indonesia – branch of Sidoarjo.

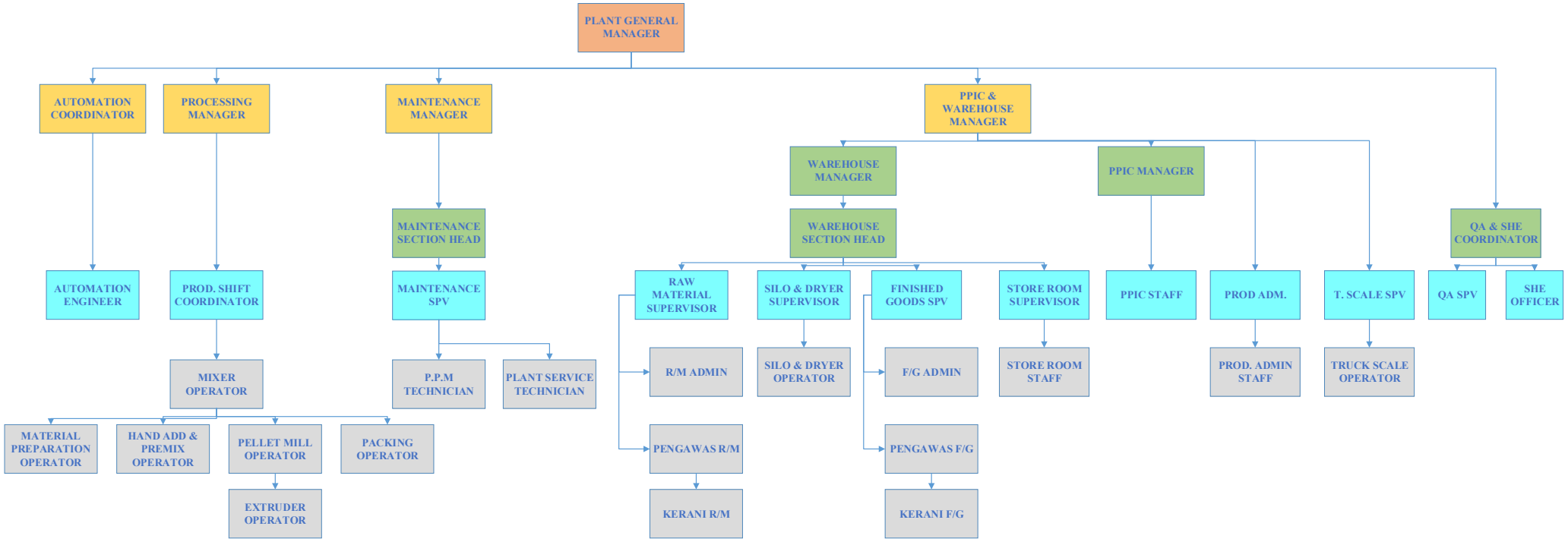


Figure 4.1 PT. Charoen Pokphand Organization Structure, Krian, Sidoarjo

4.1.4 Working Schedule

Working schedule at PT. Charoen Pokphand is divided into two parts based on the division of work, namely shift and non-shift. Shift work hours for workers who are directly related to the production process. While the non-shift working hours apply to employees relating to the management or that are not directly related to the production process.

1. Shift

   For shift work schedule is 6 days a week ie Monday to Saturday. Employees were divided into three teams based on hours of work. The first shift works from 07.00 till 16.00. Shift 2 starts to work at 16.00 to 24.00, while the third shift starts to work from 24.00 until 07:00. Because it is directly related to the production process, the employee shift schedule is 24 hours. If the production process is stopped for a moment it would result in substantial losses to be borne by the company. Because if the engine stops or dies briefly make work in process and it required big cost.

2. Non shift

   Non-shift employees are required to enter 5 days a week ie Monday to Friday with hours ranging 08.00 until 17.00.

4.1.5 Workforce

Workforce in PT. Charoen Pokphand is divided into three, namely labor monthly, daily labor, and labor contract. The total number of the existing workforce of about 528 people with the number of permanent employees 96 people, consisting of 5 women and 91 men. Permanent employees of PT Charoen Pokphand Krian, Sidoarjo is divided into 6 levels.

- Level 1: AVP (Assistant Vice President)
- Level 2: General Manager
- Level 3: Plant Manager
- Level 4: Supervisor
- Level 5: Senior Operator
- Level 6: Junior Operator

The number of workers at each level are shown in the table 4.1.

Table 4.1 Workforce Levelling

No	Workforce	Amount of Workforce
1	Level 1	1
2	Level 2	2
3	Level 3	5
4	Level 4	18
5	Level 5	56
6	Level 6	16
	Total	**98**

Recruitment at PT. Charoen Pokphand is done professionally through campuses to seek graduates who are still fresh graduate. The new employees will be trained for 3 months before work. From the results of the training will be obtained decision are new employees are accepted or rejected.

4.1.6 Product

The following will be discussed on the raw material, product type, and warehouse for materials and finished products.

4.1.6.1 Raw Material

The raw material is used to produce animal feed is divided into two, namely the main ingredient and supporting materials.

1. The main raw material is used in making animal feed is corn, soybean meal, wheat bran, and rice bran.
2. Raw material support is used in animal feed processing is meat bone meal, palm oil meal, corn gluten meal, fish meal, feather meal, cotton seed flour, groats, rock flour, rape seed meal, palm oil, and premix.

4.1.7 Machinery

Production machines is used by PT. Charoen Pokphand in making animal feed are as follows:

1. Intake Machine

   Intake engine is owned by PT. Charoen Pokphand Krian there are three that are located on raw materials. These machines are used to pour raw

material of lower ground to the storage cask or directly to the subsequent production process. Storage bins are located on the top floor so the engine intake and elevators as there are chain conveyor used to transfer material to a storage cask. The engine intake is operated by an operator whose job is to monitor the contents of the barrel and fill it with the necessary raw materials.

2. Chain Conveyor

   Chain conveyor is used to move raw materials or flat horizontal position.

3. Bucket Elevator

   The working principle is basically the same bucket elevators with chain conveyor. They differ only in the bucket elevators move material with vertical or upward position.

4. Screw Feeder

   Screw feeder is also a machine that is used to move the raw materials but only for the form of bulk material. Distance pitch screw can be adjusted to obtain the desired transport capacity.

5. Turn Head

   Turn head is a machine that is used to divide the raw material into a particular barrel. In the head turn two pipes, one large and one small. Large pipe has four doors that are connected to the intake barrel, barrel hammer mill, mixer barrel, and the barrel pallet.

6. Hopper

   Hopper is a temporary shelter before the material is transferred to the next process. Hopper found on each engine intake, hammer mill machine, mixer machine, pellet machine, and packing machine.

7. Hammer Mill

   Hammer mill is a grinding machine used to grind or smooth the rough shape of the raw material into powder or granules according to the shape of the feed.

8. Mixer

   Mixer machine is used to mix the raw materials in accordance with the formula and dosage of each type of animal feed. Mixer machine there are two that are distinguished from the material shape, smooth and rough. For material that is smooth then directly into the mixer engine to be mixed with other materials, while for coarse material to be rolled out through a hammer mill machine new entry into the mixer machine.

9. Pellet Machine

   Pellet machine is used to make animal feed pellets are specially shaped and crumble. The process of making feed pellets, namely: mixing, conditioning, and pelleting. Mixing in question is the mix of materials received from the mixer then carried conditioning to get a water content of 15-18%.

10. Cooler

    Cooler is used to cool the feed from the pelleting process. In the process of pellets contained vapor flux that causes high temperature feed. Therefore the feed needs to be cooled with a blower. Blower is sucking heat from the cooler then release vapor into the air. This cooling process will make more dry and hard pellets.

11. Crumble Machine

    Shaped feed pellets will be inserted into the machine crumble if desired feed shaped crumble. This machine will break down the feed pellets into small granules.

12. Sieve

    Sieve is used for sieving machine or separate feed pelleting process or crumble so obtained only in the form of feed pellets, granules crumble, or flour.

13. Packing Machine

    There are twelve units of packing machines consisting two units for one kilogram plastic and ten units for sack. Fodder that are coming from the mixer, pellet, crumble, or sifter can directly go to the packing process. Fodder that is usually packaged in kilogram is for rooster's

feed. Packaging weight is 1 kg which is packed into a cardboard box containing 20 packs kilogram of feed. There are three kinds of sack's packaging. Those are packaged in 10 kg, 50 kg, and 60 kg. After being packed in sacks, it will be put into a pellets with provisions for ten kilograms concentrates is one hundred fifty bags in one pellet, for fifty kilograms concentrates is forty nine bags, for sixty kilograms concentrates is thirty six bags, and for fifty kilograms of grains is forty two bags in one pellet.

4.2 Business Process Identification

Production department is one of department in plant production of the company. And also poultry feed is the main company product besides Day Old Chicks (DOC) and Food Consumption. The description of business process that is used in this research is by using IDEF0 (Integration Definition Language 0). IDEF0 represents activity that can be used for analyzing function and system performance. So there will be seen input, output, control, and also mechanism of the process happen. IDEF0 is also usually fitted for describing business process of manufacturing industry. Besides that, each process can be done decomposition for knowing sub process inside the process in detail. Identification of business process by IDEF0 is done by direct observation, interview, and brainstorming with Mr. Lucky as manager of Production Department. Validation of IDEF0 model is done by confirmation to Mr. Lucky as manager of Production Department.

4.2.1 IDEF0 Business Process Lv. 0

Each model in a business process has top model diagram that will be represented by one box and some arrows that surround it. Therefore, that box represents process that will be happened and has general characteristic. The same thing is done on all the arrow that are in the process. Inside the figure there are four arrows that represent general input, output, control, and mechanism. Here is the business process map of "Pokphand's Poultry Feed Production" level 0.

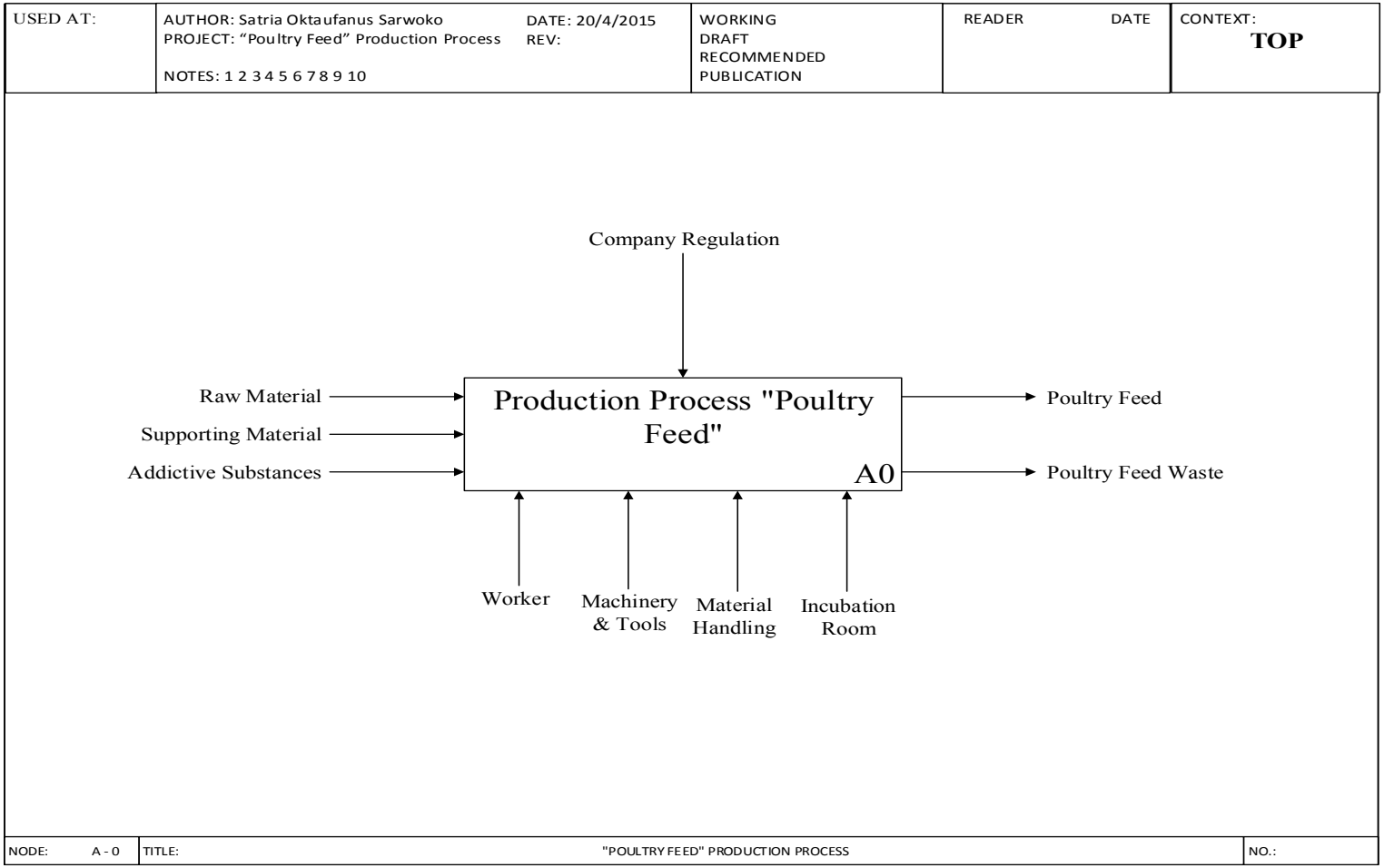


Figure 4.2 Business Process "Pokphand's Poultry Feed" IDEF0 Level 0

4.2.2 IDEF0 Business Process Lv. 1

IDEF0 business process of Poultry Feed production level 1 is a decomposition stage which is coming from IDEF0 business process level 0. This business process level has eight main processes. Those are storage processing of raw material, grinding process, mixing process, pelleting process, crumbling process, cooling process, sieving process, and packaging process.

Here is the figure of IDEF0 business process of Poultry Feed production level 1.

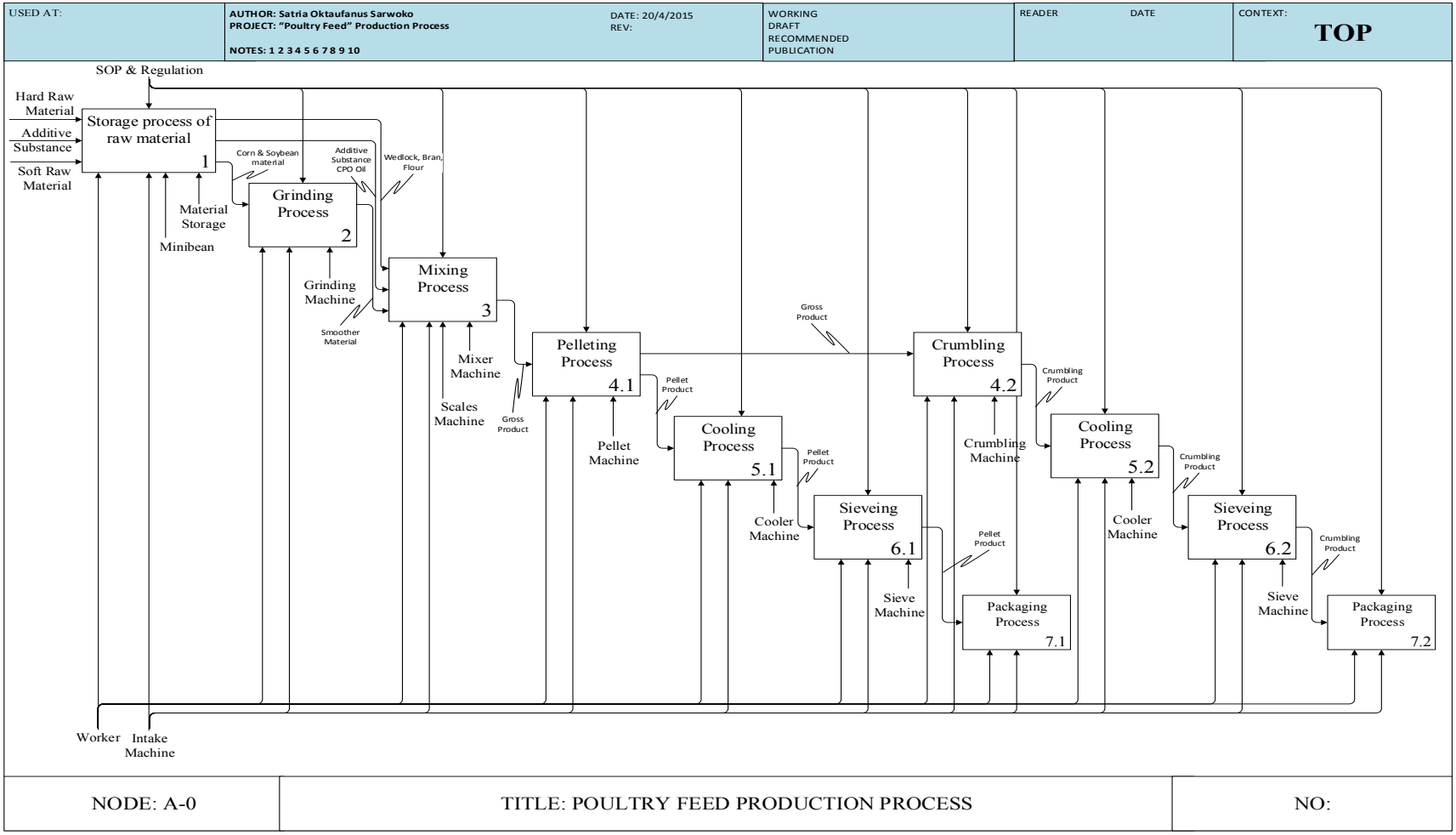


Figure 4.3 Business Process of Poultry Feed Production Process IDEF0 Lv. 1

Here is IDEF0 Production Process of Poultry Feed which is added by code on each process. That codes have function to review risks that will be identified in each activity.

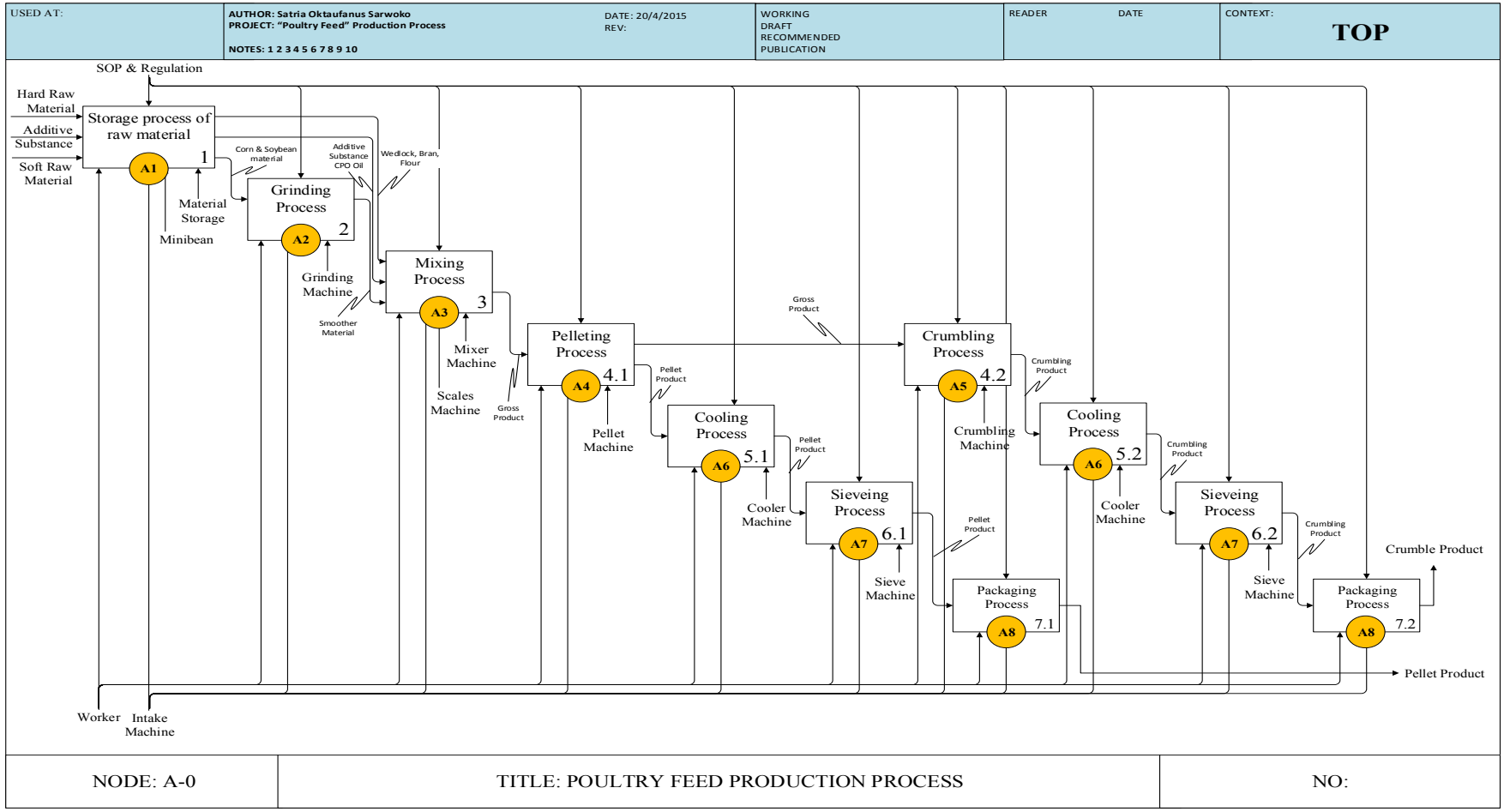


Figure 4.4 IDEF0 Business Process of Poultry Feed Production level 1 with code

After identifying IDEF0 level 1 of business process Production Department on PT. Charoen Pokphand Poultry Feed, the next step for making easier to identify risk factor is identifying any activities on each process.

4.2.2.1 Raw Material Storing Process

Based on the IDEF0 level 1 of Poultry Feed production that has already made above, here is the activity detail on storing process of raw material. This process consists of five main activities.

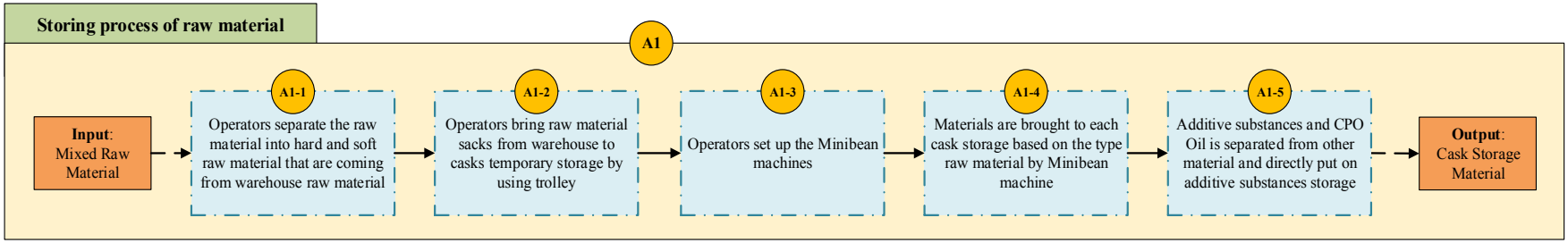


Figure 4.5 Raw Material Storing Activities

Based on the figure 4.5 it is shown that the input of this activity is mixed raw material. And the output is raw material cask storage. Overall this activity is dominated by operators which they do that activity manually.

4.2.2.2 Grinding Process

Based on IDEF0 level 1 of poultry feed production that has already made, here is the activity detail on grinding process.

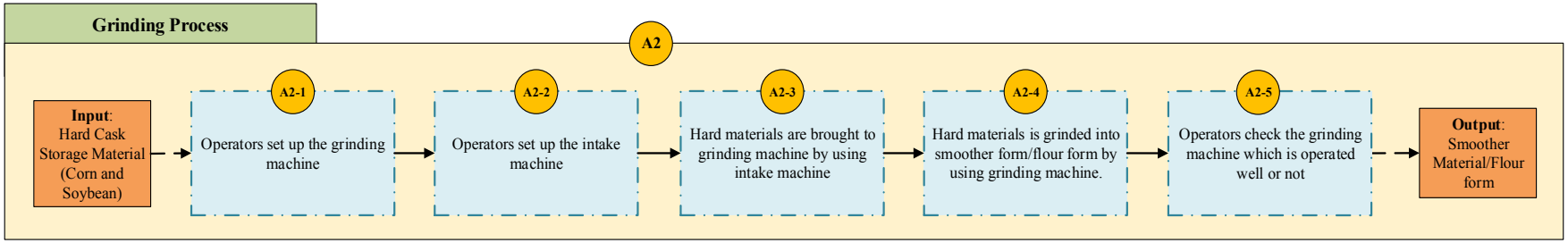


Figure 4.6 Grinding Process Activities

Based on figure 4.6 it is shown that this activity is dominated by machinery process. The input for this activity is hard material (corn and soybean). And the output for this activity is smoother material (Flour form).

4.2.2.3 Mixing Process

Based on IDEF0 level 1 of poultry feed production that has already made, here is the activity detail on mixing process.

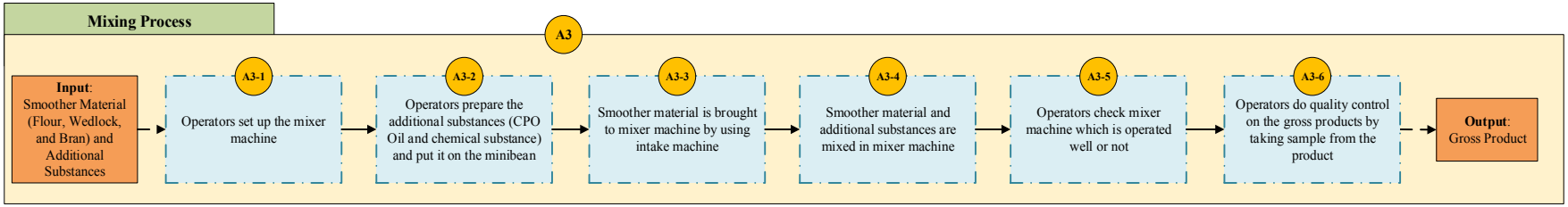


Figure 4.7 Mixing Process Activities

Based on figure 4.7 it is shown that this activity is dominated by machinery process. The input for this activity is smoother material (flour, wedlock, and bran) and additional substances (CPO Oil and chemical substances). And the output for this activity is Gross product.

4.2.2.4 Pelleting Process

Based on IDEF0 level 1 of poultry feed production that has already made, here is the activity detail on pelleting process.

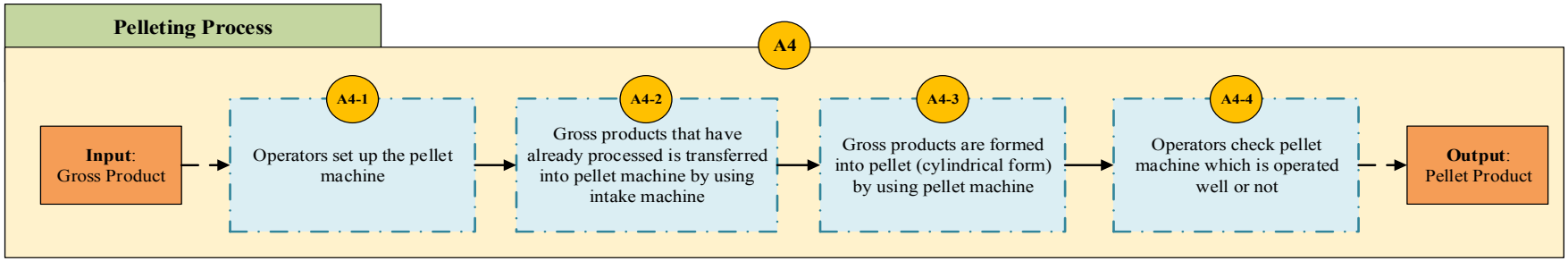


Figure 4.8 Pelleting Process Activities

Based on figure 4.8 it is shown that this activity is dominated by machinery process. The input for this activity is gross material. And the output for this activity is Pellet product.

4.2.2.5 Crumbling Process

Based on IDEF0 level 1 of poultry feed production that has already made, here is the activity detail on crumbling process.

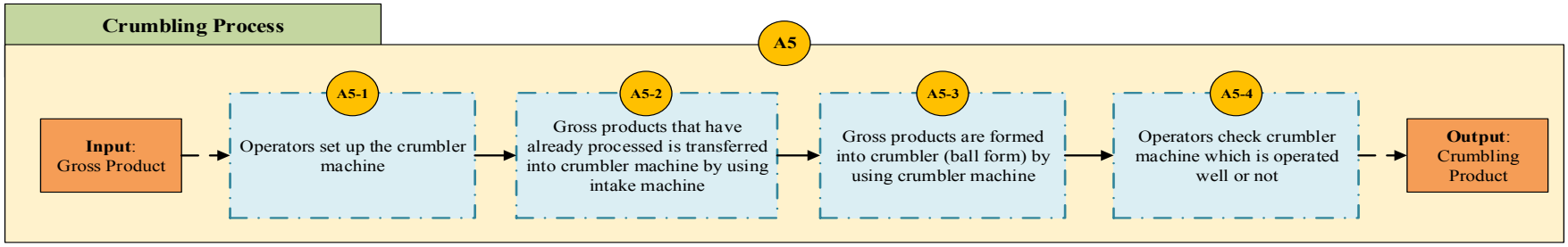


Figure 4.9 Crumbling Process Activities

Based on figure 4.9 it is shown that this activity is dominated by machinery process. The input for this activity is gross material. And the output for this activity is Crumbling product.

4.2.2.6 Cooling Process

Based on IDEF0 level 1 of poultry feed production that has already made, here is the activity detail on cooling process.

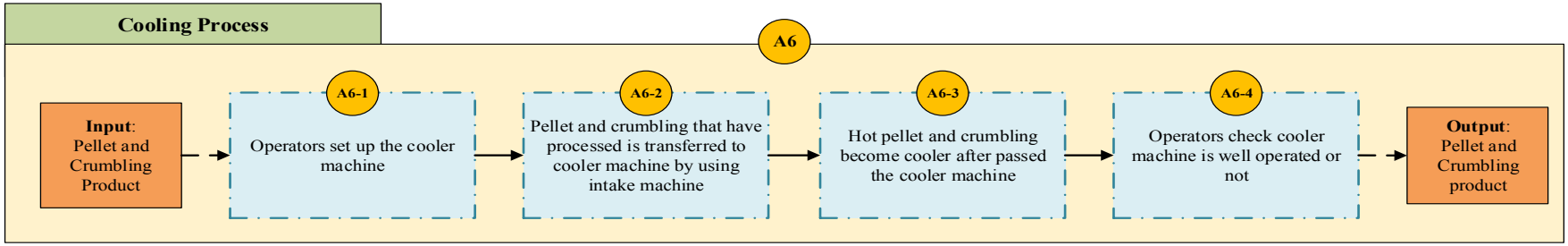


Figure 4.10 Cooling Process Activities

Based on figure 4.10 it is shown that this activity is dominated by machinery process. The input for this activity is pellet and crumbling product. And the output for this activity is cooler pellet and crumbling product.

4.2.2.7 Sieveing Process

Based on IDEF0 level 1 of poultry feed production that has already made, here is the activity detail on sieveing process.

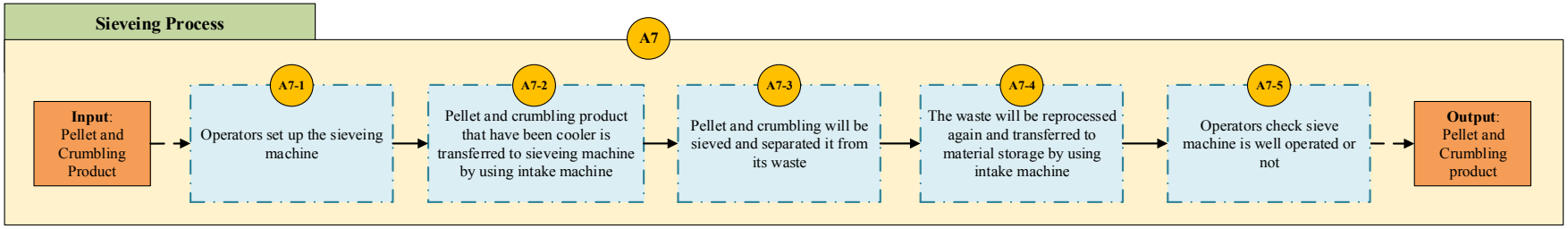


Figure 4.11 Sieveing Process Activities

Based on figure 4.11 it is shown that this activity is dominated by machinery process. The input for this activity is pellet and crumbling product. And the output for this activity is net pellet and crumbling product.

4.2.2.8 Packaging Process

Based on IDEF0 level 1 of poultry feed production that has already made, here is the activity detail on packaging process.

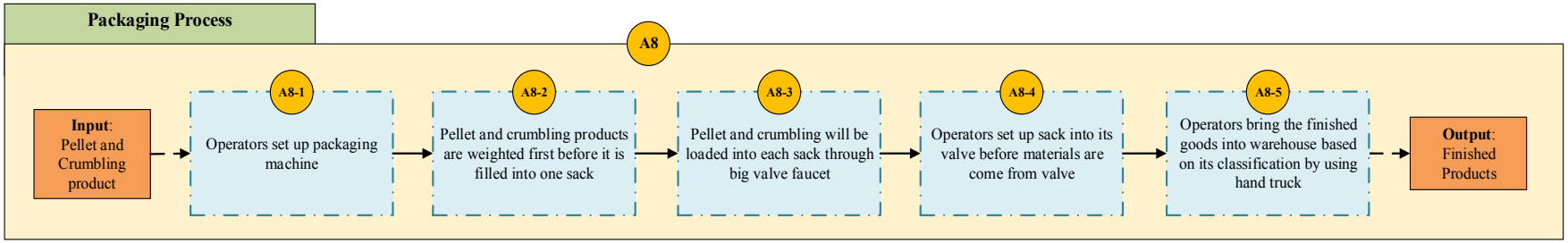


Figure 4.12 Packaging Process Activities

Based on figure 4.12 it is shown that this activity is dominated by machinery process. The input for this activity is pellet and crumbling product. And the output for this activity is finished product that has already packed on sack.

4.3 Risk Identification

This subchapter describes about risk identification of business process on production department PT. Charoen Pokphand Poultry Feed which is based on IDEF0. This risk factor can be described by using Fault Tree Analysis. This method generates risk factor by identifying any potential negative event occurred on a business process. Identification process of negative event could be done by:

1. Determining the purpose of each activity of Business Process.
2. Determining sub system failure.
3. Determining risk driver for causing failures.

Here is one example of making fault tree analysis from activity A1-2 (Operators bring raw material sacks from warehouse to casks temporary storage by using trolley).

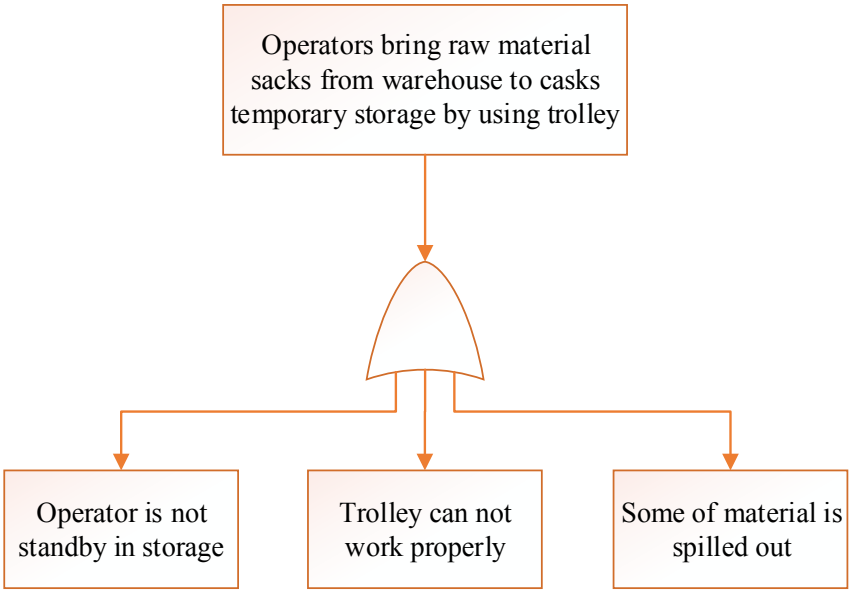


Figure 4.13 Fault Tree Analysis Activity A1-2

Based on the figure 4.13 that shows fault tree analysis on activity A1-2. On that fault tree, there are four risks which is resulted from this activity. And those risks characteristic includes “or”. It means that those risk happen independently with other risks on that event. The description of fault tree analysis concept is same with other activity.

Table 4.2 Risk Identification by Using Fault Tree Analysis

Code Activity	Activity	Risk Code	Risk	Sub System Code	Sub System Failure	Purpose
A1	**Raw Material Storing Process**					
A1-1	Operators separate the raw material into hard and soft that are coming from warehouse raw material	R1	Operator do not separate raw materials into two places	SF1	Hard and soft raw material will be mixed in warehouse raw material	Hard and soft material can be separated based on classification
A1-2	Operators bring raw material sacks from warehouse to casks temporary storage by using trolley	R2	Operator is not standby in storage	SF2	Raw material can't be delivered into temporary storage	Raw material can be delivered into temporary storage
		R3	Trolley cannot work properly			
		R4	Some of material is spilled out			
A1-3	Operators set up the Minibean machines	R5	Operator are not standby in mini bean machine	SF3	Minibean machine couldn't be set up well	Minibean machine could be set up well
		R6	Minibean machine set up time is too long			
		R7	Minibean machine set up time is too fast			
A1-4	Materials are brought to each cask storage based on the type raw material by Minibean machine	R8	Minibean machine stops suddenly in sending raw material process	SF4	All raw material couldn't be transferred well by using minibean machine	All raw material could be transferred well by using minibean machine
		R9	Minibean machine's valve is opened			
		R10	Raw material temporary storage tank is too full			

Table 4.3 Risk Identification by Using Fault Tree Analysis (Con't)

Code Activity	Activity	Risk Code	Risk	Sub System Code	Sub System Failure	Purpose
		R11	Some material are spilled out from minibean machine			
A1-5	Additive substances and CPO Oil is separated from other material and directly put on additive substances storage	R12	Operator fills additional substances and CPO oil into wrong storage	SF5	Additive and CPO Oil couldn't be separated from other material well	Additive and CPO Oil could be separated from other material well
		R13	Mixing happen between additional substances and CPO oil			
A2	**Grinding Process**					
A2-1	Operators set up the grinding machine	R14	Grinding machine's operator doesn't standby	SF6	Grinding machine couldn't be set up well	Grinding machine could be set up well
		R15	Grinder machine set up time is too long			
		R16	Grinder machine set up time is too fast			
		R17	Grinder machine can't be set up well			
A2-2	Operators set up the intake machine	R18	Intake machine's operator doesn't standby	SF7	Intake machine couldn't be set up well	Intake machine could be set up well
		R19	Intake machine set up time is too long			
		R20	Intake machine set up time is too fast			

Table 4.4 Risk Identification by Using Fault Tree Analysis (Con't)

Code Activity	Activity	Risk Code	Risk	Sub System Code	Sub System Failure	Purpose
		R21	Intake machine can't be set up well			
A2-3	Hard materials are brought to grinding machine by using intake machine	R22	Intake machine's valve of hard material is opened	SF8	Hard material couldn't be brought to grinding machine	Hard material could be brought to grinding machine
		R23	Intake machine stops suddenly in sending hard raw material			
		R24	Some of hard material are spilled out from intake machine			
A2-4	Hard materials is grinded into smoother form/flour form by using grinding machine.	R25	Grinder machine stops suddenly in grinding hard raw material	SF9	Hard material couldn't be grinded well	Hard material could be grinded well
		R26	Hard material is not fully grinded			
		R27	Grinder machine's valve is opened			
A2-5	Operators check the grinding machine which is operated well or not	R28	Some of material are still in hard form	SF10	Operators can't check grinding machine is operated well	Operators can check grinding machine is operated well
		R29	Operator doesn't check grinder machine based on SOP			
A3	**Mixing Process**					
A3-1	Operators set up the mixer machine	R30	Mixer machine's operator doesn't standby	SF11	Mixer machine couldn't be set up well	Mixer machine could be set up well

Table 4.5 Risk Identification by Using Fault Tree Analysis (Con't)

Code Activity	Activity	Risk Code	Risk	Sub System Code	Sub System Failure	Purpose
		R31	Mixer machine set up time is too long			
		R32	Mixer machine set up time is too fast			
		R33	Mixer machine can't be set up well			
A3-2	Operators prepare the additional substances (CPO Oil and chemical substance) and put it on the minibean	R34	Too much additional substances and CPO oil is filled into minibean machine	SF12	CPO oil and chemical substance couldn't be processed well	CPO oil and chemical substance could be processed well
		R35	Some of CPO oil are spilled out			
		R36	Some of additional sustances are spilled out			
A3-3	Smoother material is brought to mixer machine by using intake machine	R37	Intake machine's valve of smooth material is opened	SF13	Smoother material couldn't be brought to mixer machine	Smoother material could be brought to mixer machine
		R38	Some smoother materials are spilled out			
		R39	Some of pollutant are mixed with the smoother material			
A3-4	Smoother material and additional substances are mixed in mixer machine	R40	There is miss composition in material mixing of each poultry classification	SF14	Smoother and additional substance couldn't be mixed	Smoother and additional substance could be mixed

Table 4.6 Risk Identification by Using Fault Tree Analysis (Con't)

Code Activity	Activity	Risk Code	Risk	Sub System Code	Sub System Failure	Purpose
		R41	Mixer machine stops suddenly in mixing the material			
		R42	Mixer machine's valve is opened			
		R43	All material are not mixed fully on its batch			
A3-5	Operators check mixer machine which is operated well or not	R44	Operator does fault in checking mixer machine	SF15	Operators can't check mixer machine is operated well	Operators can check mixer machine is operated well
		R45	Operator accidents happen on checking mixer machine			
A3-6	Operators do quality control on the gross products by taking sample from the product	R46	Some gross product result are out of composition	SF16	Gross product couldn't be inspected well	Gross product could be inspected well
		R47	Sample taker equipment are not sterile			
		R48	Composition checking equipment are not sterile			
A4	**Pelleting Process**					
A4-1	Operators set up the pellet machine	R49	Pellet machine's operator doesn't standby	SF17	Pellet machine couldn't be set up well	Pellet machine could be set up well
		R50	Pellet machine set up time is too long			

Table 4.7 Risk Identification by Using Fault Tree Analysis (Con't)

Code Activity	Activity	Risk Code	Risk	Sub System Code	Sub System Failure	Purpose
		R51	Pellet machine set up time is too fast			
		R52	Pellet machine can't be set up well			
A4-2	Gross products that have already processed is transferred into pellet machine by using intake machine	R53	Some of gross product are spilled out	SF18	Gross product couldn't be brought to pellet machine	Gross product could be brought to pellet machine
		R54	Some of pollutant substances are mixed with gross product			
		R55	Some of gross product are still stacked on intake machine surface			
A4-3	Gross products are formed into pellet (cylindrical form) by using pellet machine	R56	Pellet machine suddenly stops on pelleting process	SF19	Gross products couldn't be processed becoming pellet product well	Gross products couldn't be processed becoming pellet product well
		R57	Pellet machine's valve is opened			
		R58	Some of pellet products are spilled out when pelleting process is done			
		R59	Gross products are not fully form becoming pellet			

Table 4.8 Risk Identification by Using Fault Tree Analysis (Con't)

Code Activity	Activity	Risk Code	Risk	Sub System Code	Sub System Failure	Purpose
A4-4	Operators check pellet machine which is operated well or not	R60	Some pollutants stick on pellet products	SF20	Operators can't check pellet machine is operated well	Operators can't check pellet machine is operated well
		R61	There is color difference on some pellet products' surface			
A5	**Crumbling Process**					
A5-1	Operators set up the crumbler machine	R62	Crumbler machine's operator doesn't standby	SF21	Crumbler machine couldn't be set up well	Crumbler machine could be set up well
		R63	Crumbler machine set up time is too long			
		R64	Crumbler machine set up time is too fast			
		R65	Crumbler machine can't be set up well			
A5-2	Gross products that have already processed is transferred into crumbler machine by using intake machine	R66	Some of pellet products stick on intake machine's surface	SF22	Gross product couldn't be brought to crumbler machine	Gross product could be brought to crumbler machine
		R67	Some of pellet products are not castaway intentionally			
A5-3	Gross products are formed into crumbler (ball form) by using crumbler machine	R68	Crumbler machine suddenly stops when crumbling process was happening	SF23	Gross products couldn't be processed becoming crumbling product well	Gross products could be processed becoming crumbling product well

Table 4.9 Risk Identification by Using Fault Tree Analysis (Con't)

Code Activity	Activity	Risk Code	Risk	Sub System Code	Sub System Failure	Purpose
		R69	Crumbler machine's valve is opened			
		R70	Pellet products are not fully formed into ball form			
		R71	Some of crumbler products are spilled out when crumbling process was done			
A5-4	Operators check crumbler machine which is operated well or not	R72	Some of pollutant substances adhere on crumbling products	SF24	Operators can't check crumbler machine is operated well	Operators can check crumbler machine is operated well
A6	**Cooling Process**					
A6-1	Operators set up the cooler machine	R73	Cooler machine's operator doesn't standby	SF25	Cooler machine couldn't be set up well	Cooler machine could be set up well
		R74	Cooler machine set up time is too long			
		R75	Cooler machine set up time is too fast			
		R76	Cooler machine can't be set up well			

Table 4.10 Risk Identification by Using Fault Tree Analysis (Con't)

Code Activity	Activity	Risk Code	Risk	Sub System Code	Sub System Failure	Purpose
A6-2	Pellet and crumbling that have processed is transferred to cooler machine by using intake machine	R77	Some of pellet and crumbling products stick on intake machine's surface	SF26	Pellet and Crumble product couldn't be brought to cooler machine	Pellet and Crumble product couldn't be brought to cooler machine
		R78	The leakage happens on intake machine's pipe			
A6-3	Hot pellet and crumbling become cooler after passed the cooler machine	R79	Cooler machine's valve is opened	SF27	Pellet and crumble product couldn't be processed becoming cooler well	Pellet and crumble product could be processed becoming cooler well
		R80	Cooler machine suddenly stops when cooling process was done			
		R81	Cooler machine's fan doesn't operate suddenly			
		R82	Pellet and crumbling products are not fully becoming colder			
A6-4	Operators check cooler machine is well operated or not	R83	Operator faultiness checks on products that have passed cooler machine	SF28	Operators can't check cooler machine is operated well	Operators can check cooler machine is operated well
A7	**Sieveing Process**					
A7-1	Operators set up the sieveing machine	R84	Sieve machine's operator doesn't standby	SF29	Sieveing machine couldn't be set up well	Sieveing machine could be set up well
		R85	Sieve machine set up time is too long			

Table 4.11 Risk Identification by Using Fault Tree Analysis (Con't)

Code Activity	Activity	Risk Code	Risk	Sub System Code	Sub System Failure	Purpose
		R86	Sieve machine set up time is too fast			
		R87	Sieve machine can't be set up well			
A7-2	Pellet and crumbling product that have been cooler is transferred to sieveing machine by using intake machine	R88	Some of pollutants contaminate product result that has been cold	SF30	Pellet and Crumble product couldn't be delivered to sieveing machine	Pellet and Crumble product could be delivered to sieveing machine
A7-3	Pellet and crumbling will be sieved and separated it from its waste	R89	Sieve machine's valve is opened	SF31	Pellet and crumble product couldn't be sieved well	Pellet and crumble product could be sieved well
		R90	Sieve machine suddenly stops when sieveing process is done			
		R91	It's too little amount of product resulted from sieveing process			
		R92	Many impurities that escaped from the sieve			
A7-4	The waste will be reprocessed again and transferred to material storage by using intake machine	R93	Granules settles in the bottom sieve's surface so that it can't be transferred into material storage	SF32	The waste of products couldn't be transferred to material storage for reprocessing again	The waste of products could be transferred to material storage for reprocessing again

Table 4.12 Risk Identification by Using Fault Tree Analysis (Con't)

Code Activity	Activity	Risk Code	Risk	Sub System Code	Sub System Failure	Purpose
A7-5	Operators check sieve machine is well operated or not	R94	Operator faultiness doesn't check on sieve machine based on SOP	SF33	Operators can't check sieve machine is operated well	Operators can check sieve machine is operated well
A8	**Packaging Process**					
A8-1	Operators set up packaging machine	R95	Packaging machine's operator doesn't standby	SF34	Packaging machine couldn't be set up well	Packaging machine could be set up well
		R96	Packaging machine set up time is too long			
		R97	Packaging machine set up time is too fast			
		R98	Packaging machine can't be set up well			
A8-2	Pellet and crumbling products are weighted first before it is filled into one sack	R99	The measurement of weighing machine is less accurate	SF35	Pellet and crumble product couldn't be weighted well	Pellet and crumble product could be weighted well
		R100	Operator forget to reset the weight categories based on the type of packaging sacks			
		R101	Product barrier valve doesn't work properly			
A8-3	Pellet and crumbling will be loaded into each sack through big valve faucet	R102	Faucet valve is clogged	SF36	Pellet and crumble product couldn't be loaded well into each sack	Pellet and crumble product could be loaded well into each sack

Table 4.13 Risk Identification by Using Fault Tree Analysis (Con't)

Code Activity	Activity	Risk Code	Risk	Sub System Code	Sub System Failure	Purpose
A8-4	Operators set up sack into its valve before materials are come from valve	R103	Sack to wrap products are broken	SF37	Sack couldn't be set up well	Sack could be set up well
		R104	Many products are spilled during charging products			
		R105	Sack straps are less strong			
		R106	Operator doesn't standby when products are filled into sack			
		R107	Packaging machine suddenly stops when filling process of finished products is done			
A8-5	Operators bring the finished goods into warehouse based on its classification by using hand truck	R108	Sack's product wrapping is leaked	SF38	Finished products couldn't be delivered well into warehose well	Finished products could be delivered well into warehose well
		R109	Operator misplaced finished goods to storage classification in warehouse			
		R110	Hand truck machine suddenly stops when products are transferred into warehouse			

4.3.1 Risk Driver, Potential Effect, and Current Control Identification

Identification of effect, risk cause, and current control is one of approaching way that is done for evaluating risk by using FMEA. The effect identification result will be used for calculating impact rate or severity. The risk cause result will be used for calculating the probability of risk happen and it can be called as occurrence or likelihood. And current control result will be used for determining existing control rate that has done and it can be called as detection. These identification is done by observing and interviewing with the expert concerned about Production Department of Charoen Pokphand business process. Here is the result of potential effect, risk cause, and current control identification on table 4.14 and 4.32.

Table 4.14 Potential Effect, Risk Driver, and Risk Control Identification

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
A1	**Raw Material Storing Process**					
A1-1	Operators separate the raw material into hard and soft that are coming from warehouse raw material	R1	Operator do not separate raw materials into two places	Hard and soft material will be mixed	Operator feels fatigueless because of repetitive work	There is operator rotation for repetitive work in each shift
A1-2	Operators bring raw material sacks from warehouse to casks temporary storage by using trolley	R2	Operator is not standby in storage	Operator must find other operator to replace his work	Operator is doing other job	There is operator rotation for repetitive work in each shift
		R3	Trolley can't work properly	Operator must lift up the sack manually	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset
		R4	Some of material is spilled out	The raw material amount that will be entered will be decreased	Operator is careless in filling sack that contains raw material	There is operator rotation for repetitive work in each shift
A1-3	Operators set up the Minibean machines	R5	Operator are not standby in mini bean machine	Operator must find substitutor with other operator	Operator is doing other job	There is operator rotation for repetitive work in each shift
		R6	Minibean machine set up time is too long	Machine performance will not be maximum	Operator doesn't pay attention with machine setup	There is operational standard in machine handling
		R7	Minibean machine set up time is too fast	Machine lifetime will be decreasing	Operator doesn't pay attention with machine setup	There is operational standard in machine handling

Table 4.15 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
A1-4	Materials are brought to each cask storage based on the type raw material by Minibean machine	R8	Minibean machine stops suddenly in sending raw material process	Production process will be stopped temporary, and will rise looses	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset
		R9	Minibean machine's valve is opened	Many materials will be spilled out	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset
		R10	Raw material temporary storage tank is too full	Some materials that can't be accommodated in storage tank	Operator doesn't pay attention with storage tank condition before filling the material	There is signing / alarm equipment if tank is already full
		R11	Some material are spilled out from minibean machine	The amount of material will be decreased in production process	Minibean valve is opened	There is regular maintenance scheduling of company asset in workshop
A1-5	Additive substances and CPO Oil is separated from other material and directly put on additive substances storage	R12	Operator fills additional substances and CPO oil into wrong storage	Additional substances and CPO oil will be mixed	Operator is less understanding SOP for raw material putting that come into warehouse	There is operational standard for raw material handling that stacked clearly in warehouse
		R13	Mixing happen between additional substances and CPO oil	Additional substances and CPO oil will be mixed	Operator feels exhaustion because repetitive job	There is operator rotation for repetitive work in each shift

Table 4.16 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
A2	**Grinding Process**					
A2-1	Operators set up the grinding machine	R14	Grinding machine's operator doesn't standby	Operator must find substitutor with other operator	Operator is doing other job	There is operator rotation for repetitive work in each shift
		R15	Grinder machine set up time is too long	Machine performance will not be maximum	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine
		R16	Grinder machine set up time is too fast	Machine lifetime will be decreased	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine
		R17	Grinder machine can't be set up well	Production process will be run late	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset in workshop
A2-2	Operators set up the intake machine	R18	Intake machine's operator doesn't standby	Operator must find substitutor with other operator	Operator is doing other job	There is operator rotation for repetitive work in each shift
		R19	Intake machine set up time is too long	Machine performance will not be maximum	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine

Table 4.17 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
		R20	Intake machine set up time is too fast	Machine lifetime will be decreased	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine
		R21	Intake machine can't be set up well	Production process will be run late	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset in workshop
A2-3	Hard materials are brought to grinding machine by using intake machine	R22	Intake machine's valve of hard material is opened	Many materials will be spilled out	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset
		R23	Intake machine stops suddenly in sending hard raw material	Production process will be stopped temporary, and will rise looses	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset
		R24	Some of hard material are spilled out from intake machine	The amount of material will be decreased in production process	Intake valve is opened	There is regular maintenance scheduling of company asset in workshop
A2-4	Hard materials is grinded into smoother form/flour form by using grinding machine.	R25	Grinder machine stops suddenly in grinding hard raw material	Production process will be stopped temporary, and will rise looses	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset

Table 4.18 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
		R26	Hard material is not fully grinded	The product result's amount will decrease or not much as material being processed	Operator miss arrange the grinding machine velocity because it doesn't fit with material dimension which is processed inside	There is operational standard for machine handling that stacked in machine
		R27	Grinder machine's valve is opened	Many materials will be spilled out	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset
A2-5	Operators check the grinding machine which is operated well or not	R28	Some of material are still in hard form	The amount of gross product being not same with the amount material	The grinder velocity doesn't fit with hard material dimension that processed in grinding machine	There is regular maintenance by giving lubricant into grinder
		R29	Operator doesn't check grinder machine based on SOP	Many products that's in out specification or still in hard form	There is less education or sharing knowledge about machine handling	There is sharing knowledge between senior operator and junior manager
A3	**Mixing Process**					
A3-1	Operators set up the mixer machine	R30	Mixer machine's operator doesn't standby	Operator must find substitutor with other operator	Operator is doing other job	There is operator rotation for repetitive work in each shift
		R31	Mixer machine set up time is too long	Machine performance will not be maximum	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine

Table 4.19 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
		R32	Mixer machine set up time is too fast	Machine lifetime will be decreased	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine
		R33	Mixer machine can't be set up well	Production process will run late	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset
A3-2	Operators prepare the additional substances (CPO Oil and chemical substance) and put it on the minibean	R34	Too much additional substances and CPO oil is filled into minibean machine	Some material can't be accommodated into minibean machine	Operator doesn't pay attention with minibean machine condition before it is poured	There is signing / alarm equipment if minibean is already full
		R35	Some of CPO oil are spilled out	The amount of material will be decreased in production process	Minibean machine valve is opened	There is regular maintenance scheduling of company asset
		R36	Some of additional substances are spilled out	The amount of material will be decreased in production process	Minibean machine valve is opened	There is regular maintenance scheduling of company asset
A3-3	Smoother material is brought to mixer machine by using intake machine	R37	Intake machine's valve of smooth material is opened	Many materials will be spilled out	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset
		R38	Some smoother materials are spilled out	The amount of material will be decreased in production process	Intake machine valve is opened	There is regular maintenance scheduling of company asset in a shop floor

Table 4.20 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
		R39	Some of pollutant are mixed with the smoother material	Product result will become outspec	It is done regular cleaning for company asset especially for machine	There is regular cleaning schedule of machine and other asset that is in workshop
A3-4	Smoother material and additional substances are mixed in mixer machine	R40	There is miscompotition in material mixing of each poultry classification	Product result will become outspec	Lack in education or knowledge sharing about product receipt	There is sharing knowledge between senior operator and junior manager
		R41	Mixer machine stops suddenly in mixing the material	Production process will be stopped temporary, and will rise looses	There is no reguler maintenance of company's assets	There is reguler maintenance scheduling of company asset
		R42	Mixer machine's valve is opened	Many materials will be spilled out	There is no reguler maintenance of company's assets	There is reguler cleaning schedule of machine and other asset that is in workshop
		R43	All material are not mixed fully on its batch	Product result will become outspec	There is faultiness in setting frequency of mixing from mixer machine	There is operational standard for machine handling that stacked in machine
A3-5	Operators check mixer machine which is operated well or not	R44	Operator does fault in checking mixer machine	Product result will become outspec	Operator do checking to mixer machine which is not appropriate with SOP	There is sharing knowledge between senior operator and junior manager

Table 4.21 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
		R45	Operator accidents happen on checking mixer machine	Create loses not only individual level but also in company level	Operator doesn't wear safety equipment when it is entered into workstation	There is safety training for making realize to use safety equipment
A3-6	Operators do quality control on the gross products by taking sample from the product	R46	Some gross product result are out of composition	Resulted product will become outspec and will be reprocessed	There is pollutant inside mixer machine	There is regular maintenance by cleaning the machine and also other asset in workshop
		R47	Sample taker equipments are not sterile	Can contaminate or mix to the resulted product	There is no cleaning scheduling for sample taker equipment	There is regular cleaning schedule of machine and other asset that is in workshop
		R48	Composition checking equipments are not sterile	Can contaminate or mix to the resulted product	There is no cleaning schedule for sample checker equipments	There is regular maintenance scheduling of company asset in a shop floor
A4	**Pelleting Process**					
A4-1	Operators set up the pellet machine	R49	Pellet machine's operator doesn't standby	Operator must find substitutor with other operator	Operator is doing other job	There is operator rotation for repetitive work in each shift
		R50	Pellet machine set up time is too long	Machine performance will not be maximum	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine

Table 4.22 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
		R51	Pellet machine set up time is too fast	Machine lifetime will be decreased	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine
		R52	Pellet machine can't be set up well	Production process will run late	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset
A4-2	Gross products that have already processed is transferred into pellet machine by using intake machine	R53	Some of gross product are spilled out	The amount of product will be decreased in production process	Intake machine valve is opened	There is regular maintenance scheduling of company asset in a shop floor
		R54	Some of pollutant substances are mixed with gross product	Product result will become out spec	It is done regular cleaning for company asset especially for machine	There is regular cleaning schedule of machine and other asset that is in workshop
		R55	Some of gross product are still stacked on intake machine surface	The amount of product will be decreased in production process	It is done regular cleaning for company asset especially for machine	There is regular cleaning schedule of machine and other asset that is in workshop
A4-3	Gross products are formed into pellet (cylindrical form) by using pellet machine	R56	Pellet machine suddenly stops on pelleting process	Production process will be stopped temporary, and will rise looses	There is no regular maintenance of company's assets	There is regular cleaning schedule of machine and other asset that is in workshop
		R57	Pellet machine's valve is opened	Many materials will be spilled out	There is no regular maintenance of company's assets	There is regular cleaning schedule of machine and other asset that is in workshop

Table 4.23 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
		R58	Some of pellet products are spilled out when pelleting process is done	The amount of pellet product will be decreased in production process	Pellet machine valve is opened	There is regular maintenance scheduling of company asset in a shop floor
		R59	Gross products are not fully form becoming pellet	Product result will become out spec	There is faultiness in inputting of velocity's frequency of pellet machine	There is operational standard for machine handling that stacked in machine
A4-4	Operators check pellet machine which is operated well or not	R60	Some pollutants stick on pellet products	The results of product will have a different color and can be regarded as a product out spec	There is no regular maintenance of company's assets	There is regular cleaning schedule of machine and other asset that is in workshop
		R61	There is color difference on some pellet products' surface	Results of the product is not in accordance with the results of the finished product expectations	Possibility of many impurities that contaminate the finished product	The schedule of cleaning machines and other assets in the workshop
A5	**Crumbling Process**					
A5-1	Operators set up the crumbler machine	R62	Crumbler machine's operator doesn't standby	Operator must find substitutor with other operator	Operator is doing other job	There is operator rotation for repetitive work in each shift
		R63	Crumbler machine set up time is too long	Machine performance will not be maximum	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine

Table 4.24 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
		R64	Crumbler machine set up time is too fast	Machine lifetime will be decreased	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine
		R65	Crumbler machine can't be set up well	Production process will run late	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset
A5-2	Gross products that have already processed is transferred into crumbler machine by using intake machine	R66	Some of pellet products stick on intake machine's surface	The production process will be slower because will be the duct blockage of engine intake	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset in a shop floor
		R67	Some of pellet products are not castaway intentionally	The amount of pellet product will be decreasing	Intake machine's sieve is opened	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop
A5-3	Gross products are formed into crumbler (ball form) by using crumbler machine	R68	Crumbler machine suddenly stops when crumbling process was happening	The production process will be temporarily halted, and will cause losses	Lack of regular maintenance schedule on assets of the company	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop

Table 4.25 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
		R69	Crumbler machine's valve is opened	Many pellet products will be spilled out	Lack of regular maintenance schedule on assets of the company	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop
		R70	Pellet products are not fully formed into ball form	Product result will become out spec	There is faultiness in inputting of velocity's frequency of crumbler machine	There is operational standard for machine handling that stacked in machine
		R71	Some of crumbler products are spilled out when crumbling process was done	The number of crumble product number will be reduced, and the resulting loss	Crumbler machine's valve is opened	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop
A5-4	Operators check crumbler machine which is operated well or not	R72	Some of pollutant substances adhere on crumbling products	Results of the product will cause differences in color and can be regarded as a product out spec	Lack of regular maintenance schedule on assets of the company	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop
A6	**Cooling Process**					
A6-1	Operators set up the cooler machine	R73	Cooler machine's operator doesn't standby	Operator must find substitutor with other operator	Operator is doing other job	There is operator rotation for repetitive work in each shift

Table 4.26 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
		R74	Cooler machine set up time is too long	Machine performance will not be maximum	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine
		R75	Cooler machine set up time is too fast	Machine lifetime will be decreased	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine
		R76	Cooler machine can't be set up well	Production process will run late	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset
A6-2	Pellet and crumbling that have processed is transferred to cooler machine by using intake machine	R77	Some of pellet and crumbling products stick on intake machine's surface	The production process will be slower because will be the duct blockage of engine intake	Lack of regular maintenance schedule on assets of the company	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop
		R78	The leakage happens on intake machine's pipe	The amount of product will be decreasing	Lack of regular maintenance schedule on assets of the company	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop

Table 4.27 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
A6-3	Hot pellet and crumbling become cooler after passed the cooler machine	R79	Cooler machine's valve is opened	Some of crumble products are spilled out	Lack of regular maintenance schedule on assets of the company	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop
		R80	Cooler machine suddenly stops when cooling process was done	Production process will be stopped temporary, and will rise looses	There is no regular maintenance of company's assets	There is regular cleaning schedule of machine and other asset that is in workshop
		R81	Cooler machine's fan doesn't operate suddenly	Production process will be stopped temporary, and will rise looses	There is no regular maintenance of company's assets	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop
		R82	Pellet and crumbling products are not fully becoming colder	The products will stay in hot conditions	There is faultiness in inputting of velocity's frequency of fan cooler machine	There is operational standard for machine handling that stacked in machine
A6-4	Operators check cooler machine is well operated or not	R83	Operator faultiness checks on products that have passed cooler machine	The finished product cannot be completely inspected	Lack of learning or sharing knowledge about the handling of products	There is sharing knowledge between senior operator and junior manager

Table 4.28 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
A7	**Sieveing Process**					
A7-1	Operators set up the sieveing machine	R84	Sieve machine's operator doesn't standby	Operator must find substitutor with other operator	Operator is doing other job	There is operator rotation for repetitive work in each shift
		R85	Sieve machine set up time is too long	Machine performance will not be maximum	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine
		R86	Sieve machine set up time is too fast	Machine lifetime will be decreased	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine
		R87	Sieve machine can't be set up well	Production process will run late	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset
A7-2	Pellet and crumbling product that have been cooler is transferred to sieveing machine by using intake machine	R88	Some of pollutants contaminate product result that has been cold	Product result will become out spec	Many pollutants are attached to the engine intake	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop
A7-3	Pellet and crumbling will be sieved and separated it from its waste	R89	Sieve machine's valve is opened	Many products that are after going through a sieve process are spilled out	There is no regular maintenance of company's assets	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop

Table 4.29 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
		R90	Sieve machine suddenly stops when sieveing process is done	Production process will be stopped temporary, and will rise looses	There is no regular maintenance of company's assets	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop
		R91	It's too little amount of product resulted from sieveing process	Total net product produced is reduced	Filters on sieve machines much clogged by impurities or pollutants	The existence of schedule for the replacement of small components as a step corrective maintenance
		R92	Many impurities that escaped from the sieve	Net product will be out spec	A leak in the filter of sieve engine	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop
A7-4	The waste will be reprocessed again and transferred to material storage by using intake machine	R93	Granules settles in the bottom sieve's surface so that it can't be transferred into material storage	The amount of product that can be reprocessed to be reduced	Condition of the intake machine is too moist	There is cleaning schedule machines and other assets in the workshop
A7-5	Operators check sieve machine is well operated or not	R94	Operator faultiness doesn't check on sieve machine based on SOP	Some of net products are becoming out spec	Lack of learning or sharing knowledge about the handling of products	There is sharing knowledge between senior operator and junior manager

Table 4.30 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
A8	**Packaging Process**					
A8-1	Operators set up packaging machine	R95	Packaging machine's operator doesn't standby	Operator must find substitutor with other operator	Operator is doing other job	There is operator rotation for repetitive work in each shift
		R96	Packaging machine set up time is too long	Machine performance will not be maximum	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine
		R97	Packaging machine set up time is too fast	Machine lifetime will be decreased	Operator doesn't pay attention with setup time machine	There is operational standard for machine handling that stacked in machine
		R98	Packaging machine can't be set up well	Production process will run late	There is no regular maintenance of company's assets	There is regular maintenance scheduling of company asset
A8-2	Pellet and crumbling products are weighted first before it is filled into one sack	R99	The measurement of weighing machine is less accurate	The product's weight become not consistent between one product to others	The operator made a mistake in resetting the machine condition scales	There is operational standard for machine handling that stacked in machine
		R100	Operator forget to reset the weight categories based on the type of packaging sacks	The amount / weight product that comes out of the faucet valve does not match the size sack	Lack of knowledge transfer activity is intense among operator	An increase in the intensity of knowledge sharing activities between operators

Table 4.31 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
		R101	Product barrier valve doesn't work properly	Production process will be stopped temporary, and will rise looses	There is no regular maintenance of company's assets	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop
A8-3	Pellet and crumbling will be loaded into each sack through big valve faucet	R102	Faucet valve is clogged	Production process will be stopped temporary, and will rise looses	There is no regular maintenance of company's assets	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop
A8-4	Operators set up sack into its valve before materials are come from valve	R103	Sack to wrap products are broken	Leakage at the time of filling product into sack	Operators do not check sack before charging starts	The existence of use of standard treatment for material handling
		R104	Many products are spilled during charging products	The amount of products will be decreased	Operator feels tired because repetitive jobs	There is operator rotation for repetitive work in each shift
		R105	Sack straps are less strong	If the sacks falls, the products inside sack will be spilled out	There is no regular maintenance of company's assets	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop

Table 4.32 Potential Effect, Risk Driver, and Risk Control Identification (Con't)

Activity Code	Activity	Risk Code	Risk	Potential Effect	Risk Driver	Risk Control
		R106	Operator doesn't standby when products are filled into sack	Operator must find other operator to replace his work	Operator is doing other job	There is operator rotation for repetitive work in each shift
		R107	Packaging machine suddenly stops when filling process of finished products is done	The production process will be running late	There is no regular maintenance of company's assets	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop
A8-5	Operators bring the finished goods into warehouse based on its classification by using hand truck	R108	Sack's product wrapping is leaked	Volume of product inside the sack will reduce	Operators do not check sack before charging starts	There is operational standard for machine handling that stacked in machine
		R109	Operator misplaced finished goods to storage classification in warehouse	Finished goods will be mixed among each sack's class	Operator feels tired because repetitive jobs	There is operator rotation for repetitive work in each shift
		R110	Hand truck machine suddenly stops when products are transferred into warehouse	Finished goods transfer process will be disturbed	There is no regular maintenance of company's assets	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop

4.4 Risk Assessment

This subchapter describes about risk assessment of business process risk on Production Department PT. Charoen Pokphand Krian, Sidoarjo. The risk assessment method is using fuzzy FMEA because this method uses fuzzy logic in problem or failure cause that happen through Likelihood, Impact, and Detection consideration. Fuzzy FMEA is the developing method from FMEA that gives flexibility on uncertainty problem caused by information ambiguity or subjective preferential. Those information and preferential is used in failure mode assessment. (Iqbal *et al*., 2013).

4.4.1 Fuzzy Logic Number Identification

This subchapter describes about likelihood, impact, and detection factor can be evaluated by linguistic way. Linguistic term and fuzzy number that is used in evaluating likelihood, impact, and detection is shown on table 4.33, 4.34, and 4.35. Importance index of L, I, and D factors can be also assessed by using linguistic term that can be shown in table 4.36.

The procedures of Fuzzy FMEA assessment can be done by this following step:

a. Determining fuzzy number of L, I, and D based on table 4.33, 4.34, and 4.35.
b. Calculating aggregation of fuzzy assessment for L, I, and D factors which is based equation (1), (2), and (3).
c. Calculating importance index aggregation for L, I, and D which is based on equation (4), (5), and (6).

$$R_i^L = \frac{1}{n}\sum_{j=1}^{m} h_j R_j^L = \left(\sum_{j=1} h_j R_{jL}^L, \sum_{j=1} h_j R_{jM}^L, \sum_{j=1} h_j R_{jH}^L\right) \quad \text{.....(1)}$$

$$R_i^I = \frac{1}{n}\sum_{j=1}^{m} h_j R_j^I = \left(\sum_{j=1} h_j R_{jL}^I, \sum_{j=1} h_j R_{jM}^I, \sum_{j=1} h_j R_{jH}^I\right) \quad \text{.....(2)}$$

$$R_i^D = \frac{1}{n}\sum_{j=1}^{m} h_j R_j^D = \left(\sum_{j=1} h_j R_{jL}^D, \sum_{j=1} h_j R_{jM}^D, \sum_{j=1} h_j R_{jH}^D\right) \quad \text{.....(3)}$$

Here is the identification of fuzzy number for each likelihood, impact, detection, and also linguistic term.

Table 4.33 Impact Fuzzy Number Determination

IMPACT				
1	Insignificant	1	1	2
2	Minor	1	2	3
3	Moderate	2	3	4
4	Major	3	4	5
5	Catastrophic	4	5	5

Table 4.34 Likelihood Fuzzy Number Determination

LIKELIHOOD				
1	Rare	1	1	2
2	Unlikely	1	2	3
3	Possible	2	3	4
4	Likely	3	4	5
5	Almost Certain	4	5	5

Table 4.35 Detection Fuzzy Number Determination

DETECTION				
1	Almost Certain	1	1	2
2	High	1	2	3
3	Moderate	2	3	4
4	Low	3	4	5
5	Almost Uncertain	4	5	5

Table 4.36 Linguistic Term Fuzzy Number Determination

Linguistic Term				
1	Very Low (VL)	0	0	0.25
2	Low (L)	0	0.25	0.5
3	Medium (M)	0.25	0.5	0.75
4	High (H)	0.5	0.75	1
5	Very High (VH)	0.75	1	1

4.4.2 Likelihood, Impact, and Detection Identification

Determining likelihood, impact, and detection value is gotten from result of questionnaire assessment filled by an expert. Questionnaire of risk assessment can be seen on attachment. Here are likelihood, impact, and detection assessment based on its criteria in each risk.

Table 4.37 Likelihood, Impact, and Detection Assessment Risk

Risk Code	Risk	Impact	Likelihood	Detection
Raw Material Storing Process				
R1	Operator does not separate raw materials into two places	2	1	1
R2	Operator is not standby in storage	2	1	1
R3	Trolley cannot work properly	2	1	1
R4	Some of materials are spilled out	3	3	3
R5	Operators are not standby in mini bean machine	3	3	3
R6	Minibean machine set up time is too long	2	1	1
R7	Minibean machine set up time is too fast	2	1	1
R8	Minibean machine stops suddenly in sending raw material process	2	1	1
R9	Minibean machine's valve is opened	2	1	1
R10	Raw material temporary storage tank is too full	5	5	5
R11	Some material are spilled out from minibean machine	5	5	4
R12	Operator fills additional substances and CPO oil into wrong storage	2	1	5
R13	Mixing happen between additional substances and CPO oil	2	1	5
Grinding Process				
R14	Grinding machine's operator doesn't standby	2	1	2

Table 4.38 Likelihood, Impact, and Detection Assessment Risk (Con't)

Risk Code	Risk	Impact	Likelihood	Detection
R15	Grinder machine set up time is too long	2	1	2
R16	Grinder machine set up time is too fast	2	1	2
R17	Grinder machine can't be set up well	2	1	2
R18	Intake machine's operator doesn't standby	2	1	2
R19	Intake machine set up time is too long	2	1	2
R20	Intake machine set up time is too fast	2	1	2
R21	Intake machine can't be set up well	2	1	2
R22	Intake machine's valve of hard material is opened	2	1	2
R23	Intake machine stops suddenly in sending hard raw material	5	1	2
R24	Some of hard material are spilled out from intake machine	2	1	2
R25	Grinder machine stops suddenly in grinding hard raw material	5	1	2
R26	Hard material is not fully grinded	3	3	4
R27	Grinder machine's valve is opened	2	1	2
R28	Some of material are still in hard form	3	3	4
R29	Operator doesn't check grinder machine based on SOP	3	3	4
Mixing Process				
R30	Mixer machine's operator doesn't standby	2	1	2
R31	Mixer machine set up time is too long	2	1	2
R32	Mixer machine set up time is too fast	2	1	2

Table 4.39 Likelihood, Impact, and Detection Assessment Risk (Con't)

Risk Code	Risk	Impact	Likelihood	Detection
R33	Mixer machine can't be set up well	2	1	2
R34	Too much additional substances and CPO oil is filled into minibean machine	2	1	2
R35	Some of CPO oil are spilled out	2	1	2
R36	Some of additional sustances are spilled out	2	1	2
R37	Intake machine's valve of smooth material is opened	2	1	2
R38	Some smoother materials are spilled out	2	1	2
R39	Some of pollutant are mixed with the smoother material	3	3	4
R40	There is miscompotition in material mixing of each poultry classification	3	3	4
R41	Mixer machine stops suddenly in mixing the material	5	1	2
R42	Mixer machine's valve is opened	3	2	4
R43	All material are not mixed fully on its batch	3	2	4
R44	Operator does fault in checking mixer machine	3	3	4
R45	Operator accidents happen on checking mixer machine	2	1	2
R46	Some gross product result are out of composition	2	1	2
R47	Sample taker equipments are not sterile	2	1	2
R48	Composition checking equipments are not sterile	2	1	2
Pelleting Process				
R49	Pellet machine's operator doesn't standby	2	1	2
R50	Pellet machine set up time is too long	2	1	2

Table 4.40 Likelihood, Impact, and Detection Assessment Risk (Con't)

Risk Code	Risk	Impact	Likelihood	Detection
R51	Pellet machine set up time is too fast	2	1	2
R52	Pellet machine can't be set up well	2	1	2
R53	Some of gross produk are spilled out	2	1	2
R54	Some of pollutant substances are mixed with gross product	3	2	4
R55	Some of gross product are still sticked on intake machine surface	3	2	4
R56	Pellet machine suddenly stops on pelleting process	5	1	2
R57	Pellet machine's valve is opened	2	1	2
R58	Some of pellet products are spilled out when pelleting process is done	2	1	2
R59	Gross products are not fully form becoming pellet	3	2	4
R60	Some pollutants stick on pellet products	2	1	2
R61	There is color difference on some pellet products' surface	2	1	2
Crumbling Process				
R62	Crumbler machine's operator doesn't standby	2	1	2
R63	Crumbler machine set up time is too long	2	1	2
R64	Crumbler machine set up time is too fast	2	1	2
R65	Crumbler machine can't be set up well	2	1	2
R66	Some of pellet products stick on intake machine's surface	2	1	2
R67	Some of pellet products are not castaway intentionally	2	1	2

Table 4.41 Likelihood, Impact, and Detection Assessment Risk (Con't)

Risk Code	Risk	Impact	Likelihood	Detection
R68	Crumbler machine suddenly stops when crumbling process was happening	5	1	2
R69	Crumbler machine's valve is opened	2	1	2
R70	Pellet products are not fully formed into ball form	3	4	5
R71	Some of crumbler products are spilled out when crumbling process was done	2	1	2
R72	Some of pollutant substances adhere on crumbling products	2	1	2
Cooling Process				
R73	Cooler machine's operator doesn't standby	2	1	2
R74	Cooler machine set up time is too long	2	1	2
R75	Cooler machine set up time is too fast	2	1	2
R76	Cooler machine can't be set up well	2	1	2
R77	Some of pellet and crumbling products stick on intake machine's surface	2	1	2
R78	The leakage happens on intake machine's pipe	2	1	2
R79	Cooler machine's valve is opened	2	1	2
R80	Cooler machine suddenly stops when cooling process was done	5	1	2
R81	Cooler machine's fan doesn't operate suddenly	5	1	2
R82	Pellet and crumbling products are not fully becoming colder	2	1	2
R83	Operator faultness checks on products that have passed cooler machine	3	2	2

Table 4.42 Likelihood, Impact, and Detection Assessment Risk (Con't)

Risk Code	Risk	Impact	Likelihood	Detection
Sieveing Process				
R84	Sieve machine's operator doesn't standby	2	1	2
R85	Sieve machine set up time is too long	2	1	2
R86	Sieve machine set up time is too fast	2	1	2
R87	Sieve machine can't be set up well	2	1	2
R88	Some of pollutants contaminate product result that has been cold	2	1	2
R89	Sieve machine's valve is opened	3	2	3
R90	Sieve machine suddenly stops when sieveing process is done	5	1	2
R91	It's too little amount of product resulted from sieveing process	3	2	3
R92	Many impurities that escaped from the sieve	3	2	3
R93	Granules settles in the bottom sieve's surface so that it can't be transferred into material storage	2	1	2
R94	Operator faultness doesn't check on sieve machine based on SOP	3	2	3
Packaging Process				
R95	Packaging machine's operator doesn't standby	2	1	2
R96	Packaging machine set up time is too long	2	1	2
R97	Packaging machine set up time is too fast	2	1	2
R98	Packaging machine can't be set up well	2	1	2
R99	The measurement of weighing machine is less accurate	3	2	3

Table 4.43 Likelihood, Impact, and Detection Assessment Risk (Con't)

Risk Code	Risk	Impact	Likelihood	Detection
R100	Operator forget to reset the weight categories based on the type of packaging sacks	3	2	3
R101	Product barrier valve doesn't work properly	2	1	2
R102	Faucet valve is clogged	2	1	2
R103	Sack to wrap products are broken	5	5	4
R104	Many products are spilled during charging products	3	2	3
R105	Sack straps are less strong	3	3	4
R106	Operator doesn't standby when products are filled into sack	2	1	2
R107	Packaging machine suddenly stops when filling process of finished products is done	2	1	2
R108	Sack's product wrapping is leaked	3	2	3
R109	Operator misplaced finished goods to storage calssification in warehouse	3	3	5
R110	Handtruck machine suddenly stops when products are transferred into warehouse	5	1	5

4.4.3 Aggregation of Fuzzy Number for Likelihood, Impact, and Detection Calculation

Aggregation of fuzzy number for likelihood, impact, and detection are based on equation (4), (5), and (6) In this stage there is value changing of score input. The average of aggregate value for each factors was shown on table 4.44. The expert aggregation input forms fuzzy which is done by average weighting. The output of this stage is fuzzy score. (Hidayat et al.,2012).

$$W_i^L = \frac{1}{n}\sum_{j=1}^{m} h_j W_j^L = \left(\sum_{j=1} h_j W_{jL}^L, \sum_{j=1} h_j W_{jM}^L, \sum_{j=1} h_j W_{jH}^L\right) \quad \text{.....(4)}$$

$$W_i^I = \frac{1}{n}\sum_{j=1}^{m} h_j W_j^I = \left(\sum_{j=1} h_j W_{jL}^I, \sum_{j=1} h_j W_{jM}^I, \sum_{j=1} h_j W_{jH}^I\right) \quad \text{.....(5)}$$

$$W_i^D = \frac{1}{n}\sum_{j=1}^{m} h_j W_j^D = \left(\sum_{j=1} h_j W_{jL}^D, \sum_{j=1} h_j W_{jM}^D, \sum_{j=1} h_j W_{jH}^D\right) \quad \text{.....(6)}$$

Here is the recapitulation of calculating the aggregation of fuzzy number of each likelihood, impact, and detection.

Table 4.44 Aggregation of Fuzzy Number of Likelihood, Impact, and Detection

Risk Code	Risk	Impact	Likelihood	Detection
Raw Material Storing Process				
R1	Operator does not separate raw materials into two places	2	1.33	1.33
R2	Operator is not standby in storage	2	1.33	1.33
R3	Trolley cannot work properly	2	1.33	1.33
R4	Some of materials are spilled out	3	3	3
R5	Operators are not standby in mini bean machine	3	3	3
R6	Minibean machine set up time is too long	2	1.33	1.33
R7	Minibean machine set up time is too fast	2	1.33	1.33
R8	Minibean machine stops suddenly in sending raw material process	2	1.33	1.33
R9	Minibean machine's valve is opened	2	1.33	1.33
R10	Raw material temporary storage tank is too full	4.67	4.67	4.67
R11	Some material are spilled out from minibean machine	4.67	4.67	4
R12	Operator fills additional substances and CPO oil into wrong storage	2	1.33	4.67

Table 4.45 Aggregation of Fuzzy Number of Likelihood, Impact, and Detection (Con't)

Risk Code	Risk	Impact	Likelihood	Detection
R13	Mixing happen between additional substances and CPO oil	2	1.33	4.67
Grinding Process				
R14	Grinding machine's operator doesn't standby	2	1.33	2
R15	Grinder machine set up time is too long	2	1.33	2
R16	Grinder machine set up time is too fast	2	1.33	2
R17	Grinder machine can't be set up well	2	1.33	2
R18	Intake machine's operator doesn't standby	2	1.33	2
R19	Intake machine set up time is too long	2	1.33	2
R20	Intake machine set up time is too fast	2	1.33	2
R21	Intake machine can't be set up well	2	1.33	2
R22	Intake machine's valve of hard material is opened	2	1.33	2
R23	Intake machine stops suddenly in sending hard raw material	4.67	1.33	2
R24	Some of hard material are spilled out from intake machine	2	1.33	2
R25	Grinder machine stops suddenly in grinding hard raw material	4.67	1.33	2
R26	Hard material is not fully grinded	3	3	4
R27	Grinder machine's valve is opened	2	1.33	2
R28	Some of material are still in hard form	3	3	4
R29	Operator doesn't check grinder machine based on SOP	3	3	4

Table 4.46 Aggregation of Fuzzy Number of Likelihood, Impact, and Detection (Con't)

Risk Code	Risk	Impact	Likelihood	Detection
Mixing Process				
R30	Mixer machine's operator doesn't standby	2	1.33	2
R31	Mixer machine set up time is too long	2	1.33	2
R32	Mixer machine set up time is too fast	2	1.33	2
R33	Mixer machine can't be set up well	2	1.33	2
R34	Too much additional substances and CPO oil is filled into minibean machine	2	1.33	2
R35	Some of CPO oil are spilled out	2	1.33	2
R36	Some of additional sustances are spilled out	2	1.33	2
R37	Intake machine's valve of smooth material is opened	2	1.33	2
R38	Some smoother materials are spilled out	2	1.33	2
R39	Some of pollutant are mixed with the smoother material	3	3	4
R40	There is miscompotition in material mixing of each poultry classification	3	3	4
R41	Mixer machine stops suddenly in mixing the material	4.67	1.33	2
R42	Mixer machine's valve is opened	3	2	4
R43	All material are not mixed fully on its batch	3	2	4
R44	Operator does fault in checking mixer machine	3	3	4
R45	Operator accidents happen on checking mixer machine	2	1.33	2
R46	Some gross product result are out of composition	2	1.33	2
R47	Sample taker equipments are not sterile	2	1.33	2

Table 4.47 Aggregation of Fuzzy Number of Likelihood, Impact, and Detection (Con't)

Risk Code	Risk	Impact	Likelihood	Detection
R48	Composition checking equipments are not sterile	2	1.33	2
Pelleting Process				
R49	Pellet machine's operator doesn't standby	2	1.33	2
R50	Pellet machine set up time is too long	2	1.33	2
R51	Pellet machine set up time is too fast	2	1.33	2
R52	Pellet machine can't be set up well	2	1.33	2
R53	Some of gross produk are spilled out	2	1.33	2
R54	Some of pollutant substances are mixed with gross product	3	2	4
R55	Some of gross product are still sticked on intake machine surface	3	2	4
R56	Pellet machine suddenly stops on pelleting process	4.67	1.33	2
R57	Pellet machine's valve is opened	2	1.33	2
R58	Some of pellet products are spilled out when pelleting process is done	2	1.33	2
R59	Gross products are not fully form becoming pellet	3	2	4
R60	Some pollutants stick on pellet products	2	1.33	2
R61	There is color difference on some pellet products' surface	2	1.33	2
Crumbling Process				
R62	Crumbler machine's operator doesn't standby	2	1.33	2
R63	Crumbler machine set up time is too long	2	1.33	2
R64	Crumbler machine set up time is too fast	2	1.33	2

Table 4.48 Aggregation of Fuzzy Number of Likelihood, Impact, and Detection (Con't)

Risk Code	Risk	Impact	Likelihood	Detection
R65	Crumbler machine can't be set up well	2	1.33	2
R66	Some of pellet products stick on intake machine's surface	2	1.33	2
R67	Some of pellet products are not castaway intentionally	2	1.33	2
R68	Crumbler machine suddenly stops when crumbling process was happening	4.67	1.33	2
R69	Crumbler machine's valve is opened	2	1.33	2
R70	Pellet products are not fully formed into ball form	3	4	4.67
R71	Some of crumbler products are spilled out when crumbling process was done	2	1.33	2
R72	Some of pollutant substances adhere on crumbling products	2	1.33	2
Cooling Process				
R73	Cooler machine's operator doesn't standby	2	1.33	2
R74	Cooler machine set up time is too long	2	1.33	2
R75	Cooler machine set up time is too fast	2	1.33	2
R76	Cooler machine can't be set up well	2	1.33	2
R77	Some of pellet and crumbling products stick on intake machine's surface	2	1.33	2
R78	The leakage happens on intake machine's pipe	2	1.33	2
R79	Cooler machine's valve is opened	2	1.33	2
R80	Cooler machine suddenly stops when cooling process was done	4.67	1.33	2
R81	Cooler machine's fan doesn't operate suddenly	4.67	1.33	2

Table 4.49 Aggregation of Fuzzy Number of Likelihood, Impact, and Detection (Con't)

Risk Code	Risk	Impact	Likelihood	Detection
R82	Pellet and crumbling products are not fully becoming colder	2	1.33	2
R83	Operator faultness checks on products that have passed cooler machine	3	2	2
Sieveing Process				
R84	Sieve machine's operator doesn't standby	2	1.33	2
R85	Sieve machine set up time is too long	2	1.33	2
R86	Sieve machine set up time is too fast	2	1.33	2
R87	Sieve machine can't be set up well	2	1.33	2
R88	Some of pollutants contaminate product result that has been cold	2	1.33	2
R89	Sieve machine's valve is opened	3	2	3
R90	Sieve machine suddenly stops when sieveing process is done	4.67	1.33	2
R91	It's too little amount of product resulted from sieveing process	3	2	3
R92	Many impurities that escaped from the sieve	3	2	3
R93	Granules settles in the bottom sieve's surface so that it can't be transferred into material storage	2	1.33	2
R94	Operator faultness doesn't check on sieve machine based on SOP	3	2	3
Packaging Process				
R95	Packaging machine's operator doesn't standby	2	1.33	2
R96	Packaging machine set up time is too long	2	1.33	2
R97	Packaging machine set up time is too fast	2	1.33	2

Table 4.50 Aggregation of Fuzzy Number of Likelihood, Impact, and Detection (Con't)

Risk Code	Risk	Impact	Likelihood	Detection
R98	Packaging machine can't be set up well	2	1.33	2
R99	The measurement of weighing machine is less accurate	3	2	3
R100	Operator forget to reset the weight categories based on the type of packaging sacks	3	2	3
R101	Product barrier valve doesn't work properly	2	1.33	2
R102	Faucet valve is clogged	2	1.33	2
R103	Sack to wrap products are broken	4.67	4.67	4
R104	Many products are spilled during charging products	3	2	3
R105	Sack straps are less strong	3	3	4
R106	Operator doesn't standby when products are filled into sack	2	1.33	2
R107	Packaging machine suddenly stops when filling process of finished products is done	2	1.33	2
R108	Sack's product wrapping is leaked	3	2	3
R109	Operator misplaced finished goods to storage calssification in warehouse	3	3	4.67
R110	Handtruck machine suddenly stops when products are transferred into warehouse	4.67	1.33	4.67

4.4.4 Fuzzy Risk Priority Number (FRPN) Calculation

Determining fuzzy risk priority number (FRPN) for each failure mode is based on equation (7).The rank is based on FRPN value, which the biggest FRPN becomes the highest rank. Determining risk rank is used to know the result orderly. The result of RPN ranking can represent the biggest RPN value which is risk that has to be handled. Here is the risk calculation recapitulation.

$$FRPN_j = R_j^L \frac{w^L}{w^L+w^I+w^D} x R_j^I \frac{w^I}{w^L+w^I+w^D} x R_j^D \frac{w^D}{w^L+w^I+w^D} \quad \text{.....(7)}$$

Here is the recapitulation of calculating fuzzy risk priority number (FRPN) that is calculated based on the equation (7).

Table 4.51 Fuzzy Risk Priority Number (FRPN) Calculation

Risk Code	Risk	Impact	Likelihood	Detection	RPN
Raw Material Storing Process					
R1	Operator does not separate raw materials into two places	1.517	1.059	1.059	1.701
R2	Operator is not standby in storage	1.517	1.059	1.059	1.701
R3	Trolley cannot work properly	1.517	1.059	1.059	1.701
R4	Some of materials are spilled out	1.442	1.442	1.442	3.000
R5	Operators are not standby in mini bean machine	1.442	1.442	1.442	3.000
R6	Minibean machine set up time is too long	1.517	1.059	1.059	1.701
R7	Minibean machine set up time is too fast	1.517	1.059	1.059	1.701
R8	Minibean machine stops suddenly in sending raw material process	1.517	1.059	1.059	1.701
R9	Minibean machine's valve is opened	1.517	1.059	1.059	1.701
R10	Raw material temporary storage tank is too full	1.671	1.671	1.671	4.667
R11	Some material are spilled out from minibean machine	1.727	1.727	1.495	4.462
R12	Operator fills additional substances and CPO oil into wrong storage	1.149	1.019	3.096	3.625
R13	Mixing happen between additional substances and CPO oil	1.149	1.019	3.096	3.625
Grinding Process					
R14	Grinding machine's operator doesn't standby	1.346	1.042	1.346	1.888
R15	Grinder machine set up time is too long	1.346	1.042	1.346	1.888
R16	Grinder machine set up time is too fast	1.346	1.042	1.346	1.888

Table 4.52 Fuzzy Risk Priority Number (FRPN) Calculation (Con't)

Risk Code	Risk	Impact	Likelihood	Detection	RPN
R17	Grinder machine can't be set up well	1.346	1.042	1.346	1.888
R18	Intake machine's operator doesn't standby	1.346	1.042	1.346	1.888
R19	Intake machine set up time is too long	1.346	1.042	1.346	1.888
R20	Intake machine set up time is too fast	1.346	1.042	1.346	1.888
R21	Intake machine can't be set up well	1.346	1.042	1.346	1.888
R22	Intake machine's valve of hard material is opened	1.346	1.042	1.346	1.888
R23	Intake machine stops suddenly in sending hard raw material	3.096	1.019	1.149	3.625
R24	Some of hard material are spilled out from intake machine	1.346	1.042	1.346	1.888
R25	Grinder machine stops suddenly in grinding hard raw material	3.096	1.019	1.149	3.625
R26	Hard material is not fully grinded	1.369	1.369	1.811	3.394
R27	Grinder machine's valve is opened	1.346	1.042	1.346	1.888
R28	Some of material are still in hard form	1.369	1.369	1.811	3.394
R29	Operator doesn't check grinder machine based on SOP	1.369	1.369	1.811	3.394
Mixing Process					
R30	Mixer machine's operator doesn't standby	1.346	1.042	1.346	1.888
R31	Mixer machine set up time is too long	1.346	1.042	1.346	1.888
R32	Mixer machine set up time is too fast	1.346	1.042	1.346	1.888
R33	Mixer machine can't be set up well	1.346	1.042	1.346	1.888
R34	Too much additional substances and CPO oil is filled into minibean machine	1.346	1.042	1.346	1.888

Table 4.53 Fuzzy Risk Priority Number (FRPN) Calculation (Con't)

Risk Code	Risk	Impact	Likelihood	Detection	RPN
R35	Some of CPO oil are spilled out	1.346	1.042	1.346	1.888
R36	Some of additional sustances are spilled out	1.346	1.042	1.346	1.888
R37	Intake machine's valve of smooth material is opened	1.346	1.042	1.346	1.888
R38	Some smoother materials are spilled out	1.346	1.042	1.346	1.888
R39	Some of pollutant are mixed with the smoother material	1.369	1.369	1.811	3.394
R40	There is miscompotition in material mixing of each poultry classification	1.369	1.369	1.811	3.394
R41	Mixer machine stops suddenly in mixing the material	3.096	1.019	1.149	3.625
R42	Mixer machine's valve is opened	1.442	1.122	2.000	3.238
R43	All material are not mixed fully on its batch	1.442	1.122	2.000	3.238
R44	Operator does fault in checking mixer machine	1.369	1.369	1.811	3.394
R45	Operator accidents happen on checking mixer machine	1.346	1.042	1.346	1.888
R46	Some gross product result are out of composition	1.346	1.042	1.346	1.888
R47	Sample taker equipments are not sterile	1.346	1.042	1.346	1.888
R48	Composition checking equipments are not sterile	1.346	1.042	1.346	1.888
Pelleting Process					
R49	Pellet machine's operator doesn't standby	1.346	1.042	1.346	1.888
R50	Pellet machine set up time is too long	1.346	1.042	1.346	1.888
R51	Pellet machine set up time is too fast	1.346	1.042	1.346	1.888
R52	Pellet machine can't be set up well	1.346	1.042	1.346	1.888
R53	Some of gross produk are spilled out	1.346	1.042	1.346	1.888

Table 4.54 Fuzzy Risk Priority Number (FRPN) Calculation (Con't)

Risk Code	Risk	Impact	Likelihood	Detection	RPN
R54	Some of pollutant substances are mixed with gross product	1.442	1.122	2.000	3.238
R55	Some of gross product are still sticked on intake machine surface	1.442	1.122	2.000	3.238
R56	Pellet machine suddenly stops on pelleting process	3.096	1.019	1.149	3.625
R57	Pellet machine's valve is opened	1.346	1.042	1.346	1.888
R58	Some of pellet products are spilled out when pelleting process is done	1.346	1.042	1.346	1.888
R59	Gross products are not fully form becoming pellet	1.442	1.122	2.000	3.238
R60	Some pollutants stick on pellet products	1.346	1.042	1.346	1.888
R61	There is color difference on some pellet products' surface	1.346	1.042	1.346	1.888
Crumbling Process					
R62	Crumbler machine's operator doesn't standby	1.346	1.042	1.346	1.888
R63	Crumbler machine set up time is too long	1.346	1.042	1.346	1.888
R64	Crumbler machine set up time is too fast	1.346	1.042	1.346	1.888
R65	Crumbler machine can't be set up well	1.346	1.042	1.346	1.888
R66	Some of pellet products stick on intake machine's surface	1.346	1.042	1.346	1.888
R67	Some of pellet products are not castaway intentionally	1.346	1.042	1.346	1.888
R68	Crumbler machine suddenly stops when crumbling process was happening	3.096	1.019	1.149	3.625
R69	Crumbler machine's valve is opened	1.346	1.042	1.346	1.888
R70	Pellet products are not fully formed into ball form	1.289	1.616	1.919	3.995

Table 4.55 Fuzzy Risk Priority Number (FRPN) Calculation (Con't)

Risk Code	Risk	Impact	Likelihood	Detection	RPN
R71	Some of crumbler products are spilled out when crumbling process was done	1.346	1.042	1.346	1.888
R72	Some of pollutant substances adhere on crumbling products	1.346	1.042	1.346	1.888
Cooling Process					
R73	Cooler machine's operator doesn't standby	1.346	1.042	1.346	1.888
R74	Cooler machine set up time is too long	1.346	1.042	1.346	1.888
R75	Cooler machine set up time is too fast	1.346	1.042	1.346	1.888
R76	Cooler machine can't be set up well	1.346	1.042	1.346	1.888
R77	Some of pellet and crumbling products stick on intake machine's surface	1.346	1.042	1.346	1.888
R78	The leakage happens on intake machine's pipe	1.346	1.042	1.346	1.888
R79	Cooler machine's valve is opened	1.346	1.042	1.346	1.888
R80	Cooler machine suddenly stops when cooling process was done	3.096	1.019	1.149	3.625
R81	Cooler machine's fan doesn't operate suddenly	3.096	1.019	1.149	3.625
R82	Pellet and crumbling products are not fully becoming colder	1.346	1.042	1.346	1.888
R83	Operator faultness checks on products that have passed cooler machine	1.732	1.189	1.189	2.449
Sieveing Process					
R84	Sieve machine's operator doesn't standby	1.346	1.042	1.346	1.888
R85	Sieve machine set up time is too long	1.346	1.042	1.346	1.888
R86	Sieve machine set up time is too fast	1.346	1.042	1.346	1.888
R87	Sieve machine can't be set up well	1.346	1.042	1.346	1.888

Table 4.56 Fuzzy Risk Priority Number (FRPN) Calculation (Con't)

Risk Code	Risk	Impact	Likelihood	Detection	RPN
R88	Some of pollutants contaminate product result that has been cold	1.346	1.042	1.346	1.888
R89	Sieve machine's valve is opened	1.552	1.149	1.552	2.766
R90	Sieve machine suddenly stops when sieveing process is done	3.096	1.019	1.149	3.625
R91	It's too little amount of product resulted from sieveing process	1.552	1.149	1.552	2.766
R92	Many impurities that escaped from the sieve	1.552	1.149	1.552	2.766
R93	Granules settles in the bottom sieve's surface so that it can't be transferred into material storage	1.346	1.042	1.346	1.888
R94	Operator faultness doesn't check on sieve machine based on SOP	1.552	1.149	1.552	2.766
Packaging Process					
R95	Packaging machine's operator doesn't standby	1.346	1.042	1.346	1.888
R96	Packaging machine set up time is too long	1.346	1.042	1.346	1.888
R97	Packaging machine set up time is too fast	1.346	1.042	1.346	1.888
R98	Packaging machine can't be set up well	1.346	1.042	1.346	1.888
R99	The measurement of weighing machine is less accurate	1.552	1.149	1.552	2.766
R100	Operator forget to reset the weight categories based on the type of packaging sacks	1.552	1.149	1.552	2.766
R101	Product barrier valve doesn't work properly	1.346	1.042	1.346	1.888
R102	Faucet valve is clogged	1.346	1.042	1.346	1.888
R103	Sack to wrap products are broken	1.727	1.727	1.495	4.462
R104	Many products are spilled during charging products	1.552	1.149	1.552	2.766
R105	Sack straps are less strong	1.369	1.369	1.811	3.394

Table 4.57 Fuzzy Risk Priority Number (FRPN) Calculation (Con't)

Risk Code	Risk	Impact	Likelihood	Detection	RPN
R106	Operator doesn't standby when products are filled into sack	1.346	1.042	1.346	1.888
R107	Packaging machine suddenly stops when filling process of finished products is done	1.346	1.042	1.346	1.888
R108	Sack's product wrapping is leaked	1.552	1.149	1.552	2.766
R109	Operator misplaced finished goods to storage classification in warehouse	1.332	1.332	2.089	3.706
R110	Handtruck machine suddenly stops when products are transferred into warehouse	1.671	1.019	1.671	3.625

4.5 Risk Evaluation

This subchapter describes about risk evaluation of business process risk on Production Department PT. Charoen Pokphand Krian, Sidoarjo. The risk evaluation is done by classifying the risk based on value of likelihood, and impact (risk map). The risk classification is divided into four class, those are Extreme Risk, High Risk, Medium Risk, and Low Risk. After classifying risk, the next step is risk treatment. By using FRPN that has already calculated, the risk is classify into corrective and non-corrective risk. The risk that has the higher FRPN value should be classified into corrective risk and for risk that has lower FRPN value should be classified into non-corrective risk.

4.5.1 Risk Priority Identification

Risk priority is an evaluation of risk for a given input prioritized mitigation efforts. Prioritization of risks is based on considerations Fuzzy Risk Priority Number (FRPN) in the previous subchapter. FRPN calculation results are evaluated based on the multiplier elements that likelihood, impact, and detection. FRPN calculation results are not paying attention to the contribution of each multiplier elements, so that the value of the same FRPN does not mean coming from the same

multiplier element value. Here is the result of the evaluation of the FRPN in Table 4.58 until 4.64.

Table 4.58 Risk Evaluation Identification

Risk Code	Risk	RPN	Evaluation
R10	Raw material temporary storage tank is too full	4.667	Corrective
R11	Some material are spilled out from minibean machine	4.462	Corrective
R103	Sack to wrap products are broken	4.462	Corrective
R70	Pellet products are not fully formed into ball form	3.995	Corrective
R109	Operator misplaced finished goods to storage classification in warehouse	3.706	Corrective
R110	Handtruck machine suddenly stops when products are transferred into warehouse	3.625	Corrective
R12	Operator fills additional substances and CPO oil into wrong storage	3.625	Corrective
R13	Mixing happen between additional substances and CPO oil	3.625	Corrective
R23	Intake machine stops suddenly in sending hard raw material	3.625	Corrective
R25	Grinder machine stops suddenly in grinding hard raw material	3.625	Corrective
R41	Mixer machine stops suddenly in mixing the material	3.625	Corrective
R56	Pellet machine suddenly stops on pelleting process	3.625	Corrective
R68	Crumbler machine suddenly stops when crumbling process was happening	3.625	Corrective
R80	Cooler machine suddenly stops when cooling process was done	3.625	Corrective
R81	Cooler machine's fan doesn't operate suddenly	3.625	Corrective

Table 4.59 Risk Evaluation Identification (Con't)

Risk Code	Risk	RPN	Evaluation
R90	Sieve machine suddenly stops when sieveing process is done	3.625	Corrective
R26	Hard material is not fully grinded	3.394	Corrective
R28	Some of material are still in hard form	3.394	Corrective
R29	Operator doesn't check grinder machine based on SOP	3.394	Corrective
R39	Some of pollutant are mixed with the smoother material	3.394	Corrective
R40	There is miscompotition in material mixing of each poultry classification	3.394	Corrective
R44	Operator does fault in checking mixer machine	3.394	Corrective
R105	Sack straps are less strong	3.394	Corrective
R42	Mixer machine's valve is opened	3.238	Corrective
R43	All material are not mixed fully on its batch	3.238	Corrective
R54	Some of pollutant substances are mixed with gross product	3.238	Corrective
R55	Some of gross product are still sticked on intake machine surface	3.238	Corrective
R59	Gross products are not fully form becoming pellet	3.238	Corrective
R4	Some of material is spilled out	3.000	Corrective
R5	Operator are not standby in mini bean machine	3.000	Corrective
R89	Sieve machine's valve is opened	2.766	Corrective
R91	It's too little amount of product resulted from sieveing process	2.766	Corrective
R92	Many impurities that escaped from the sieve	2.766	Corrective

Table 4.60 Risk Evaluation Identification (Con't)

Risk Code	Risk	RPN	Evaluation
R94	Operator faultness doesn't check on sieve machine based on SOP	2.766	Corrective
R99	The measurement of weighing machine is less accurate	2.766	Corrective
R100	Operator forget to reset the weight categories based on the type of packaging sacks	2.766	Corrective
R104	Many products are spilled during charging products	2.766	Corrective
R108	Sack's product wrapping is leaked	2.766	Corrective
R83	Operator faultness checks on products that have passed cooler machine	2.449	Corrective
R14	Grinding machine's operator doesn't standby	1.888	Non-Corrective
R15	Grinder machine set up time is too long	1.888	Non-Corrective
R16	Grinder machine set up time is too fast	1.888	Non-Corrective
R17	Grinder machine can't be set up well	1.888	Non-Corrective
R18	Intake machine's operator doesn't standby	1.888	Non-Corrective
R19	Intake machine set up time is too long	1.888	Non-Corrective
R20	Intake machine set up time is too fast	1.888	Non-Corrective
R21	Intake machine can't be set up well	1.888	Non-Corrective
R22	Intake machine's valve of hard material is opened	1.888	Non-Corrective
R24	Some of hard material are spilled out from intake machine	1.888	Non-Corrective
R27	Grinder machine's valve is opened	1.888	Non-Corrective
R30	Mixer machine's operator doesn't standby	1.888	Non-Corrective

Table 4.61 Risk Evaluation Identification (Con't)

Risk Code	Risk	RPN	Evaluation
R31	Mixer machine set up time is too long	1.888	Non-Corrective
R32	Mixer machine set up time is too fast	1.888	Non-Corrective
R33	Mixer machine can't be set up well	1.888	Non-Corrective
R34	Too much additional substances and CPO oil is filled into minibean machine	1.888	Non-Corrective
R35	Some of CPO oil are spilled out	1.888	Non-Corrective
R36	Some of additional sustances are spilled out	1.888	Non-Corrective
R37	Intake machine's valve of smooth material is opened	1.888	Non-Corrective
R38	Some smoother materials are spilled out	1.888	Non-Corrective
R45	Operator accidents happen on checking mixer machine	1.888	Non-Corrective
R46	Some gross product result are out of composition	1.888	Non-Corrective
R47	Sample taker equipments are not sterile	1.888	Non-Corrective
R48	Composition checking equipments are not sterile	1.888	Non-Corrective
R49	Pellet machine's operator doesn't standby	1.888	Non-Corrective
R50	Pellet machine set up time is too long	1.888	Non-Corrective
R51	Pellet machine set up time is too fast	1.888	Non-Corrective
R52	Pellet machine can't be set up well	1.888	Non-Corrective
R53	Some of gross produk are spilled out	1.888	Non-Corrective
R57	Pellet machine's valve is opened	1.888	Non-Corrective

Table 4.62 Risk Evaluation Identification (Con't)

Risk Code	Risk	RPN	Evaluation
R58	Some of pellet products are spilled out when pelleting process is done	1.888	Non-Corrective
R60	Some pollutants stick on pellet products	1.888	Non-Corrective
R61	There is color difference on some pellet products' surface	1.888	Non-Corrective
R62	Crumbler machine's operator doesn't standby	1.888	Non-Corrective
R63	Crumbler machine set up time is too long	1.888	Non-Corrective
R64	Crumbler machine set up time is too fast	1.888	Non-Corrective
R65	Crumbler machine can't be set up well	1.888	Non-Corrective
R66	Some of pellet products stick on intake machine's surface	1.888	Non-Corrective
R67	Some of pellet products are not castaway intentionally	1.888	Non-Corrective
R69	Crumbler machine's valve is opened	1.888	Non-Corrective
R71	Some of crumbler products are spilled out when crumbling process was done	1.888	Non-Corrective
R72	Some of pollutant substances adhere on crumbling products	1.888	Non-Corrective
R73	Cooler machine's operator doesn't standby	1.888	Non-Corrective
R74	Cooler machine set up time is too long	1.888	Non-Corrective
R75	Cooler machine set up time is too fast	1.888	Non-Corrective
R76	Cooler machine can't be set up well	1.888	Non-Corrective
R77	Some of pellet and crumbling products stick on intake machine's surface	1.888	Non-Corrective
R78	The leakage happens on intake machine's pipe	1.888	Non-Corrective

Table 4.63 Risk Evaluation Identification (Con't)

Risk Code	Risk	RPN	Evaluation
R79	Cooler machine's valve is opened	1.888	Non-Corrective
R82	Pellet and crumbling products are not fully becoming colder	1.888	Non-Corrective
R84	Sieve machine's operator doesn't standby	1.888	Non-Corrective
R85	Sieve machine set up time is too long	1.888	Non-Corrective
R86	Sieve machine set up time is too fast	1.888	Non-Corrective
R87	Sieve machine can't be set up well	1.888	Non-Corrective
R88	Some of pollutants contaminate product result that has been cold	1.888	Non-Corrective
R93	Granules settles in the bottom sieve's surface so that it can't be transferred into material storage	1.888	Non-Corrective
R95	Packaging machine's operator doesn't standby	1.888	Non-Corrective
R96	Packaging machine set up time is too long	1.888	Non-Corrective
R97	Packaging machine set up time is too fast	1.888	Non-Corrective
R98	Packaging machine can't be set up well	1.888	Non-Corrective
R101	Product barrier valve doesn't work properly	1.888	Non-Corrective
R102	Faucet valve is clogged	1.888	Non-Corrective
R106	Operator doesn't standby when products are filled into sack	1.888	Non-Corrective
R107	Packaging machine suddenly stops when filling process of finished products is done	1.888	Non-Corrective
R1	Operator do not separate raw materials into two places	1.701	Non-Corrective

Table 4.64 Risk Evaluation Identification (Con't)

Risk Code	Risk	RPN	Evaluation
R2	Operator is not standby in storage	1.701	Non-Corrective
R3	Trolley cannot work properly	1.701	Non-Corrective
R6	Minibean machine set up time is too long	1.701	Non-Corrective
R7	Minibean machine set up time is too fast	1.701	Non-Corrective
R8	Minibean machine stops suddenly in sending raw material process	1.701	Non-Corrective
R9	Minibean machine's valve is opened	1.701	Non-Corrective

4.5.2 Risk Mapping

Based on the results of the risk calculation, established risk maps are used to determine the overall risk level. The risk levels are divided into four sections, namely extreme risk, high risk medium risk, and low risk. The overall risk are plotted into the following risk maps and risk maps at figure 4.14.

LIKELIHOOD							
	Almost Certain	5					R10, R11, R103
	Likely	4			R70		
	Possible	3			R4, R5, R26, R28, R29, R39, R40, R44, R105, R109		
	Unlikely	2			R42, R43, R54, R55, R59, R83, R89, R91, R92, R94, R99, R100, R104, R108		
	Rare	1		R1, R2, R3, R6, R7, R8, R9, R14, R15, R16, R17, R18, R19, R20, R21, R22, R24, R27, R30, R31, R32, R33, R34, R35, R36, R37, R38, R45, R46, R47, R48, R49, R50, R51, R52, R53, R57, R58, R60, R61, R62, R63, R64, R65, R66, R67, R69, R71, R72, R73, R74, R75, R76, R77, R78, R79, R82, R84, R85, R86, R87, R88, R93, R95, R96, R97, R98, R101, R102, R106, R107			R12, R13, R23, R25, R41, R56, R68, R80, R81, R90, R110
			1	2	3	4	5
			Insignificant	Minor	Moderate	Major	Catastrophic
			IMPACT				
	Information :		**Extreme Risk**	**High Risk**	**Moderate Risk**	**Low Risk**	

Figure 4.14 Risk Mapping of Charoen Pokphand Business Process Risk

Based on the figure 4.14, it is shown that 110 risks are classified into four risk classification. Here is the risk classification result that is based on the figure 4.14.

Table 4.65 Risk Classification Based on Risk Map

Risk Code	Risk	RPN	Risk Classification
R10	Raw material temporary storage tank is too full	4.667	Extreme Risk
R11	Some material are spilled out from minibean machine	4.462	Extreme Risk
R103	Sack to wrap products are broken	4.462	Extreme Risk
R70	Pellet products are not fully formed into ball form	3.995	High Risk
R109	Operator misplaced finished goods to storage classification in warehouse	3.706	High Risk
R110	Handtruck machine suddenly stops when products are transferred into warehouse	3.625	Extreme Risk
R12	Operator fills additional substances and CPO oil into wrong storage	3.625	High Risk
R13	Mixing happen between additional substances and CPO oil	3.625	High Risk
R23	Intake machine stops suddenly in sending hard raw material	3.625	High Risk
R25	Grinder machine stops suddenly in grinding hard raw material	3.625	High Risk
R41	Mixer machine stops suddenly in mixing the material	3.625	High Risk
R56	Pellet machine suddenly stops on pelleting process	3.625	High Risk
R68	Crumbler machine suddenly stops when crumbling process was happening	3.625	High Risk
R80	Cooler machine suddenly stops when cooling process was done	3.625	High Risk
R81	Cooler machine's fan doesn't operate suddenly	3.625	High Risk

Table 4.66 Risk Classification Based on Risk Map (Con't)

Risk Code	Risk	RPN	Risk Classification
R90	Sieve machine suddenly stops when sieveing process is done	3.625	High Risk
R26	Hard material is not fully grinded	3.394	High Risk
R28	Some of material are still in hard form	3.394	High Risk
R29	Operator doesn't check grinder machine based on SOP	3.394	High Risk
R39	Some of pollutant are mixed with the smoother material	3.394	High Risk
R40	There is miscompotition in material mixing of each poultry classification	3.394	High Risk
R44	Operator does fault in checking mixer machine	3.394	High Risk
R105	Sack straps are less strong	3.394	High Risk
R42	Mixer machine's valve is opened	3.238	Medium Risk
R43	All material are not mixed fully on its batch	3.238	Medium Risk
R54	Some of pollutant substances are mixed with gross product	3.238	Medium Risk
R55	Some of gross product are still sticked on intake machine surface	3.238	Medium Risk
R59	Gross products are not fully form becoming pellet	3.238	Medium Risk
R4	Some of material is spilled out	3.000	Medium Risk
R5	Operator are not standby in mini bean machine	3.000	Medium Risk
R89	Sieve machine's valve is opened	2.766	Medium Risk
R91	It's too little amount of product resulted from sieveing process	2.766	Medium Risk

Table 4.67 Risk Classification Based on Risk Map (Con't)

Risk Code	Risk	RPN	Risk Classification
R92	Many impurities that escaped from the sieve	2.766	Medium Risk
R94	Operator faultness doesn't check on sieve machine based on SOP	2.766	Medium Risk
R99	The measurement of weighing machine is less accurate	2.766	Medium Risk
R100	Operator forget to reset the weight categories based on the type of packaging sacks	2.766	Medium Risk
R104	Many products are spilled during charging products	2.766	Medium Risk
R108	Sack's product wrapping is leaked	2.766	Medium Risk
R83	Operator faultness checks on products that have passed cooler machine	2.449	Medium Risk
R14	Grinding machine's operator doesn't standby	1.888	Low Risk
R15	Grinder machine set up time is too long	1.888	Low Risk
R16	Grinder machine set up time is too fast	1.888	Low Risk
R17	Grinder machine can't be set up well	1.888	Low Risk
R18	Intake machine's operator doesn't standby	1.888	Low Risk
R19	Intake machine set up time is too long	1.888	Low Risk
R20	Intake machine set up time is too fast	1.888	Low Risk
R21	Intake machine can't be set up well	1.888	Low Risk
R22	Intake machine's valve of hard material is opened	1.888	Low Risk

Table 4.68 Risk Classification Based on Risk Map (Con't)

Risk Code	Risk	RPN	Risk Classification
R24	Some of hard material are spilled out from intake machine	1.888	Low Risk
R27	Grinder machine's valve is opened	1.888	Low Risk
R30	Mixer machine's operator doesn't standby	1.888	Low Risk
R31	Mixer machine set up time is too long	1.888	Low Risk
R32	Mixer machine set up time is too fast	1.888	Low Risk
R33	Mixer machine can't be set up well	1.888	Low Risk
R34	Too much additional substances and CPO oil is filled into minibean machine	1.888	Low Risk
R35	Some of CPO oil are spilled out	1.888	Low Risk
R36	Some of additional substances are spilled out	1.888	Low Risk
R37	Intake machine's valve of smooth material is opened	1.888	Low Risk
R38	Some smoother materials are spilled out	1.888	Low Risk
R45	Operator accidents happen on checking mixer machine	1.888	Low Risk
R46	Some gross product result are out of composition	1.888	Low Risk
R47	Sample taker equipments are not sterile	1.888	Low Risk
R48	Composition checking equipments are not sterile	1.888	Low Risk
R49	Pellet machine's operator doesn't standby	1.888	Low Risk
R50	Pellet machine set up time is too long	1.888	Low Risk
R51	Pellet machine set up time is too fast	1.888	Low Risk

Table 4.69 Risk Classification Based on Risk Map (Con't)

Risk Code	Risk	RPN	Risk Classification
R52	Pellet machine can't be set up well	1.888	Low Risk
R53	Some of gross produk are spilled out	1.888	Low Risk
R57	Pellet machine's valve is opened	1.888	Low Risk
R58	Some of pellet products are spilled out when pelleting process is done	1.888	Low Risk
R60	Some pollutants stick on pellet products	1.888	Low Risk
R61	There is color difference on some pellet products' surface	1.888	Low Risk
R62	Crumbler machine's operator doesn't standby	1.888	Low Risk
R63	Crumbler machine set up time is too long	1.888	Low Risk
R64	Crumbler machine set up time is too fast	1.888	Low Risk
R65	Crumbler machine can't be set up well	1.888	Low Risk
R66	Some of pellet products stick on intake machine's surface	1.888	Low Risk
R67	Some of pellet products are not castaway intentionally	1.888	Low Risk
R69	Crumbler machine's valve is opened	1.888	Low Risk
R71	Some of crumbler products are spilled out when crumbling process was done	1.888	Low Risk
R72	Some of pollutant substances adhere on crumbling products	1.888	Low Risk
R73	Cooler machine's operator doesn't standby	1.888	Low Risk
R74	Cooler machine set up time is too long	1.888	Low Risk

Table 4.70 Risk Classification Based on Risk Map (Con't)

Risk Code	Risk	RPN	Risk Classification
R75	Cooler machine set up time is too fast	1.888	Low Risk
R76	Cooler machine can't be set up well	1.888	Low Risk
R77	Some of pellet and crumbling products stick on intake machine's surface	1.888	Low Risk
R78	The leakage happens on intake machine's pipe	1.888	Low Risk
R79	Cooler machine's valve is opened	1.888	Low Risk
R82	Pellet and crumbling products are not fully becoming colder	1.888	Low Risk
R84	Sieve machine's operator doesn't standby	1.888	Low Risk
R85	Sieve machine set up time is too long	1.888	Low Risk
R86	Sieve machine set up time is too fast	1.888	Low Risk
R87	Sieve machine can't be set up well	1.888	Low Risk
R88	Some of pollutants contaminate product result that has been cold	1.888	Low Risk
R93	Granules settles in the bottom sieve's surface so that it can't be transferred into material storage	1.888	Low Risk
R95	Packaging machine's operator doesn't standby	1.888	Low Risk
R96	Packaging machine set up time is too long	1.888	Low Risk
R97	Packaging machine set up time is too fast	1.888	Low Risk
R98	Packaging machine can't be set up well	1.888	Low Risk

Table 4.71 Risk Classification Based on Risk Map (Con't)

Risk Code	Risk	RPN	Risk Classification
R101	Product barrier valve doesn't work properly	1.888	Low Risk
R102	Faucet valve is clogged	1.888	Low Risk
R106	Operator doesn't standby when products are filled into sack	1.888	Low Risk
R107	Packaging machine suddenly stops when filling process of finished products is done	1.888	Low Risk
R1	Operator do not separate raw materials into two places	1.701	Low Risk
R2	Operator is not standby in storage	1.701	Low Risk
R3	Trolley can not work properly	1.701	Low Risk
R6	Minibean machine set up time is too long	1.701	Low Risk
R7	Minibean machine set up time is too fast	1.701	Low Risk
R8	Minibean machine stops suddenly in sending raw material process	1.701	Low Risk
R9	Minibean machine's valve is opened	1.701	Low Risk

4.6 Risk Mitigation

The establishment of mitigation efforts is given for the risk which have obtained priority to be given mitigation. Mitigation efforts will be given to risk that has “corrective” on RPN evaluation. Additionally, in granting this mitigation efforts take into consideration input from the current identification control has been carried out on Production Department PT. Charoen Pokphand Krian, Sidoarjo. So that technical matters in mitigation efforts have been adapted to the conditions existing control performed. This proposed mitigation is conducted also with expert interviews so that the results can be more representative. The following proposed mitigation efforts in table 4.72.

Table 4.72 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R10	Raw material temporary storage tank is too full	There is signing / alarm notice if tank is already full			
R110	Handtruck machine suddenly stops when products are transferred into warehouse	There is regular maintenance schedule for about twice a month			Operator will bring finished product manually
R11	Some material are spilled out from minibean machine	There is regular maintenance schedule for about once a month		The minibean valve is given something strong adhesive material / glue	
R103	Sack which is to wrap products are broken	The existence of use of standard treatment for material handling			Change to the other sack
R70	Pellet products are not fully formed into ball form	There is operational standard for machine handling that sticked in machine			Products that are still not formed into ball will be reprocessed

Table 4.73 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R109	Operator misplaced finished goods to storage calssification in warehouse	There is operator rotation for repetitive work in each shift	Operator ask truck operator to help the warehouse's operator to replace the finished goods into right place		
R12	Operator fills additional substances and CPO oil into wrong storage	There is operational standard for raw material handling that sticked clearly in warehouse			
R13	Mixing happen between additional substances and CPO oil	There is operator rotation for repetitive work in each shift			
R23	Intake machine stops suddenly in sending hard raw material	There is regular maintenance schedule for about twice a month			
R25	Grinder machine stops suddenly in grinding hard raw material	There is regular maintenance schedule for about twice a month			

Table 4.74 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R41	Mixer machine stops suddenly in mixing the material	There is regular maintenance schedule for about twice a month			
R56	Pellet machine suddenly stops on pelleting process	There is regular maintenance schedule for about twice a month			
R68	Crumbler machine suddenly stops when crumbling process was happening	There is regular maintenance schedule for about twice a month			
R80	Cooler machine suddenly stops when cooling process was done	There is regular maintenance schedule for about twice a month			
R81	Cooler machine's fan doesn't operate suddenly	There is regular maintenance schedule for about twice a month			
R90	Sieve machine suddenly stops when sieveing process is done	There is regular maintenance schedule for about twice a month			

Table 4.75 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R26	Hard material is not fully grinded	There is operational standard for machine handling that sticked in machine			Products that are still not becoming smoother will be reprocessed
R28	Some of material are still in hard form	There is reguler maintenance by giving lubricant into grinder			Products that are still in hard form will be reprocessed
R29	Operator doesn't check grinder machine based on SOP	There is sharing knowledge between senior operator and junior manager			
R39	Some of pollutant are mixed with the smoother material	There is reguler cleaning schedule of machine and other asset that is in workshop twice in a month			
R40	There is miscompotition in material mixing of each poultry classification	There is sharing knowledge between senior operator and junior manager		It is done the review session in each morning	
R44	Operator does fault in checking mixer machine	There is sharing knowledge between senior operator and junior manager			

Table 4.76 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R105	Sack straps are less strong	The existence of a regular maintenance schedule for some of the assets of the existing machines in the workshop			
R42	Mixer machine's valve is opened	There is regular maintenance schedule for about once a month		The mixer valve is given something strong adhesive material / glue	
R43	All material are not mixed fully on its batch	There is operational standard for machine handling that sticked in machine			
R54	Some of pollutant substances are mixed with gross product	There is reguler cleaning schedule of machine and other asset that is in workshop twice in a month			
R55	Some of gross product are still sticked on intake machine surface	There is reguler cleaning schedule of machine and other asset that is in workshop twice in a month			

Table 4.77 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R59	Gross products are not fully form becoming pellet	There is operational standard for machine handling that sticked in machine			Products that are still not becoming pellet will be reprocessed
R4	Some of material is spilled out	There is regular maintenance schedule for about once a month		The minibean valve is given something strong adhesive material / glue	
R5	Operator are not standby in mini bean machine	There is operator rotation for repetitive work in each shift	Minibean operator ask the other opeartor to standby in minibean machine		
R89	Sieve machine's valve is opened	There is regular maintenance schedule for about once a month		The sieve valve is given something strong adhesive material / glue	
R91	It's too little amount of product resulted from sieveing process	There is regular maintenance schedule for about once a month		The minibean valve is given something strong adhesive material / glue	
R92	Many impurities that escaped from the sieve	There is reguler cleaning schedule of machine and other asset that is in workshop twice in a month		Change the filter in sieve machine once in one month	

Table 4.78 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R94	Operator faultness doesn't check on sieve machine based on SOP	There is sharing knowledge between senior operator and junior manager		It is done the review session in each morning	
R99	The measurement of weighing machine is less accurate	There is operational standard for machine handling that sticked in machine			
R100	Operator forget to reset the weight categories based on the type of packaging sacks	An increase in the intensity of knowledge sharing activities between operators			
R104	Many products are spilled during charging products	There is operator rotation for repetitive work in each shift	Packaging operator asks help to the other operator to do packaging activities		Operator will fulfill the spilled material into sack by manually / hand
R108	Sack's product wrapping is leaked	There is operational standard for machine handling that sticked in machine		Giving the scotch tape on sack when it is leaked	

Table 4.79 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R83	Operator faultness checks on products that have passed cooler machine	There is sharing knowledge between senior operator and junior manager		It is done the review session in each morning	
R14	Grinder machine's operator doesn't standby		Grinder operator ask the other operator to stand by in grinding machine		
R15	Grinder machine set up time is too long			Adding the set up time for grinder machine	
R16	Grinder machine set up time is too fast			Reducing the set up time for grinder machine	
R17	Grinder machine can't be set up well	There is regular maintenance schedule for about twice a month			
R18	Intake machine's operator doesn't standby		Intake operator ask the other operator to stand by in intake machine		

Table 4.80 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R19	Intake machine set up time is too long			Adding the set up time for intake machine	
R20	Intake machine set up time is too fast			Reducing the set up time for intake machine	
R21	Intake machine can't be set up well	There is regular maintenance schedule for about twice a month			
R22	Intake machine's valve of hard material is opened			The intake valve is given something strong adhesive material / glue	
R24	Some of hard material are spilled out from intake machine			The minibean valve is given something strong adhesive material / glue	
R27	Grinder machine's valve is opened			The grinder valve is given something strong adhesive material / glue	

Table 4.81 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R30	Mixer machine's operator doesn't standby		Mixer operator ask the other operator to stand by in mixer machine		
R31	Mixer machine set up time is too long			Adding the set up time for mixer machine	
R32	Mixer machine set up time is too fast			Reducing the set up time for mixer machine	
R33	Mixer machine can't be set up well	There is regular maintenance schedule for about twice a month			
R34	Too much additional substances and CPO oil is filled into minibean machine	There is signing / alarm equipment if minibean is already full			

Table 4.82 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R35	Some of CPO oil are spilled out			The minibean valve is given something strong adhesive material / glue	
R36	Some of additional sustances are spilled out			The minibean valve is given something strong adhesive material / glue	
R37	Intake machine's valve of smooth material is opened			The minibean valve is given something strong adhesive material / glue	
R38	Some smoother materials are spilled out			The intake valve is given something strong adhesive material / glue	
R45	Operator accidents happen on checking mixer machine			There is punishment for operators who are not wearing safety equipment	
R46	Some gross product result are out of composition	There is regular maintenance schedule for about once a month			

Table 4.83 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R47	Sample taker equipments are not sterile	There is reguler cleaning schedule of machine and other asset that is in workshop twice in a month			
R48	Composition checking equipments are not sterile			Company provide more inspection tool	
R49	Pellet machine's operator doesn't standby		Pellet operator ask the other operator to stand by in pellet machine		
R50	Pellet machine set up time is too long			Adding the set up time for pellet machine	
R51	Pellet machine set up time is too fast			Reducing the set up time for pellet machine	
R52	Pellet machine can't be set up well	There is regular maintenance schedule for about twice a month			

Table 4.84 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R53	Some of gross produk are spilled out			The minibean valve is given something strong adhesive material / glue	
R57	Pellet machine's valve is opened			The pellet machine valve is given something strong adhesive material / glue	
R58	Some of pellet products are spilled out when pelleting process is done			The minibean valve is given something strong adhesive material / glue	
R60	Some pollutants stick on pellet products				Produce more product to replace the outspect product
R61	There is color difference on some pellet products' surface				Produce more product to replace the outspect product
R62	Crumbler machine's operator doesn't standby		Crumbler operator ask the other operator to stand by in crumbler machine		

Table 4.85 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R63	Crumbler machine set up time is too long			Adding the set up time for crumbler machine	
R64	Crumbler machine set up time is too fast			Reducing the set up time for crumbler machine	
R65	Crumbler machine can't be set up well	There is regular maintenance schedule for about twice a month			
R66	Some of pellet products stick on intake machine's surface	There is reguler cleaning schedule of machine and other asset that is in workshop twice in a month			
R67	Some of pellet products are not castaway intentionally			The crumbler machine valve is given something strong adhesive material / glue	
R69	Crumbler machine's valve is opened			The crumbler machine valve is given something strong adhesive material / glue	

Table 4.86 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R71	Some of crumbler products are spilled out when crumbling process was done			The crumbler machine valve is given something strong adhesive material / glue	
R72	Some of pollutant substances adhere on crumbling products	There is reguler cleaning schedule of machine and other asset that is in workshop twice in a month			
R73	Cooler machine's operator doesn't standby		Cooler machine operator ask the other operator to stand by in cooler machine		
R74	Cooler machine set up time is too long			Adding the set up time for cooler machine	
R75	Cooler machine set up time is too fast			Reducing the set up time for cooler machine	

Table 4.87 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R76	Cooler machine can't be set up well	There is regular maintenance schedule for about twice a month			
R77	Some of pellet and crumbling products stick on intake machine's surface	There is regular maintenance schedule for about once a month			
R78	The leakage happens on intake machine's pipe	There is regular maintenance schedule for about once a month			
R79	Cooler machine's valve is opened			The cooler machine valve is given something strong adhesive material / glue	
R82	Pellet and crumbling products are not fully becoming colder				Products that are still not becoming fully cooler will be reprocessed
R84	Sieve machine's operator doesn't standby		Sieve machine operator ask the other operator to stand by in sieve machine		

Table 4.88 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R85	Sieve machine set up time is too long			Adding the set up time for sieve machine	
R86	Sieve machine set up time is too fast			Reducing the set up time for sieve machine	
R87	Sieve machine can't be set up well	There is regular maintenance schedule for about twice a month			
R88	Some of pollutants contaminate product result that has been cold				Produce more product to replace the outspect product
R93	Granules settles in the bottom sieve's surface so that it can't be transferred into material storage	There is reguler cleaning schedule of machine and other asset that is in workshop twice in a month			

Table 4.89 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R95	Packaging machine's operator doesn't standby		Packaging machine operator ask the other operator to stand by in packaging machine		
R96	Packaging machine set up time is too long			Adding the set up time for packaging machine	
R97	Packaging machine set up time is too fast			Reducing the set up time for packaging machine	
R98	Packaging machine can't be set up well	There is regular maintenance schedule for about twice a month			
R101	Product barrier valve doesn't work properly	There is regular maintenance schedule for about once a month			
R102	Faucet valve is clogged			Company provide more spare part component for faucet valve	

Table 4.90 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R106	Operator doesn't standby when products are filled into sack		Packaging machine operator ask the other operator to stand by in packaging machine for filling product into sack		
R107	Packaging machine suddenly stops when filling process of finished products is done	There is regular maintenance schedule for about twice a month			
R1	Operator do not separate raw materials into two places			It is done the review session in each morning	
R2	Operator is not standby in storage		Storage operator ask the other operator to stand by in storage		
R3	Trolley cannot work properly	There is regular maintenance schedule for about once a month			

Table 4.91 Proposed Risk Mitigation of Charoen Pokphand Business Process Risk (Con't)

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R6	Minibean machine set up time is too long			Adding the set up time for minibean machine	
R7	Minibean machine set up time is too fast			Reducing the set up time for minibean machine	
R8	Minibean machine stops suddenly in sending raw material process	There is regular maintenance schedule for about twice a month			
R9	Minibean machine's valve is opened			The minibean valve is given something strong adhesive material / glue	

4.7 Risk Profile Dashboard on Macro Excel Creation

This section will be explained about the creation of Macro Risk Profile in Excel. Making the Excel macros is intended to facilitate the user in accessing risk profile of Production Department's business process PT. Charoen Pokphand Krian, Sidoarjo. Risk Profile making requires data on risk assessment that has been processed in the previous section, which are as follows:

1. Results Identification of Business Processes
2. Risk Identification Results of Each Activity in Business Process
3. Risk Mapping Results
4. Results Establishment of Risk Mitigation

These data are formed and arranged with Excel macros. So, that monitoring can be done on potential failures that might occur. The following steps use an excel macro risk profile of Production Department Business Process PT. Charoen Pokphand Krian, Sidoarjo:

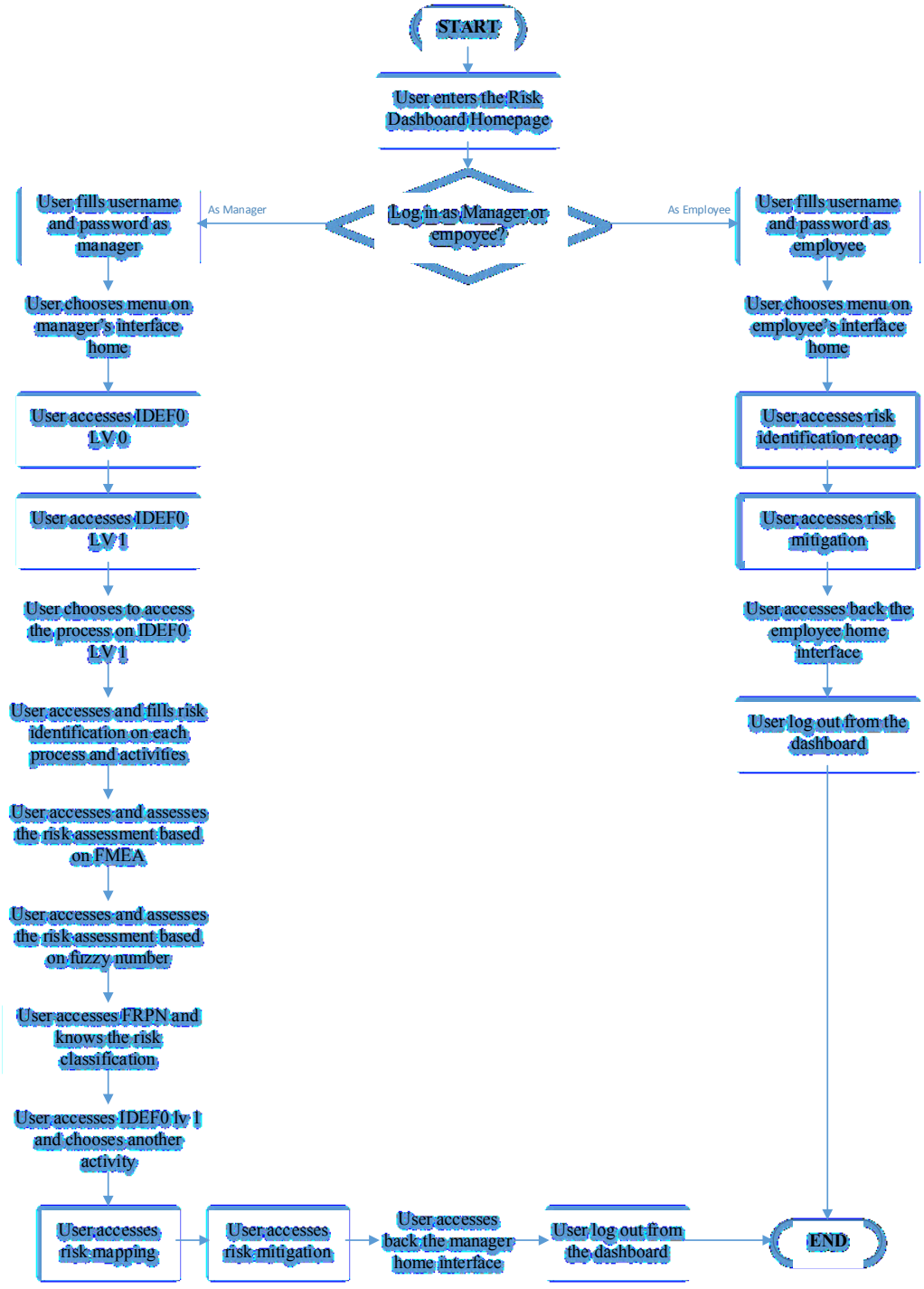


Figure 4.15 Dashboard Flowchart

Based on figure 4.15, users can access the appropriate steps of risk profile which has been described. The using of risk profile is divided into two systems, namely login as manager and login as employee. The first system can access the whole of risk processing, start from identification until assessment process. But the second system can only access the recap of risk identification and risk mitigation.

CHAPTER 5
DATA ANALYSIS AND INTERPRETATION

This chapter discusses the analysis and interpretation of result of the data collection and processing in previous chapter. This analyzes consist of business process analysis, risk analysis, risk classification analysis, mitigation efforts analysis and risk profile dashboard of macro excel.

5.1 Business Process Analysis

Analyzing the business processes is conducting an analysis of each business process that occurs by the process of production of animal feed. Mapping business processes in this research uses IDEF0. Starting from raw material separation, grinding process, the process of mixing the ingredients, pelleting process, the process of crumbling, the process of cooling, the process of sieving, and the process of packaging.

5.1.1 Raw Material Separating Business Process

The first activity that occur are operator separating raw material hard and soft when raw material warehouse. In this activity when the raw material wrapped in sacks coming into the warehouse are carried by truck. Raw material in the truck consists of two types of material are smooth material and rough material. After that, the operator carries sacks of raw material into the temporary storage casks using the trolley. In this activity, material which was originally encased then the material is inserted into the storage casks. The next step is operator sets up mini bean machine. Setting up the engine is done before the material was taken from the temporary storage cask into the storage cask that is located on the top floor. The next activity is the process of sending material into the cask storage using the minibean machine. In addition, there is material in the form of additional substances and the CPO to be separated in the storage.

Risks that occur in each of the activities is contained in the overall business process. This is due to the potential failure of existing activities in business processes production department of PT. Charoen Pokphand Indonesia. Activity

code A1-1 to A1-5 are potential failures of each respective activity. Therefore it is necessary doing risk identification of each activity.

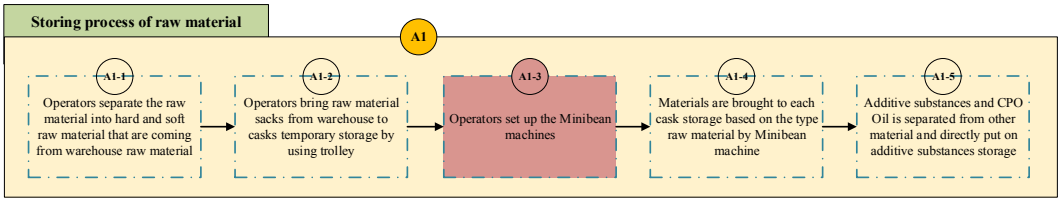


Figure 5.1 Storing Process of Raw Material Flow

One of the risks that happen to this process is minibean machine suddenly stop. This risk may be occurred on activity A1-3. It is shown in figure 5.1. This risk is classified as high risk because it happen on the middle of the process. If activity A1-3 stop because of this risk there will be much loss occur and make the following process stopped too. So, "minibean machine suddenly stop" include as high risk.

Raw material separation is an important process that must be considered because if there is mixing of raw materials, the production process cannot run smoothly, and can cause loss in production time which will become increasingly longer and production costs will be higher because of the process stopped. Raw material for producing animal feed consisting of rough material such as corn and soybeans. Smooth raw material consists of bran and corn flour. Additional raw material consists of meat bone meal, palm oil meal, corn gluten meal, fish meal, feather meal, cotton seed flour, groats, rock flour, rape seed meal, CPO oil, and premix.

5.1.2 Grinding Processing Business Process

The next business process is grinding process. The first activity that occur is operator sets up the grinding machine. Before the grinding process is running, the operator must set up first the grinding machine. The next step is setting up machine operator intake. The next activity is delivery of rough material into the grinding machine by using the intake machine. Then the next activity, namely rough material is formed into smooth shape by help of grinding machines. After that the next activity is operator checks whether the grinding machine running well or not.

Risks, which occurs in each of the activities are contained in the overall business process. This is due to the potential failure of existing activities in business processes production department of PT. Charoen Pokphand Indonesia. Activity

code A2-1 to A2-5 are potential failures of each respective activity. Therefore it is necessary doing risk identification of each activity.

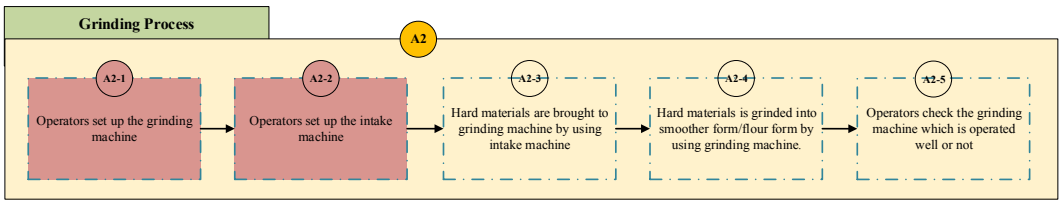


Figure 5.2 Grinding Process Flow

One of the risks that happen to this process is grinding machine and intake machine suddenly stop. This risk may be occurred on activity A2-1, and A2-2. It is shown in figure 5.2. This risk is classified as high risk because it happen on the beginning of the process. If activity A2-1 or A2-2 stop because of this risk there will be much loss occur and make the following process stopped too. So those risk include as high risk.

Business process of grinding process is one important process because in it there is the activity of set up machine. Setting up machine activity has become a major role in the production process. Because if the setting up machine is too long will cause the machine performance was not optimal, otherwise if the setting up machine is too quickly can lead to decreased engine lifetime. So that the operator should be careful in handling the machine setting up time in the business process. In addition, other important activities is the operator checks the grinding machine. Because if the product cannot be formed into smooth will cause the number of products to be reduced. So that, operator must be carefully when adjusting grinding machine speed in processing material.

5.1.3 Material Mixing Business Process

The next business process is mixing the material with the help of a mixer machine. The first activity is the mixing process. Operator sets up mixer machine. In this activity before starting the mixing process, the setting up process is done first mixer machine. Next activity is operators prepare additives and CPO oil and placed on the minibean machine. Then the next activity is smoother material brought into the mixer engine using intake engine. The next activity is operator checks whether the mixer machine operates properly or not. Next activity is the operator control the quality of the gross product that has been processed on mixer

machine. In this activity operators inspect samples of products. Product samples will be tested by testing tools in the laboratory.

Risks that occur in each of the activities is contained in the overall business process. This is due to the potential failure of existing activities in business processes production department of PT. Charoen Pokphand Indonesia. On activity code A3-1 to A3-6 are potential failures of each respective activity. Therefore it is necessary doing risk identification of each activity.

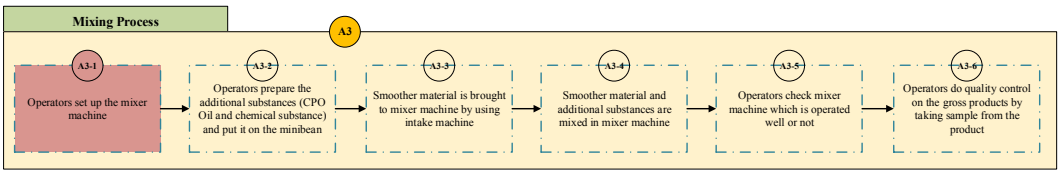


Figure 5.3 Mixing Process Flow

One of the risks that happen to this process is mixing machine suddenly stop. This risk may be occurred on activity A3-1. It is shown in figure 5.3. This risk is classified as high risk because it happen on the beginning of the process. If activity A3-1 stop because of this risk there will be much loss occur and make the following process stopped too. So those risk include as high risk.

Mixing business processes is one important process because there is a setting up mixer machine activity. Setting up machine activity has become a major role in the production process because if the machine is set up for too long will cause machine performance was not optimal, otherwise if the machine is set up too quickly can lead to decreased machine lifetime. Besides other important activities is operators inspect a sample of the mixer product. In this case the operator must be careful in checking product sample by using a sample checker, because checker tools must be sterile because from pollutant. If the fodder checker tools is not sterile eat will cause defect product.

5.1.4 Pellet Making Business Process

The next process is the pellet products making. The first activity operator is setting up the pellet machine. This activity prior to the pellet-making process that is helped by using a pellet machine, firstly operator should set up the machine. After that the next activity is delivery of the gross product of the mixing process towards pellet machine with the help of the intake machine. After that the next activity is

gross product will be transformed into a small cylindrical shape (pellets) using pellet machine. After that the next activity operator is checking pellet machine whether operating or not properly.

Risks that occur in each of the activities is contained in the overall business process. This is due to the potential failure of existing activities in business processes production department of PT. Charoen Pokphand Indonesia. On activity code A4-1 to A4-4 are potential failures of each respective activity. Therefore it is necessary doing risk identification of each activity.

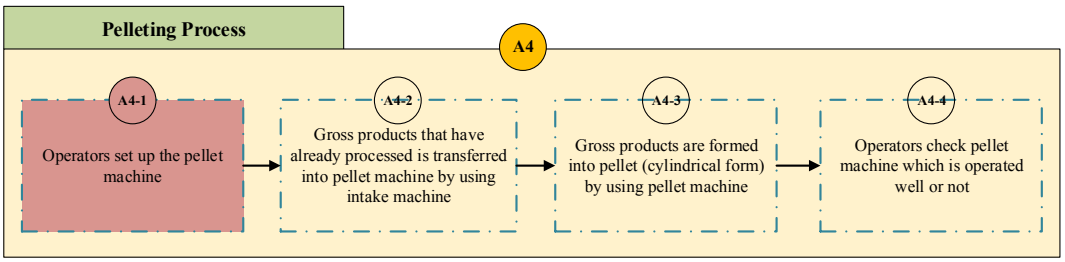


Figure 5.4 Pelleting Process Flow

One of the risks that happen to this process is pelleting machine suddenly stop. This risk may be occurred on activity A4-1. It is shown in figure 5.4. This risk is classified as high risk because it happen on the beginning of the process. If activity A4-1 stop because of this risk there will be much loss occur and make the following process stopped too. So those risk include as high risk.

Business process pelleting process is one important process because there is machine setting up activity. Setting up machine activity has become a major role in the production process. Because if the setting up machine is too long will cause the machine performance was not optimal, otherwise if the machine setting up heating too quickly can lead to decreased engine lifetime. In addition, other important activity is the operator to check the pelleting machine. Because if the product cannot be formed into a small cylindrical shape overall will cause the number of products to be reduced. The next activity is transferring gross product (mixing process result) into pellet machine by using intake machine. The next activity is pellet making (small cylindrical form) by using pellet machine. Then the next activity is checking the pellet machine whether can operate well or not.

5.1.5 Crumbling Making Business Process

The next business process is making the product crumbling (ball shape), there are some activities that make up the business process. The first activity is setting up crumble machine. In this activity, before making crumbling product that is helped by using crumble machine, firstly operator set up the crumble machine.

Risks that occur in each of the activities is contained in the overall business process. This is due to the potential failure of existing activities in business processes production department of PT. Charoen Pokphand Indonesia. On activity code A5-1 to A5-4 are potential failures of each respective activity. Therefore it is necessary doing risk identification of each activity.

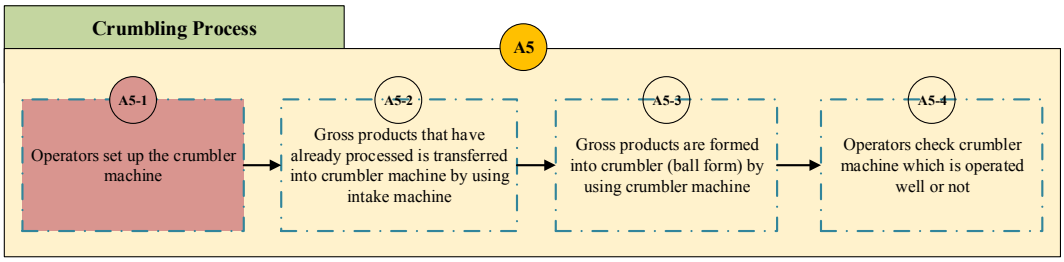


Figure 5.5 Crumbling Process Flow

One of the risks that happen to this process is crumbling machine suddenly stop. This risk may be occurred on activity A5-1. It is shown in figure 5.5. This risk is classified as high risk because it happen on the beginning of the process. If activity A5-1 stop because of this risk there will be much loss occur and make the following process stopped too. So those risk include as high risk

Business process of crumbling process is one of important process. These process need setting up machine activity. This setting up machine activity becomes main role in production process. This is caused by the duration of machine set up. If the machine set up time is too long, it will make machine performance not maximum. Vice versa, if machine set up time is too quick, it will cause machine lifetime decline. Moreover, the other important activity is operator does the checking on crumble machine because if the products cannot be formed become small balls overall. And it will make the amount of product decrease. After that the next activity is transferring gross product (mixing result product) into crumble machine by using intake machine. The next activity is forming process into small

balls (crumbler). Then the next activity is checking crumble machine whether it can be operated well or not.

5.1.6 Product Cooling Business Process

The next business process is the cooling process. There are several acitivities inside this cooling process. The first activity is the operator sets up cooler machine. In this activity before doing cooling activity on the product either pellet or crumbling, is doing the warm up activity. The next activity is the product pellet and crumble brought to the cooling machine using the machine intake. Then the subsequent activity is cooling process on the product hot pellets and crumble which is made by the help of cooler machine. The next activity is operator checks cooler machine whether the machine operates smoothly or not.

Risks that occur in each of the activities is contained in the overall business process. This is due to the potential failure of existing activities in business processes production department of PT. Charoen Pokphand Indonesia. On activity code A6-1 to A6-4 are potential failures of each respective activity. Therefore it is necessary doing risk identification of each activity.

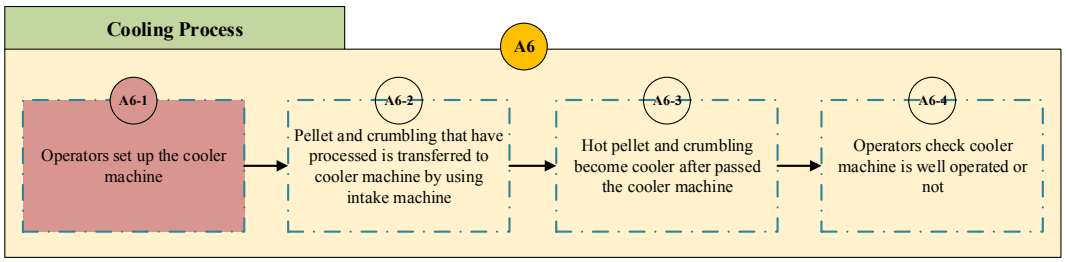


Figure 5.6 Cooling Process Flow

One of the risks that happen to this process is cooler machine suddenly stop. This risk may be occurred on activity A6-1. It is shown in figure 5.6. This risk is classified as high risk because it happen on the beginning of the process. If activity A6-1 stop because of this risk there will be much loss occur and make the following process stopped too. So those risk include as high risk

Business process of cooling process is one important process because in this activity there is set up the machine where the engine warm-up activity has become a major role in the production process. If the engine warm for too long will

cause the engine performance was not optimal, otherwise if the engine heating too quickly can lead to decreased engine lifetime. Also in the engine cooler there are many critical components will lead to failure, one of which is fan in the engine. If the fan does not work optimally, will cause products can not entirely be cold. Therefore, the operator must be careful in heat and check the condition of the engine.

5.1.7 Product Sieving Business Process

The next business process is sieving process. This sieving process consists of several activities. The first activity is operator sets up sieving machine (sieve). In this activity before doing the sieving activity, sieving machine will be set up is carried out beforehand. Then the subsequent activity is the cooled product pellet and crumble brought to the sieving machine with the help of the intake machine. Then the subsequent activity product pellet and crumble are separated or in the filter of impurities with the help of sieve machines. Then the subsequent activity is waste products siftings reprocessed and transferred into the storage vat material by using intake machine. The next activity is operator check the sieve machine operates properly or not.

Risks that occur in each of the activities is contained in the overall business process. This is due to the potential failure of existing activities in business processes production department of PT. Charoen Pokphand Indonesia. On activity code A7-1 to A7-5 are potential failures of each respective activity. Therefore it is necessary doing risk identification of each activity.

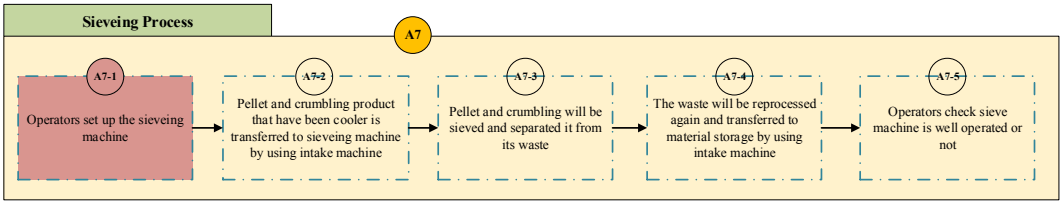


Figure 5.7 Sieving Process Flow

One of the risks that happen to this process is sieving machine suddenly stop. This risk may be occurred on activity A7-1. It is shown in figure 5.7. This risk is classified as high risk because it happen on the beginning of the process. If

activity A7-1 stop because of this risk there will be much loss occur and make the following process stopped too. So those risk include as high risk

Business process of sieving process is one important process because in it there is the activity of heat machine where the engine warm-up activity has become a major role in the production process. Because if the engine warm for too long will cause the engine performance was not optimal, otherwise if the engine heating too quickly can lead to decreased engine lifetime. Also in the sieve machine there are many critical components will lead to failure, one of which filter in the engine. If the filters are still many dirt can cause the product cannot be separated from impurities. Therefore, the operator must be careful in heat and check the condition of the engine.

5.1.8 Product Packaging Business Process

The next business process is the process of packing or packaging. This business process consists of several activities. The first activity is operator sets up the packaging machine operator. In this activity the engine warm up activities should first be done before packing activity. Because the heating activity is the most important element which will affect the activity heating performance of the machine. Then the next activity product pellet and crumble weighed first by using machine weights that are in the packaging machine before the product is wrapped in a sack. Then the next activity is the product pellet and crumble into a sack filled with big faucets use in packaging machines. Then the next activity is the operator adjust the location and position of the bag with the tap of a packaging machine while before the animal feed product is loaded into sacks. Then the next activity is the operator brings finished product in the form of sacks toward the warehouse of finished products with the help of machinery hand truck.

Risks that occur in each of the activities is contained in the overall business process. This is due to the potential failure of existing activities in business processes production department of PT. Charoen Pokphand Indonesia. On activity code A8-1 to A8-5 are potential failures of each respective activity. Therefore it is necessary doing risk identification of each activity.

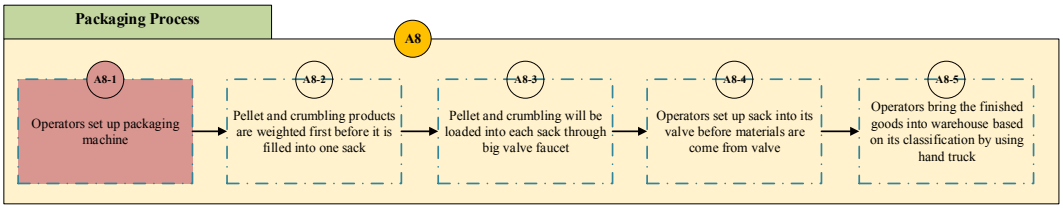


Figure 5.8 Packaging Process Flow

One of the risks that happen to this process is packaging machine suddenly stop. This risk may be occurred on activity A8-1. It is shown in figure 5.8. This risk is classified as high risk because it happen on the beginning of the process. If activity A8-1 stop because of this risk there will be much loss occur and make the following process stopped too. So those risk include as high risk

Business process of packing process is one important process because in this activity contain machine heating, where the engine warm-up activity has become a major role in the production process. Because if the engine warm for too long will cause the engine performance becomes not optimal, otherwise if the engine heating too quickly can lead to decreased engine lifetime. Also in the sieve machine there are many critical components will lead to failure, one of which filter in the engine. If the filters are still many dirt can cause the product cannot be separated from impurities. Therefore, the operator must be careful in heating and checking the condition of the engine.

5.2 Risk Analysis

Chapter 4 has already explained about risk identification by using fault tree analysis. The risk identification is done by using Fault Tree Analysis. Risk is created from business process of production department in Charoen Pokphand Krian, Sidoarjo. This business process is broken down until the smallest sub process or it can be called as activity. From that activities come up the probability of negative event or it can be called as a risk. There are 110 risks resulted from Fault Tree Analysis identification.

One example of risk identification by using FTA is on activity A1-2. That activity can be broken down into negative event or risk. Those are (R2) Operator is not standby in storage, (R3) Trolley can’t work properly, and (R4) some materials are spilled out. Those risk may happen any time at certain probability. Based on the

risk identification result the next step is identifying potential effect, risk driver, and risk control. Potential effect is showing the impact may occur when the risk is happen. Usually potential effect is used to measure the level of impact in assessing risk score. Risk driver is showing the cause of risk that may happen. Risk driver is used to calculate the probability of risk happen. Rrisk control is showing the activity that can control or reduce the probability risk to happen. Risk control is will be used for determining existing control rate that has done and used to assess the detection score.

One of the example of determining potential effect, risk drives, and risk control is on risk R3 "Trolley can't work properly of transferring raw material into temporary storage". The potential effect of this risk is operator must lift up the sack manually. The risk driver of this risk is there is no regular maintenance schedule for company assets especially for trolley. And the risk control of this risk is there is regular maintenance scheduling for company assets.

There are 3 risks that are classified as extreme risk. First risk is raw material temporary storage tank is too full. This risk includes in extreme risk because the risk driver happen so often. The effect when this risk happen is some material will be spilled out and the dangerous condition is production flow is blocked. This condition will cause the production time will be longer and cause lot of losses. And if this risk will happen, it will disturb to the business process.

Second risk is some material are spilled out from minibean machine. This risk includes in extreme risk because the risk driver happen so often. The effect when this risk happen is some material will be spilled out, between material CPO oil and additional substance will be mixed each other, and the dangerous condition is production flow is blocked. This condition will cause the production time will be longer and cause lot of losses. If this risk will happen, it will disturb to the business process.

Third risk is finished product sack is broken. This risk includes in extreme risk because the risk driver happen so often. The cause of this risk happen is some product sack leaked. The effect when this risk happen is finished goods will be spilled out. And it will make the amount of products will decrease. Then it cause losses. If this risk will happen, it will disturb to the business process.

5.3 Risk Assessment Analysis

This analysis describes about risk assessment that is already assessed on chapter 4. Risks that are obtained from the identification of the business process are assessed by using fuzzy FMEA. Fuzzy FMEA is used to reduce the subjective perspective from the expert when scoring the risks. This analysis is done for knowing the critical risk that may be happen. Those method considers on three aspects, namely likelihood, impact, and detection. Likelihood score is come from the assessment of risk driver. Impact score is come from the assessment of potential effect. Detection is come from the assessment of risk control. Results of calculation fuzzy FMEA, will be used as the basis for determining priorities and the handling of priority levels of risk.

After getting those three kinds of assessment, then it is done the Fuzzy Risk Priority Number (FRPN) by certain formula to get the aggregation number of each factors. Then from those aggregation number is multiplied each other and become FRPN. Before doing the assessment it is also done determining the fuzzy number of each factors. Based on the result of multiplication of aggregation risk number on three factors is gotten the highest value of FRPN is R10 and R110 with FRPN score is 4.667. And the lowest value of FRPN is R1, R2, R3, R6, R7, R8, and R9 with the score is 1.701.

Those risk code R10 is raw material temporary storage tank is too full that likely happen on activity A1-4 “Materials are brought to each storage based on the type of raw material by using minibean machine”. That activity is identified the potential effect namely some materials that cannot be accommodated in storage tank with the score 5. It means that those potential effect gives the biggest effect on that activity. Then for risk driver namely operator doesn’t pay attention with storage tank condition before filling material is given score 5. It means also this risk driver is happen with the probability 75% happen in 3 years. And for risk control namely there is signing or alarm tools if tank is already full is given score 5. It means that the level detection of this risk is almost uncertain. Because the alarm or signing tool is not yet installed this risk cannot be detected well. Those reason is considered by the expert for giving the detection score is 5. Based on that result, it will affect the

FRPN value become the highest score. And this risk should be evaluated by using corrective way.

5.4 Risk Mapping Analysis

This analysis describes about risk mapping that has already done on chapter 4. This mapping is used to classify the risks based on their likelihood and impact score. There are 4 classes of risk classification, namely extreme risk, high risk, moderate risk, and low risk. Risk mapping consists of 2 axis, those are x-axis for impact score and y-axis for likelihood score. Based on the assessment that are already done by interviewing production department manager, 110 risks are classified into four class.

Table 5.1 Risk Classification Recapitulation

Risk Classification	Risk Code
Extreme Risk	R10, R11, R103, R110
High Risk	R70, R4, R5, R26, R28, R29, R39, R40, R44, R105, R109, R12, R13, R23, R25, R41, R56, R68, R80, R81, R90
Moderate Risk	R42, R43, R54, R55, R59, R83, R89, R91, R92, R94, R99, R100, R104, R108
Low Risk	R1, R2, R3, R6, R7, R8, R9, R14, R15, R16, R17, R18, R19, R20, R21, R22, R24, R27, R30, R31, R32, R33, R34, R35, R36, R37, R38, R45, R46, R47, R48, R49, R50, R51, R52, R53, R57, R58, R60, R61, R62, R63, R64, R65, R66, R67, R69, R71, R72, R73, R74, R75, R76, R77, R78, R79, R82, R84, R85, R86, R87, R88, R93, R95, R96, R97, R98, R101, R102, R106, R107

From those result the risks that are classified into extreme, high and moderate risk will be done the mitigation process.

5.5 Mitigations and Recommendations Analysis

This analysis describes about risk mitigation that will be applied on the company. The mitigation effort is given to the risk that has corrective risk evaluation result. There are 39 risks that have corrective risk evaluation result. There are four kinds of risk treatment in mitigation, namely mitigate risk, avoid risk, transfer risk, and accept risk. Based on the mitigation effort making that already done in in sub chapter 4.5, risk mitigation is done to reduce the impact because reducing the risk happen is too difficult.

Here is the recapitulation of each risk treatment on mitigation process. There are 59 ways to mitigate the risk. Then there are 47 ways to avoid the risk. Then there are 13 ways to transfer the risk. And there are 11 ways to accept the risk. And here is the risk treatment proportion in pie diagram.

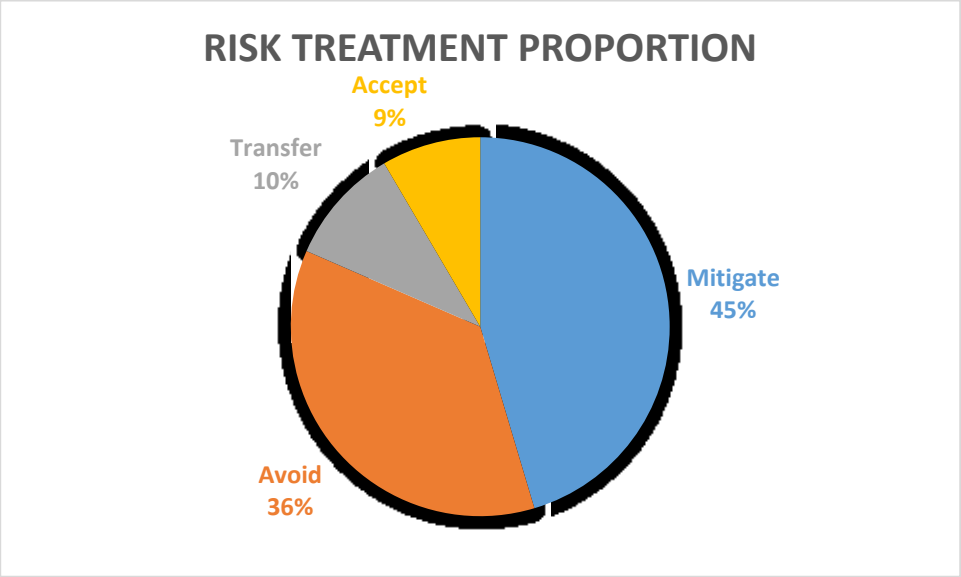


Figure 5.9 Risk Treatment Proportion

Based on the proportion in figure 5.1, the highest proportion on treatment of mitigation efforts is resulted on mitigate risk. That is caused by business process running which is continue implementation and too difficult if it is given the avoid treatment at the whole risks. These technical issues have been discussed with the expert in charge of implementing business processes fodder production PT Charoen Pokphand Krian, Sidoarjo. Results of mitigation is provided in the company to mitigate the risks that exist in implementation of business process at PT. Charoen Pokphand.

5.6 Risk Dashboard Analysis

Risk Dashboard Macro Excel analysis will be explained about the function and used of each part which is shown from the making macro excel. The main display on the risk dashboard excel macro is the risk profile home of business process IDEF0 of poultry feed production process at PT. Charoen Pokphand Krian, Sidoarjo. The parts are contained in the home risk profile include shortcut of each business process activities, shortcut whole business process, shortcut overall risk,

risk mapping results shortcut, and the shortcut risk mitigation efforts. Here are the display of some parts in risk dashboard.

a. Dashboard Home Interface

Here is the display of risk dashboard home interface.

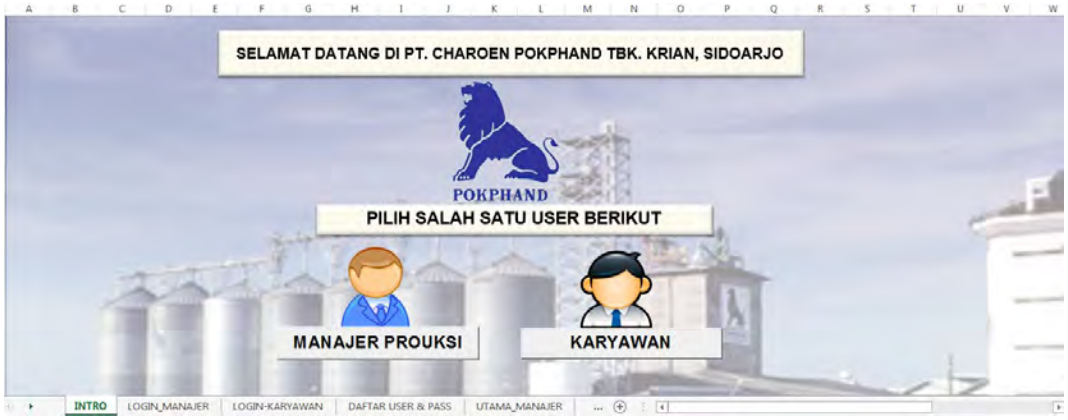


Figure 5.10 Risk Dashboard Home Interface

Based on figure 5.2, to access risk dashboard, the dashboard systems are divided into two kinds (manager system, and employee system). It is caused by the manager who has authority to input the risk data and access the risk score. On the contrary, employee can only see the risk data recap, and the mitigation efforts that company will apply.

b. Manager Home User Interface

Here is the display of manager's home interface.

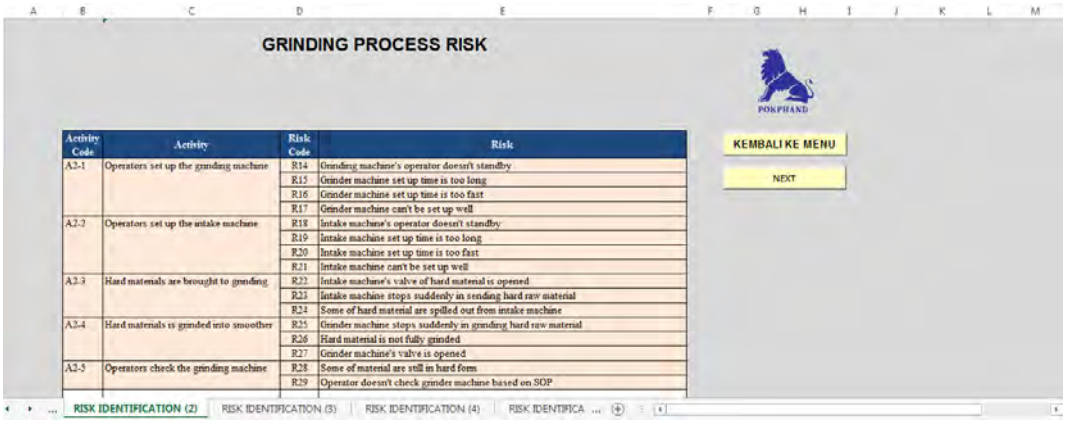
Figure 5.11 Manager's Home Interface

It can be shown on figure 5.3, that manager has priority to access and to update the risk factor on each activity. Besides updating risk factor, manager can also give risk score assessment. It is proven by the menu button on figure 5.3. There

are some buttons, such as IDEF0 LV 0, IDEF0 LV 1, Risk Mapping, Risk Mitigate, and Log Out. IDEF0 LV 1 button is important button because it used to access the risks on each activity in each business processes. And Log Out button is used to come out from the system.

c. Risk Identification User Interface

Here is the risk identification interface display.



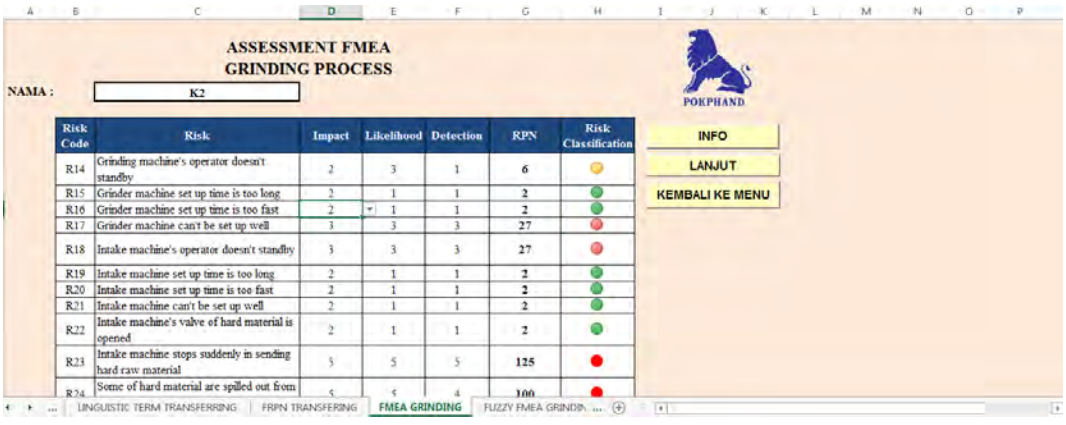
Activity Code	Activity	Risk Code	Risk
A2-1	Operators set up the grinding machine	R14	Grinding machine's operator doesn't standby
		R15	Grinder machine set up time is too long
		R16	Grinder machine set up time is too fast
		R17	Grinder machine can't be set up well
A2-2	Operators set up the intake machine	R18	Intake machine's operator doesn't standby
		R19	Intake machine set up time is too long
		R20	Intake machine set up time is too fast
		R21	Intake machine can't be set up well
A2-3	Hard materials are brought to grinding	R22	Intake machine's valve of hard material is opened
		R23	Intake machine stops suddenly in sending hard raw material
		R24	Some of hard material are spilled out from intake machine
A2-4	Hard materials is grinded into smoother	R25	Grinder machine stops suddenly in grinding hard raw material
		R26	Hard material is not fully grinded
		R27	Grinder machine's valve is opened
A2-5	Operators check the grinding machine	R28	Some of material are still in hard form
		R29	Operator doesn't check grinder machine based on SOP

Figure 5.12 Risk Identification Interface

This interface is used to updating the risks on each activity. It is shown on figure 5.4. This interface can be only assessed by manager. Employee couldn't update this page.

d. FMEA Assessment User Interface

Here is the FMEA assessment interface display.



Risk Code	Risk	Impact	Likelihood	Detection	RPN	Risk Classification
R14	Grinding machine's operator doesn't standby	2	3	1	6	
R15	Grinder machine set up time is too long	2	1	1	2	
R16	Grinder machine set up time is too fast	2	1	1	2	
R17	Grinder machine can't be set up well	3	3	3	27	
R18	Intake machine's operator doesn't standby	3	3	3	27	
R19	Intake machine set up time is too long	2	1	1	2	
R20	Intake machine set up time is too fast	2	1	1	2	
R21	Intake machine can't be set up well	2	1	1	2	
R22	Intake machine's valve of hard material is opened	2	1	1	2	
R23	Intake machine stops suddenly in sending hard raw material	5	5	5	125	
R24	Some of hard material are spilled out from	5	5	4	100	

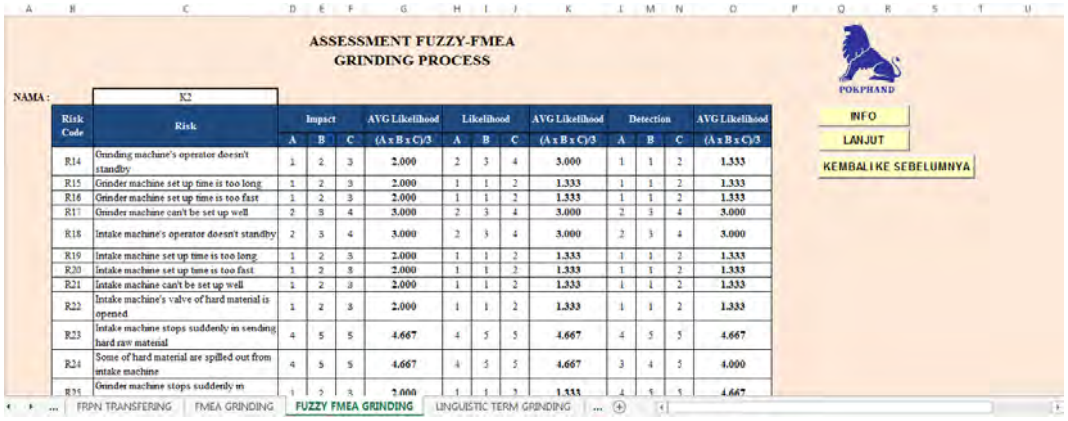
Figure 5.13 FMEA Assessment Interface

This interface is used to accessing risk score based on likelihood, impact and detection factor. The RPN (Risk Priority Number) formula is Likelihood x Impact x Detection. As shown at figure 5.5, the risks list is updated automatically

based on previous page. The risk classification color is automatically updated as manager change the impact and likelihood score.

e. Fuzzy FMEA User Interface

Here is the Fuzzy FMEA assessment user interface display.



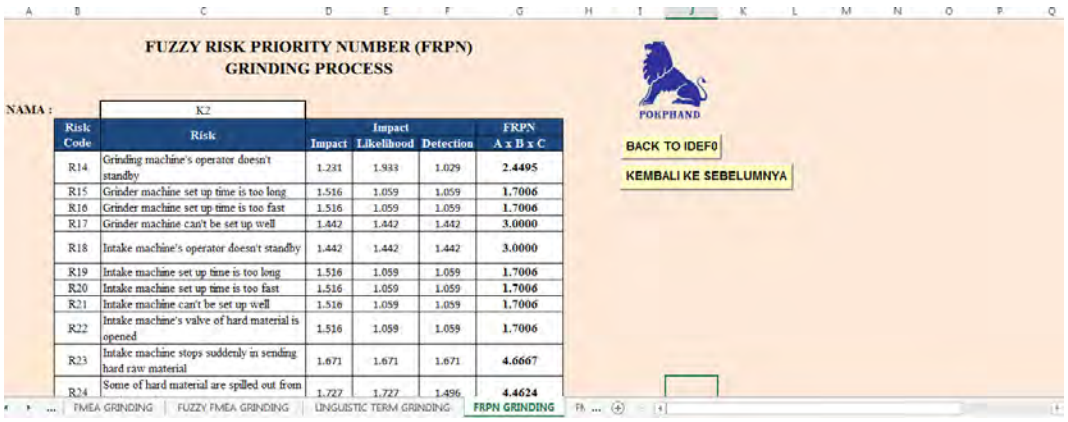
Risk Code	Risk	Impact			AVG Likelihood	Likelihood			AVG Likelihood	Detection			AVG Likelihood
		A	B	C	(A x B x C)/3	A	B	C	(A x B x C)/3	A	B	C	(A x B x C)/3
R14	Grinding machine's operator doesn't standby	1	2	3	2.000	2	3	4	3.000	1	1	2	1.333
R15	Grinder machine set up time is too long	1	2	3	2.000	1	1	2	1.333	1	1	2	1.333
R16	Grinder machine set up time is too fast	1	2	3	2.000	1	1	2	1.333	1	1	2	1.333
R17	Grinder machine can't be set up well	2	3	4	3.000	2	3	4	3.000	2	3	4	3.000
R18	Intake machine's operator doesn't standby	2	3	4	3.000	2	3	4	3.000	2	3	4	3.000
R19	Intake machine set up time is too long	1	2	3	2.000	1	1	2	1.333	1	1	2	1.333
R20	Intake machine set up time is too fast	1	2	3	2.000	1	1	2	1.333	1	1	2	1.333
R21	Intake machine can't be set up well	1	2	3	2.000	1	1	2	1.333	1	1	2	1.333
R22	Intake machine's valve of hard material is opened	1	2	3	2.000	1	1	2	1.333	1	1	2	1.333
R23	Intake machine stops suddenly in sending hard raw material	4	5	5	4.667	4	5	5	4.667	4	5	5	4.667
R24	Some of hard material are spilled out from intake machine	4	5	5	4.667	4	5	5	4.667	3	4	5	4.000
R25	Grinder machine stops suddenly in	1	2	3	2.000	1	1	2	1.333	4	5	5	4.667

Figure 5.14 Fuzzy FMEA User Interface

This interface is used to give the fuzzy score based on FMEA score in previous page. The fuzzy number in each factor will change automatically as user change the FMEA score. The formula of AVG likelihood, impact, and detection is average of triangular fuzzy number in each factor.

f. Fuzzy Risk Priority Number (FRPN) User Interface

Here is the fuzzy risk priority number user interface display.



Risk Code	Risk	Impact	Likelihood	Detection	FRPN A x B x C
R14	Grinding machine's operator doesn't standby	1.231	1.933	1.029	2.4495
R15	Grinder machine set up time is too long	1.516	1.059	1.059	1.7006
R16	Grinder machine set up time is too fast	1.516	1.059	1.059	1.7006
R17	Grinder machine can't be set up well	1.442	1.442	1.442	3.0000
R18	Intake machine's operator doesn't standby	1.442	1.442	1.442	3.0000
R19	Intake machine set up time is too long	1.516	1.059	1.059	1.7006
R20	Intake machine set up time is too fast	1.516	1.059	1.059	1.7006
R21	Intake machine can't be set up well	1.516	1.059	1.059	1.7006
R22	Intake machine's valve of hard material is opened	1.516	1.059	1.059	1.7006
R23	Intake machine stops suddenly in sending hard raw material	1.671	1.671	1.671	4.6667
R24	Some of hard material are spilled out from	1.727	1.727	1.496	4.4624

Figure 5.15 Fuzzy Risk Priority Number (FRPN) User Interface

This interface is used to access the FRPN of each risks. The formula of each factor likelihood, impact, and detection have stated on previous chapter. And FRPN formula is only the average of likelihood, impact, and detection score. The

button “Back To IDEF0” is used to accessing back IDEF0 LV 1 interface and can access to other activities.

g. Risk Recapitulation Dashboard User Interface

Here is the risk recapitulation dashboard user interface display.

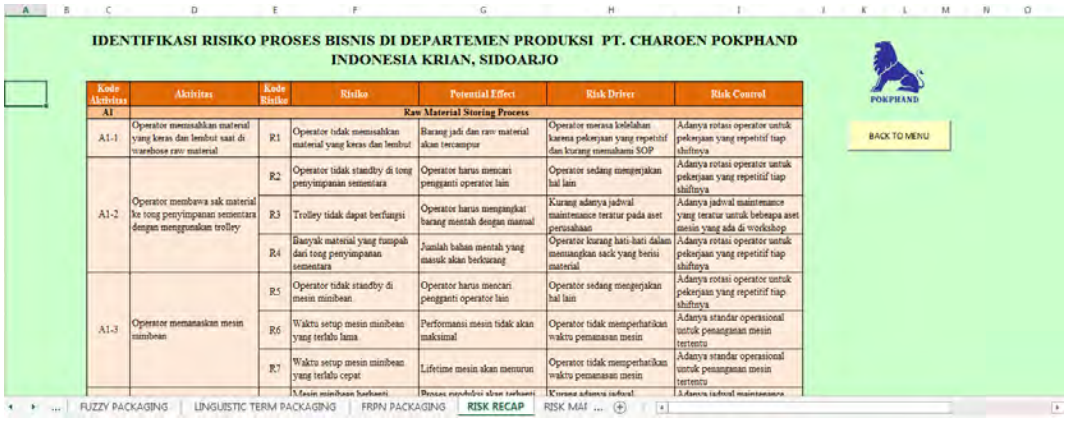


Figure 5.16 Risk Recapitulation User Interface

This interface is used to list the risk recap that has already updated by manager. This interface can be only accessed by employee.

h. Risk Mapping Dashboard User Interface

Here is the risk mapping dashboard user interface display.

Figure 5.17 Risk Mapping Dashboard User Interface

This interface is used to show the risk mapping. This is resulted from risk assessment on each factors (likelihood, impact, and detection). This interface can be accessed by both of production manager and employee.

i. Risk Mitigation Dashboard User Interface

Here is the risk mitigation dashboard user interface display.

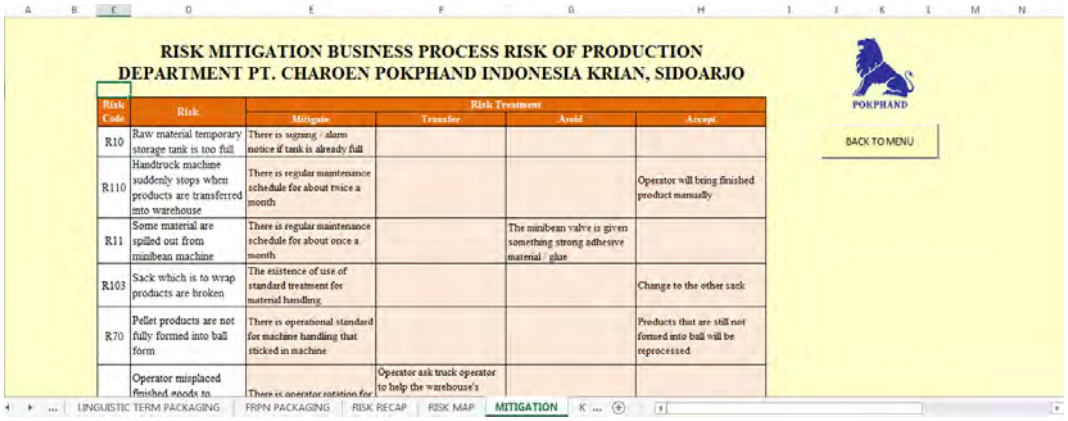


Figure 5.18 Risk Mitigation Dashboard User Interface

This interface is used to show the mitigation process. This page can be accessed by both of production manager and employee.

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CHAPTER 6
CONCLUSION AND RECOMMENDATION

This chapter provides conclusion of this research and recommendation for research object and the next research.

6.1 Conclusion

Based on the results of this research and by referring to the research objectives, it can be drawn the following conclusion.

1. There are 110 operational risks on production department business process at PT. Charoen Pokphand Krian, Sidoarjo. It is done by reviewing activities of each business process, the purpose of each activity, and the sub system failures of activity. The risk assessment is done by using fuzzy FMEA methods. This method is done by converting FMEA score into triangular fuzzy number which consists of three number as a boundaries in each risk factor. This method is done for reducing the expert subjectivity. The risk assessment is done by the expert "Production Manager Departement". The risk assessment is identified by potential effect as an impact, risk driver as a likelihood, and current control as a detection. Risk assessment is also done by giving evaluation on each risks by looking at their FRPN. There are 39 risks that will be given corrective evaluation by the company. And there are 71 risks that will be given non-corrective evaluation by the company. Risk assessment is also done by risk mapping. Risk mapping is used to classify the risks into 4 classess, namely extreme risk, high risk, moderate risk, and low risk. There are 4 risks that are classified as extreme risk. There are 19 risks that are classified as high risk. There are 16 risks that are classified as moderate risk. And there are 71 risks that are classified as low risk.
2. The risk mitigation recommendation is given to all risks with differences treatments. There are 4 kinds of risk treatments, namely mitigate, transfer, avoid, and accept risk. This mitigation analysis is done by giving

proportion to the number of risks that will be given mitigate, avoid, transfer, and accept risk. There are 45% of risk proportion that will be given mitigate treatment. There are 36% of risk proportion that will be given avoid treatment. There are 10% of risk proportion that will be given transfer treatment. And there are 9% of risk proportion that will be given accept treatment.

3. Risk Dashboard Macro Excel has been established to facilitate user accessing and monitoring the risk management that occur in business processes of poultry feed production on production department PT Charoen Pokphand Krian, Sidoarjo. The risk dashboard can access the general overall risk or direct accessing to each activity on IDEF0 Lv 1.

6.2 Recommendation

Based on the research, there are several recommendations that will be given for the next research and for PT. Charoen Pokphand Krian, Sidoarjo.

The following are recommendation for the next research.

1. To do further study relating about the mitigation cost or feasibility study when those mitigation is applied to production department business process especially in poultry feed production floor.
2. To do further study relating about relationship between risk in operational level and managerial level at whole corporate level.

And these following are recommendation for PT. Charoen Pokphand Krian, Sidoarjo.

1. PT. Charoen Pokphand forms knowledge management system in their business process in order to reduce the probability risk happen that is caused by operator.
2. PT. Charoen Pokphand could apply the risk dashboard that has made by the authors in accessing their business process risks.

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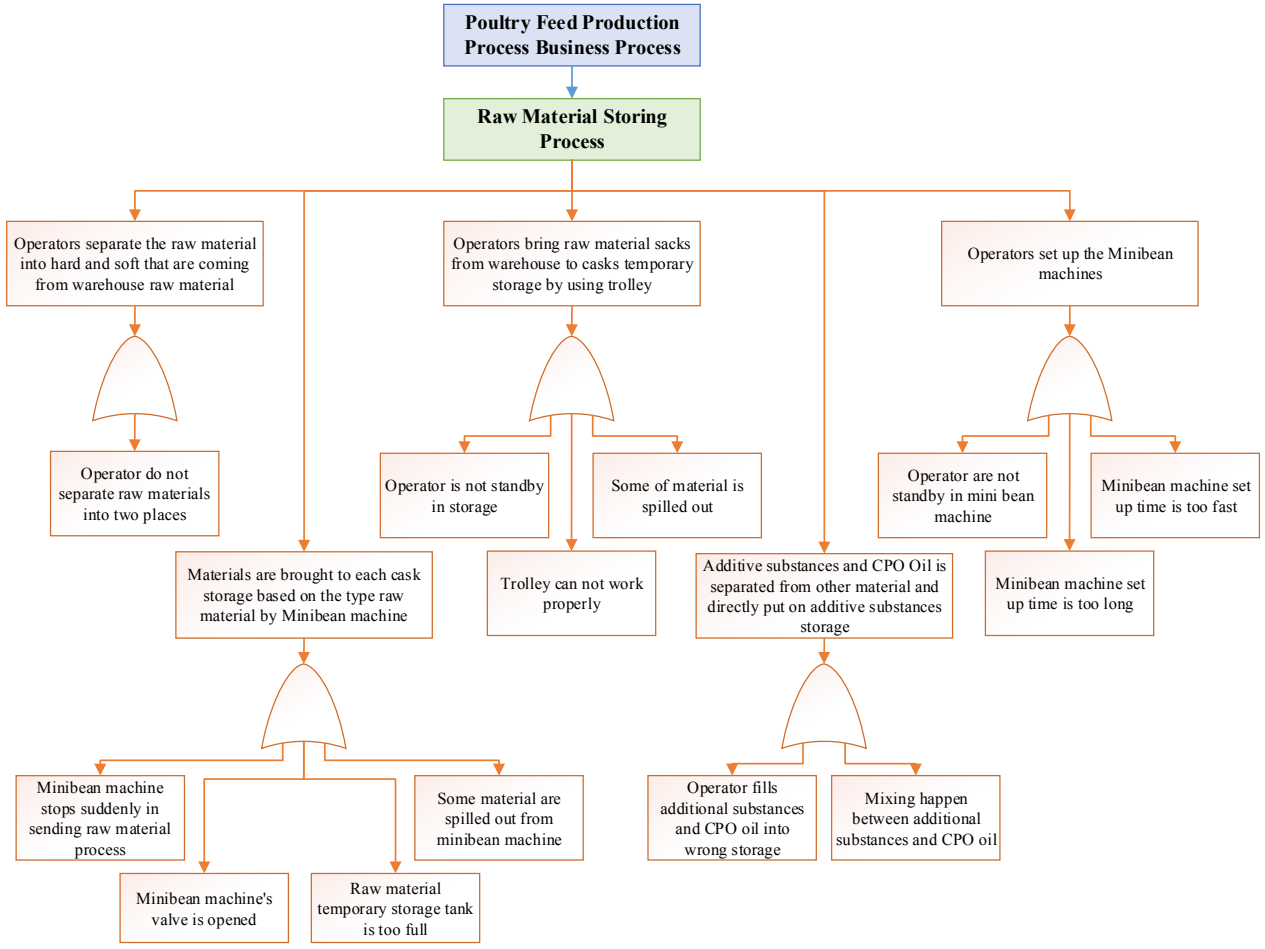
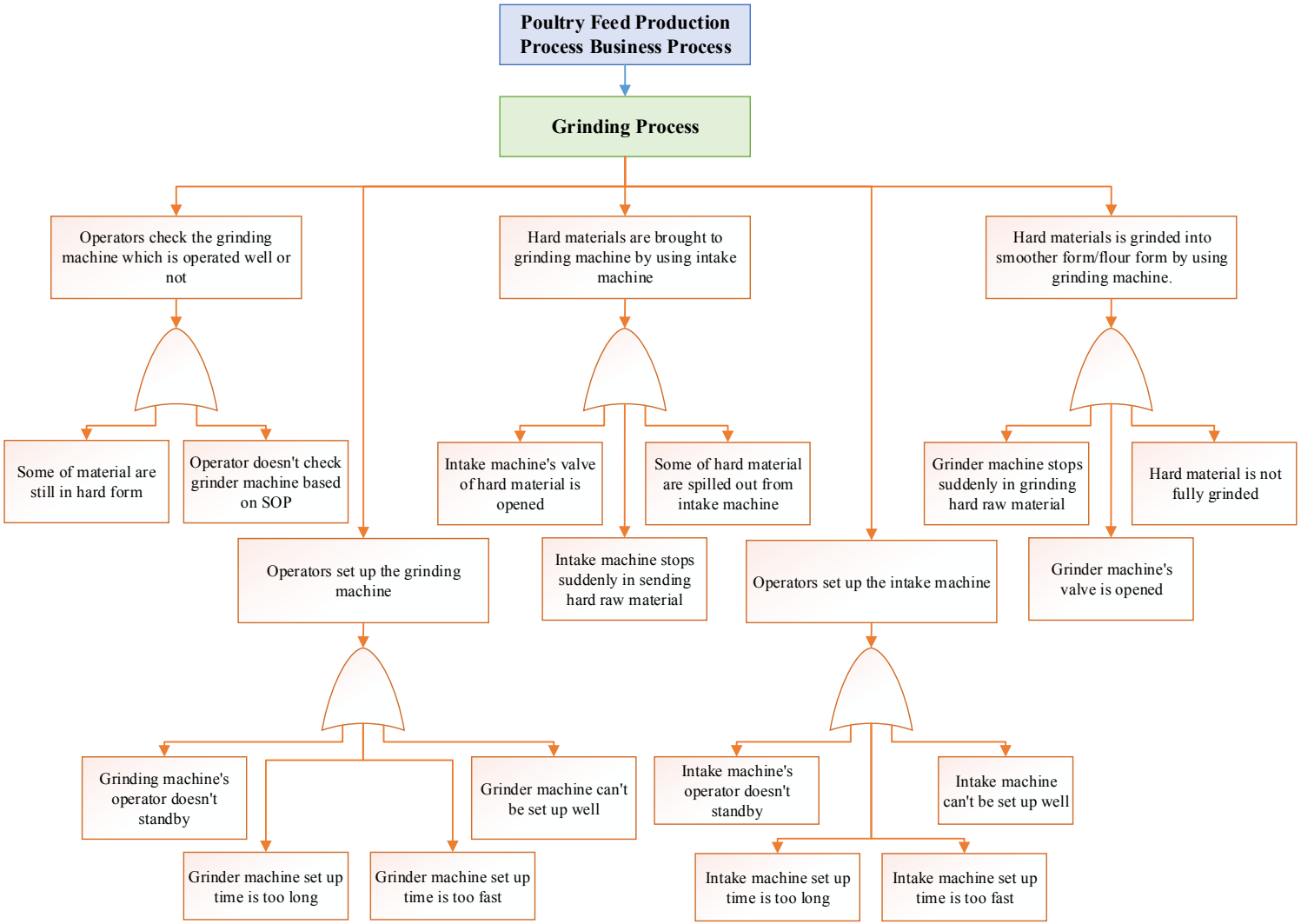
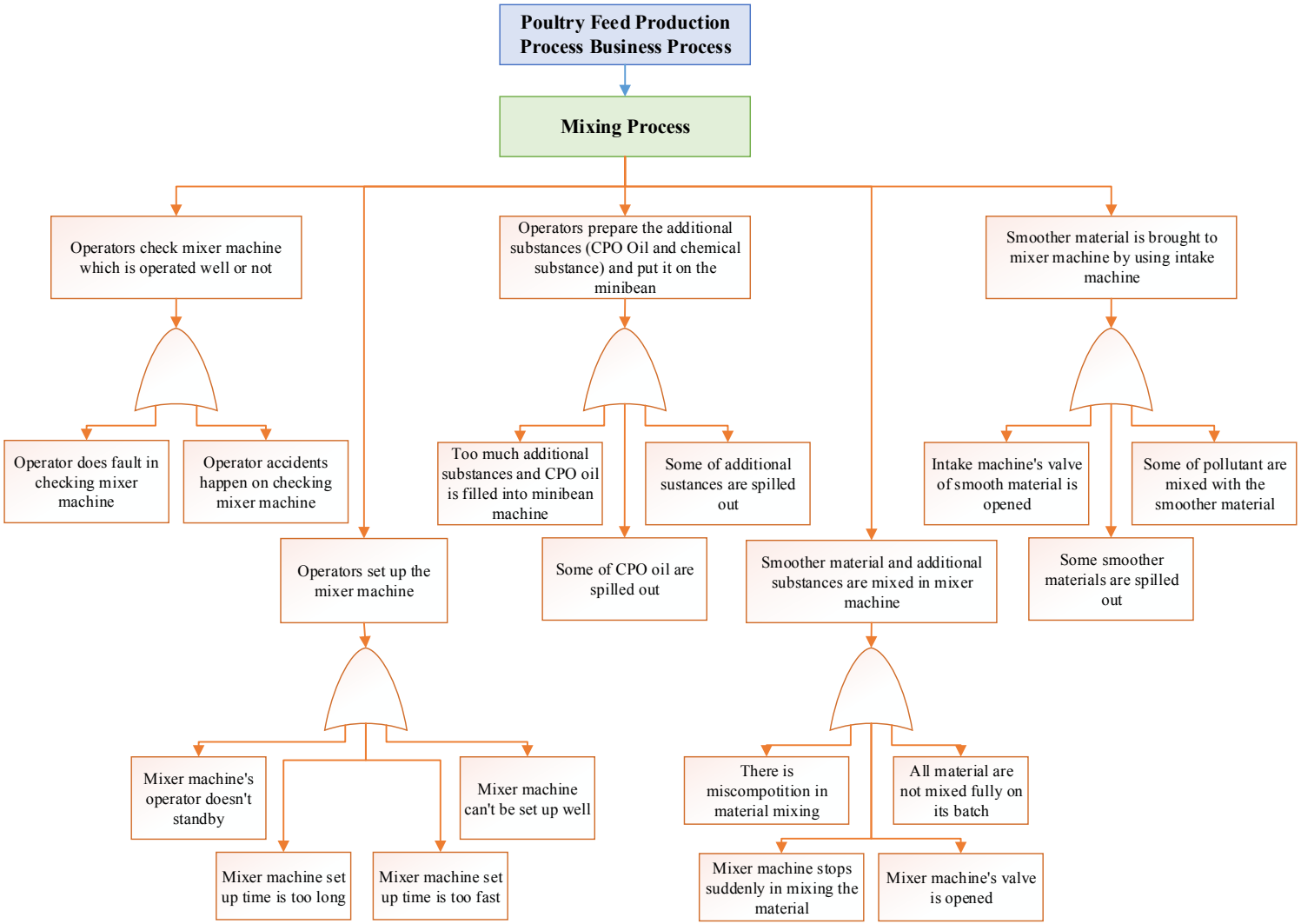
ENCLOSURE

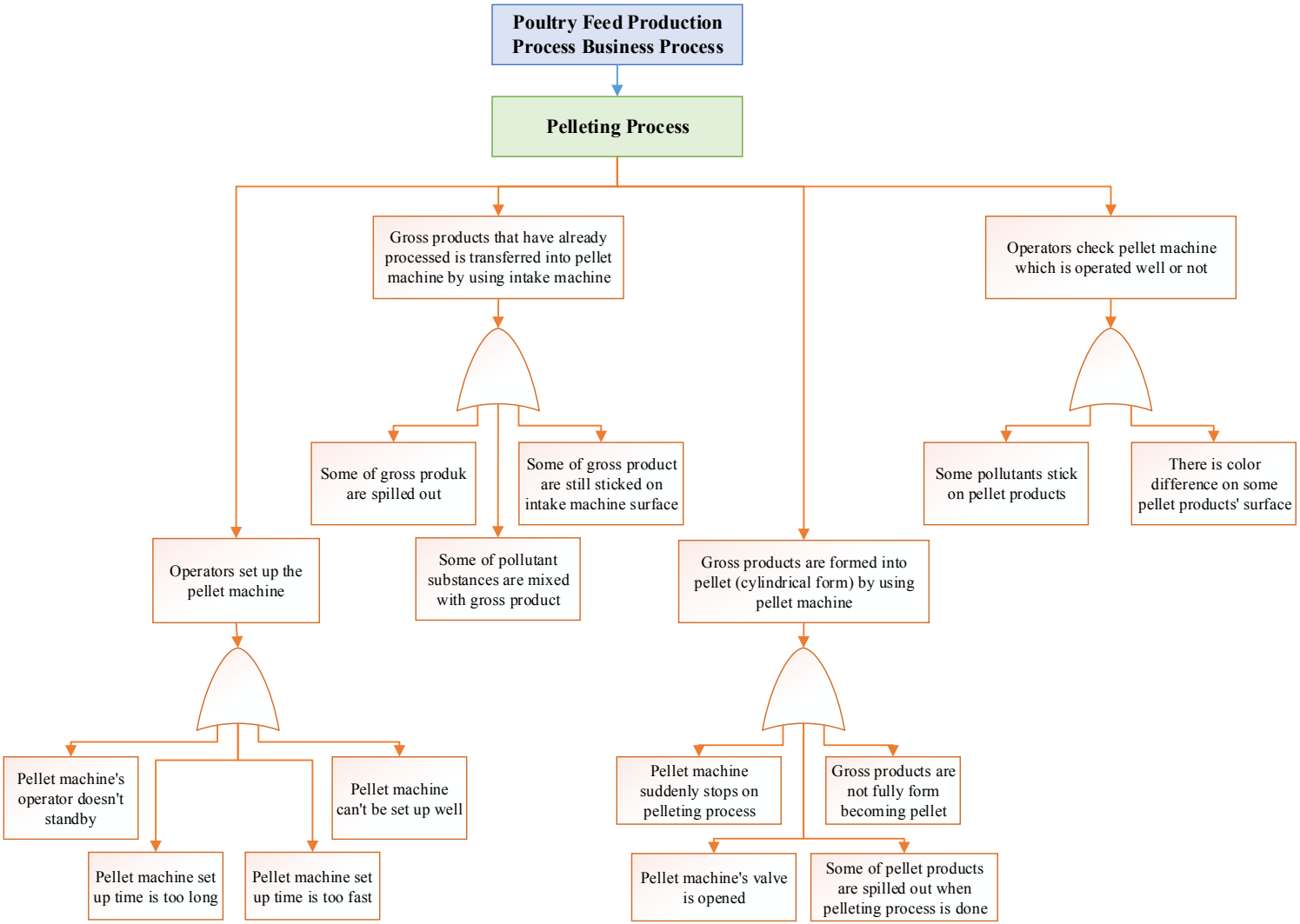
ENCLOSURE 1

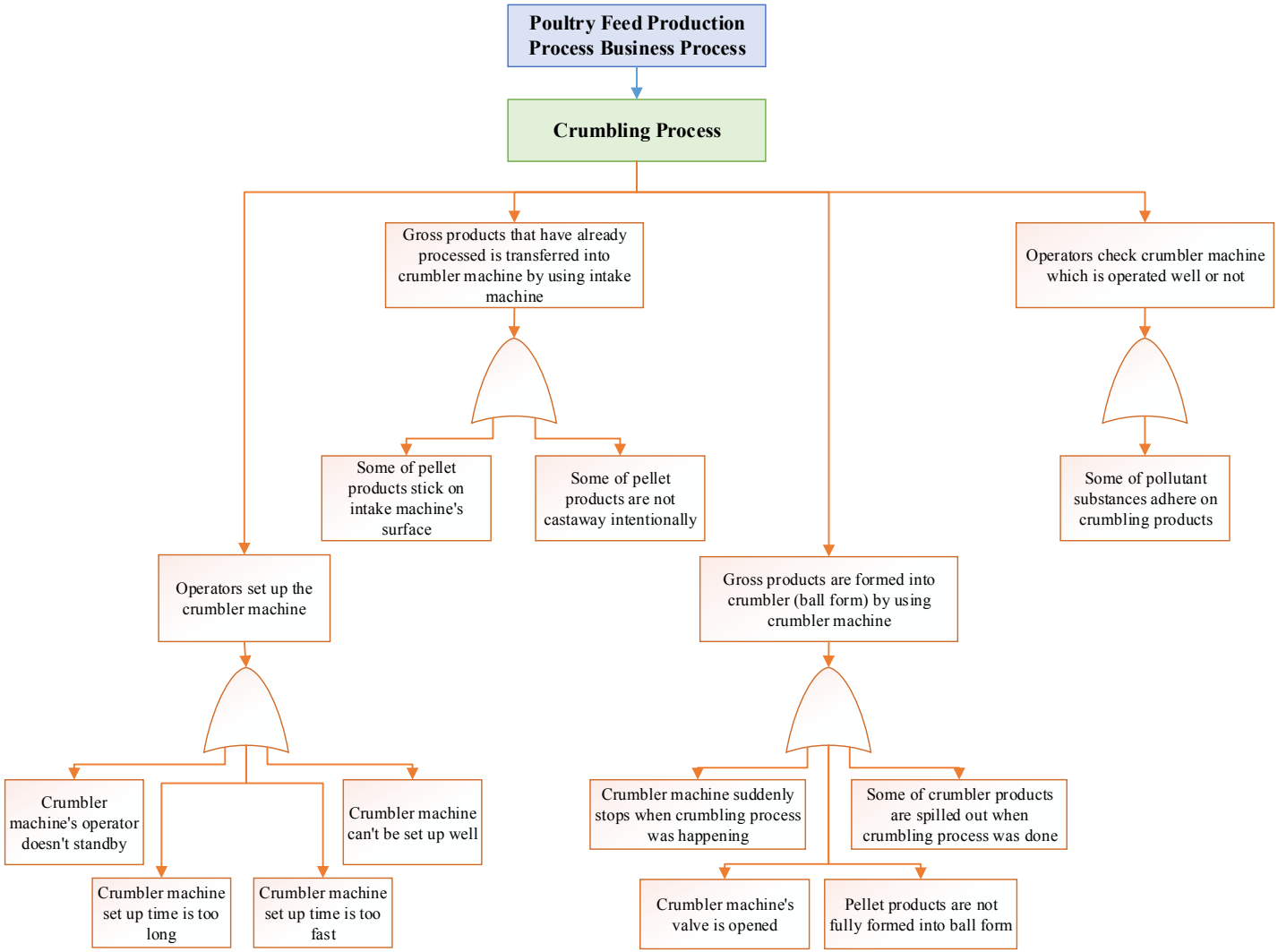
FAULT TREE ANALYSIS

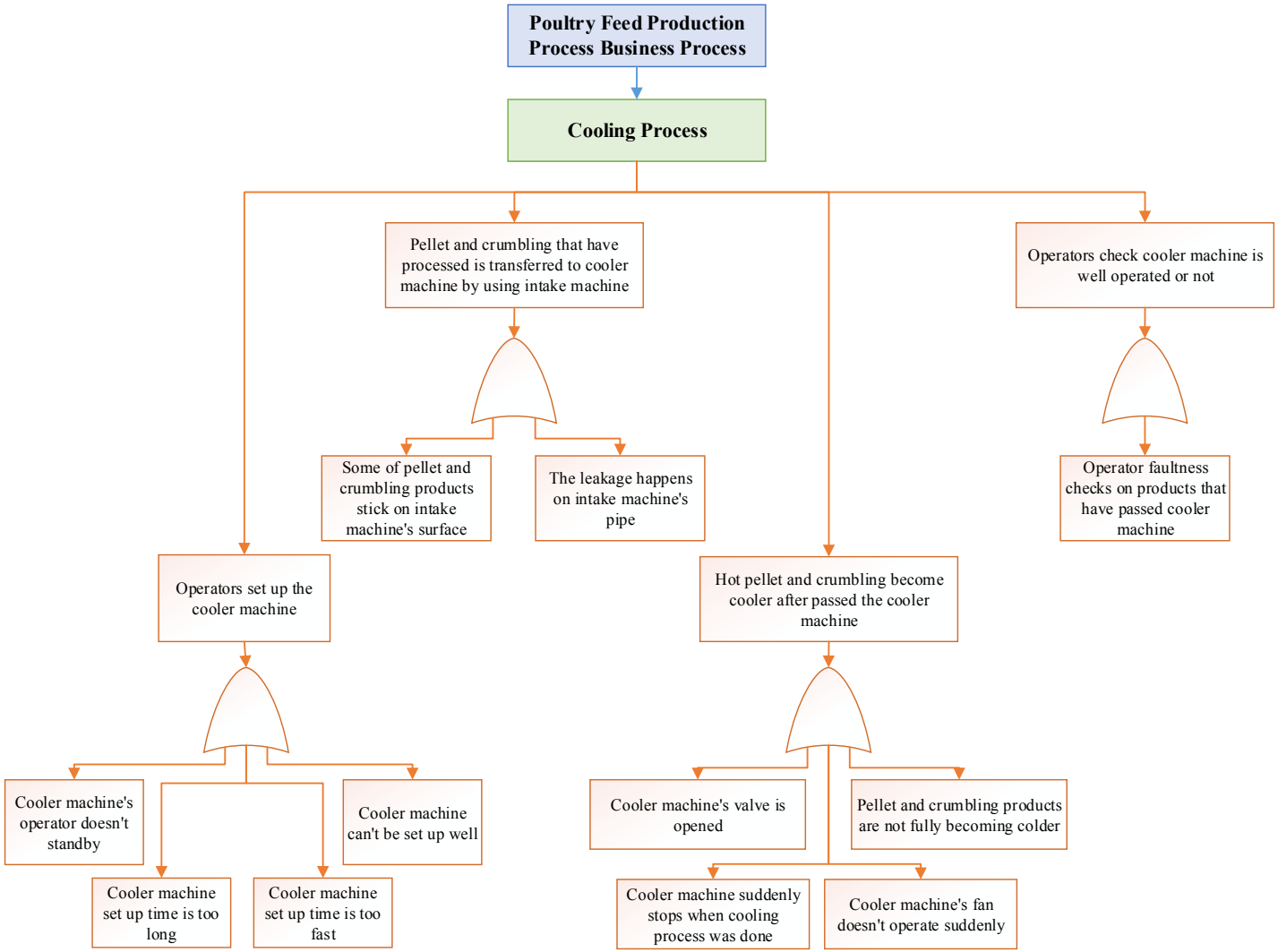


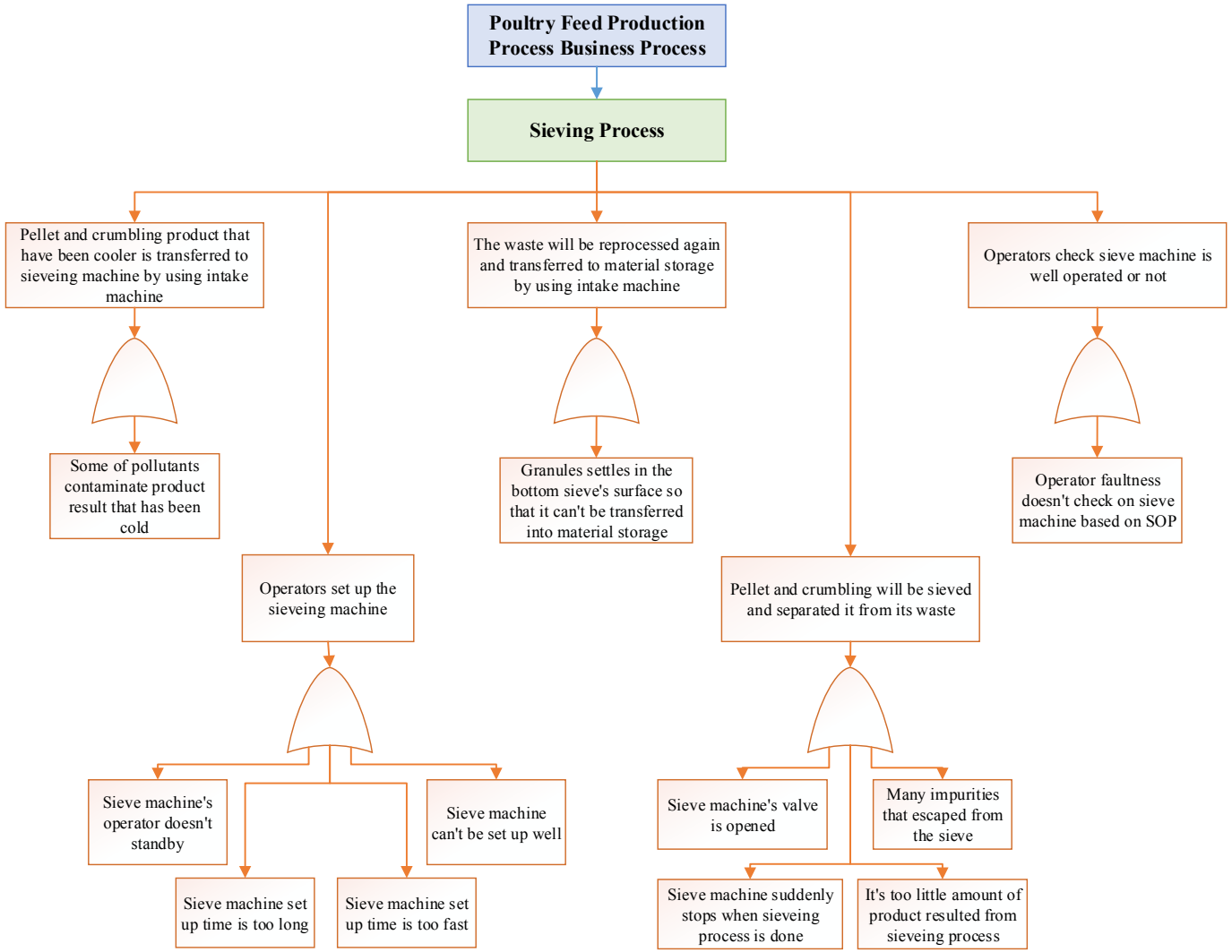

Poultry Feed Production Process Business Process
Grinding Process
Operators check the grinding machine which is operated well or not
Hard materials are brought to grinding machine by using intake machine
Hard materials is grinded into smoother form/flour form by using grinding machine.
Some of material are still in hard form
Operator doesn't check grinder machine based on SOP
Intake machine's valve of hard material is opened
Some of hard material are spilled out from intake machine
Grinder machine stops suddenly in grinding hard raw material
Hard material is not fully grinded
Operators set up the grinding machine
Intake machine stops suddenly in sending hard raw material
Operators set up the intake machine
Grinder machine's valve is opened
Grinding machine's operator doesn't standby
Grinder machine set up time is too long
Grinder machine set up time is too fast
Grinder machine can't be set up well
Intake machine's operator doesn't standby
Intake machine set up time is too long
Intake machine set up time is too fast
Intake machine can't be set up well

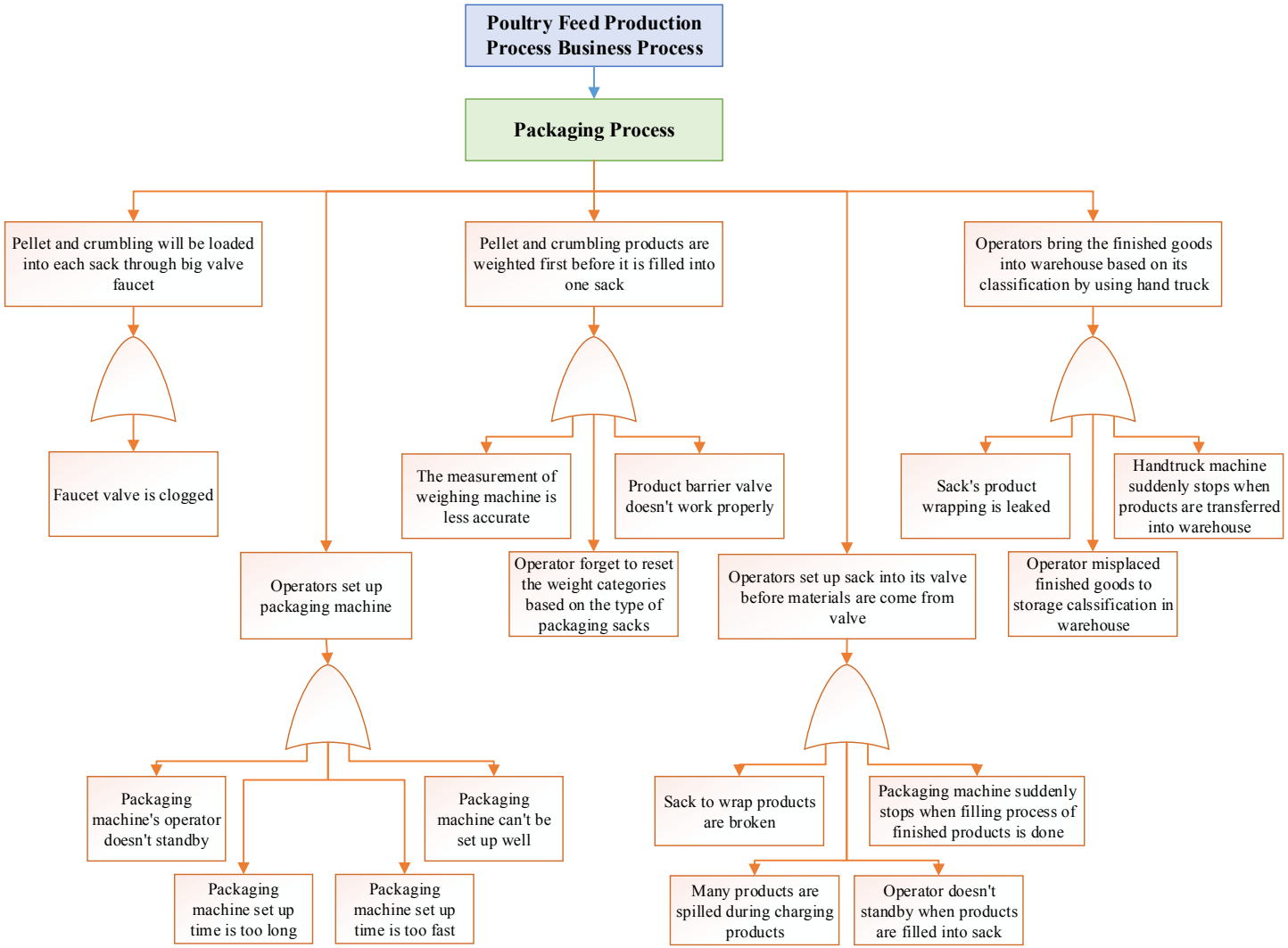

Poultry Feed Production Process Business Process
Mixing Process
Operators check mixer machine which is operated well or not
Operators prepare the additional substances (CPO Oil and chemical substance) and put it on the minibean
Smoother material is brought to mixer machine by using intake machine
Operator does fault in checking mixer machine
Operator accidents happen on checking mixer machine
Too much additional substances and CPO oil is filled into minibean machine
Some of additional sustances are spilled out
Intake machine's valve of smooth material is opened
Some of pollutant are mixed with the smoother material
Operators set up the mixer machine
Some of CPO oil are spilled out
Smoother material and additional substances are mixed in mixer machine
Some smoother materials are spilled out
Mixer machine's operator doesn't standby
Mixer machine set up time is too long
Mixer machine set up time is too fast
Mixer machine can't be set up well
There is miscompotition in material mixing
All material are not mixed fully on its batch
Mixer machine stops suddenly in mixing the material
Mixer machine's valve is opened


Poultry Feed Production Process Business Process
Pelleting Process
Gross products that have already processed is transferred into pellet machine by using intake machine
Operators check pellet machine which is operated well or not
Some of gross produk are spilled out
Some of gross product are still sticked on intake machine surface
Some pollutants stick on pellet products
There is color difference on some pellet products' surface
Operators set up the pellet machine
Some of pollutant substances are mixed with gross product
Gross products are formed into pellet (cylindrical form) by using pellet machine
Pellet machine's operator doesn't standby
Pellet machine set up time is too long
Pellet machine set up time is too fast
Pellet machine can't be set up well
Pellet machine suddenly stops on pelleting process
Gross products are not fully form becoming pellet
Pellet machine's valve is opened
Some of pellet products are spilled out when pelleting process is done


Poultry Feed Production Process Business Process
Crumbling Process
Gross products that have already processed is transferred into crumbler machine by using intake machine
Some of pellet products stick on intake machine's surface
Some of pellet products are not castaway intentionally
Operators check crumbler machine which is operated well or not
Some of pollutant substances adhere on crumbling products
Operators set up the crumbler machine
Crumbler machine's operator doesn't standby
Crumbler machine set up time is too long
Crumbler machine set up time is too fast
Crumbler machine can't be set up well
Gross products are formed into crumbler (ball form) by using crumbler machine
Crumbler machine suddenly stops when crumbling process was happening
Some of crumbler products are spilled out when crumbling process was done
Crumbler machine's valve is opened
Pellet products are not fully formed into ball form


Poultry Feed Production Process Business Process
Cooling Process
Pellet and crumbling that have processed is transferred to cooler machine by using intake machine
Operators check cooler machine is well operated or not
Some of pellet and crumbling products stick on intake machine's surface
The leakage happens on intake machine's pipe
Operator faultness checks on products that have passed cooler machine
Operators set up the cooler machine
Hot pellet and crumbling become cooler after passed the cooler machine
Cooler machine's operator doesn't standby
Cooler machine set up time is too long
Cooler machine set up time is too fast
Cooler machine can't be set up well
Cooler machine's valve is opened
Pellet and crumbling products are not fully becoming colder
Cooler machine suddenly stops when cooling process was done
Cooler machine's fan doesn't operate suddenly


Poultry Feed Production Process Business Process
Sieving Process
Pellet and crumbling product that have been cooler is transferred to sieveing machine by using intake machine
The waste will be reprocessed again and transferred to material storage by using intake machine
Operators check sieve machine is well operated or not
Some of pollutants contaminate product result that has been cold
Granules settles in the bottom sieve's surface so that it can't be transferred into material storage
Operator faultness doesn't check on sieve machine based on SOP
Operators set up the sieveing machine
Pellet and crumbling will be sieved and separated it from its waste
Sieve machine's operator doesn't standby
Sieve machine set up time is too long
Sieve machine set up time is too fast
Sieve machine can't be set up well
Sieve machine's valve is opened
Many impurities that escaped from the sieve
Sieve machine suddenly stops when sieveing process is done
It's too little amount of product resulted from sieveing process


Poultry Feed Production Process Business Process
Packaging Process
Pellet and crumbling will be loaded into each sack through big valve faucet
Faucet valve is clogged
Pellet and crumbling products are weighted first before it is filled into one sack
The measurement of weighing machine is less accurate
Product barrier valve doesn't work properly
Operator forget to reset the weight categories based on the type of packaging sacks
Operators bring the finished goods into warehouse based on its classification by using hand truck
Sack's product wrapping is leaked
Handtruck machine suddenly stops when products are transferred into warehouse
Operator misplaced finished goods to storage calssification in warehouse
Operators set up packaging machine
Packaging machine's operator doesn't standby
Packaging machine set up time is too long
Packaging machine set up time is too fast
Packaging machine can't be set up well
Operators set up sack into its valve before materials are come from valve
Sack to wrap products are broken
Packaging machine suddenly stops when filling process of finished products is done
Many products are spilled during charging products
Operator doesn't standby when products are filled into sack

ENCLOSURE 2

RISK ASSESSMENT QUESTIONNAIRE

Dengan hormat,

Perkenalkan, Saya Satria Oktaufanus Sarwoko, mahasiswa semester 8 Teknik Industri ITS yang sedang menjalankan penelitian tugas akhir di Departemen Produksi Pakan Ternak PT. Charoen Pokphand Indonesia Tbk. Krian, Sidoarjo dengan judul "***Designing Fuzzy Risk Management at Operation Department PT. Charoen Pokphand Tbk. – Poultry Feed Krian, Sidoarjo***". Penelitian tersebut terkait dengan melakukan identifikasi, penilaian, dan mitigasi terhadap risiko yang dimiliki dalam pelaksanaan proses bisnis pada departemen produksi PT. Charoen Pokphand Sidoarjo.

Sehingga, pada kuesioner ini, saya mengharapkan Bapak/Ibu dapat memberikan penilaian terhadap risiko yang dimiliki agar dapat diketahui risiko apa saja yang tergolong *extreme, high, medium*, dan *low risk* yang nantinya dapat dilakukan langkah mitigasi untuk mengurangi probabilitas terjadinya risiko.

Data-data yang diberikan dalam kuesioner ini akan dijamin kerahasiaannya oleh peneliti. Saya mohon kesedian Bapak/Ibu untuk mengisi kuesioner ini. Terima kasih.

Salam hormat,

Satria Oktaufanus Sarwoko

Jurusan Teknik Industri

Fakultas Teknologi Industri

Institut Teknologi Sepuluh Nopember

Bagian I: Data Umum Responden

Pada bagian I, Bapak/Ibu dimohon untuk mengisi data pribadi seperti Nama, jabatan, dan lama bekerja. Pengisian dapat dilakukan dengan mengisi bagian yang kosong.

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

Bagian II: Kuesioner Penelitian

Pada bagian II, Bapak/ Ibu diharapkan untuk mengisi bagian kosong pada kuesioner ini dengan memberikan ranking penilaian berupa skala bilangan (1-5) untuk kolom *severity* (sev), *occurance* (occ) dan *detection* (det) pada tiap-tiap risiko yang dirasakan atau dinilai paling sesuai dengan kondisi nyata atau persepsi Bapak/ Ibu, bukan kondisi yang bapak/ ibu harapkan. Dan nantinya dari hasil penilaian akan dikonversikan ke bilangan *fuzzy*.

A. Impact

Menurut referensi manual FMEA yang dikeluarkan oleh Ford Motor Company (2008), *impact* adalah tingkat pengaruh atau dampak dari risiko atau kegagalan. Dibawah ini merupakan keterangan angka bapak/ ibu berikan untuk *severity* (sev).

Rating	**Kriteria**		**Penjelasan**
1	*Insignificant*	Sangat Rendah	Tidak ada pengaruh.
2	*Minor*	Randah	Sistem dapat beroperasi dengan kinerja mengalami beberapa penurunan.
3	*Moderate*	Sedang	Sistem tidak dapat beroperasi dengan kerusakan kecil / kegagalan mengganggu 20% kerja sistem.
4	*Major*	Tinggi	Sistem tidak dapat beroperasi menyebabkan kerusakan dengan tanpa membahayakan keselamatan.
5	*Catastrophic*	Sangat Tinggi/Berbahaya	Tingkat keparahan sangat tinggi ketika mode kegagalan mempengaruhi system safety.

B. Likelihood

Menurut referensi manual FMEA yang dikeluarkan oleh Chrysler LCC, Ford Motor Company, dan General Motor Corporation (2008), *likelihood* adalah penilaian terhadap seberapa sering risiko atau kegagalan terjadi. Dibawah ini merupakan keterangan angka dan nilai uang bapak/ ibu berikan untuk *occurance* (occ).

Rating	*Probability of Likelihood*	Probabilitas Kegagalan
1	*Rare*	Kemungkinan terjadi kurang dari 5% dalam 3 tahun
2	*Unlikely*	Kemungkinan terjadi sebesar 5% - 25% dalam 3 tahun
3	*Possible*	Kemungkinan terjadi sebesar 25% - 50% dalam 3 tahun
4	*Likely*	Kemungkinan terjadi sebesar 50% - 75% dalam 3 tahun
5	*Almost Certain*	Kemungkinan terjadi lebih besar dari 75% dalam 3 tahun

C. Detection

Menurut referensi manual FMEA yang dikeluarkan oleh Chrysler LCC, Ford Motor Company, dan General Motor Corporation (2008), *detection* adalah penilaian seberapa baik metode pendeteksi atau pengendalian terhadap risiko yang saat ini telah dilakukan. Nilai detection dikatakan akan semakin kecil bila semakin baik risiko dapat dideteksi atau dikendalikan, begitu pula sebaliknya. Dibawah ini merupakan keterangan angka dan nilai uang bapak/ ibu berikan untuk detection.

Rating	Detection	Probabilitas Kegagalan
1	Almost Certain	Hampir pasti kemampuan alat pengontrol mendeteksi penyebab kegagalan dan modus kegagalan berikutnya.
2	High	Tinggi kemampuan alat pengontrol mendeteksi penyebab kegagalan dan modus kegagalan berikutnya.
3	Moderate	Sedang kemampuan alat pengontrol mendeteksi penyebab kegagalan dan modus kegagalan berikutnya.
4	Low	Rendah kemampuan alat pengontrol mendeteksi penyebab kegagalan dan modus kegagalan berikutnya.
5	Almost Uncertain	Tidak ada alat pengontrol yang mampu mendeteksi penyebab kegagalan dan modus kegagalan berikutnya.

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
A1	**Raw Material Storing Process**								
A1-1	Operator memisahkan material yang keras dan lembut saat di warehose raw material	R1	Operator tidak memisahkan material yang keras dan lembut	Barang jadi dan raw material akan tercampur		Operator merasa kelelahan karena pekerjaan yang repetitif dan kurang memahami SOP		Adanya rotasi operator untuk pekerjaan yang repetitif tiap shiftnya	
A1-2	Operator membawa sak material ke tong penyimpanan sementara dengan menggunakan trolley	R2	Operator tidak standby di tong penyimpanan sementara	Operator harus mencari pengganti operator lain		Operator sedang mengerjakan hal lain		Adanya rotasi operator untuk pekerjaan yang repetitif tiap shiftnya	
		R3	Trolley tidak dapat berfungsi	Operator harus mengangkat barang mentah dengan manual		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk bebeapa aset mesin yang ada di workshop	
		R4	Banyak material yang tumpah dari tong penyimpanan sementara	Jumlah bahan mentah yang masuk akan berkurang		Operator kurang hati-hati dalam menuangkan sack yang berisi material		Adanya rotasi operator untuk pekerjaan yang repetitif tiap shiftnya	
A1-3	Operator memanaskan mesin minibean	R5	Operator tidak standby di mesin minibean	Operator harus mencari pengganti operator lain		Operator sedang mengerjakan hal lain		Adanya rotasi operator untuk pekerjaan yang repetitif tiap shiftnya	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
		R6	Waktu setup mesin minibean yang terlalu lama	Performansi mesin tidak akan maksimal		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu	
		R7	Waktu setup mesin minibean yang terlalu cepat	Lifetime mesin akan menurun		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu	
A1-4	Material dibawa menuju ke tong penampungan dengan menggunakan mesin minibean	R8	Mesin minibean berhenti ditengah-tengah proses pengiriman raw material	Proses produksi akan terhenti sementara, dan akan menimbulkan kerugian		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk bebeapa aset mesin yang ada di workshop	
		R9	Katup mesin minibean terbuka	Banyak material akan tumpah keluar		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk bebeapa aset mesin yang ada di workshop	
		R10	Tangki penampung raw material sementara terlalu penuh	Banyak material yang tidak bisa tertampung dalam tangki penyimpanan		Operator tidak memperhatikan kondisi tangki penyimpanan sebelum		Adanya alat sebagai penanda apabila tangki sudah penuh	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
						menuangkan material			
		R11	Banyaknya material yang berhamburan keluar dari minibean	Jumlah material akan berkurang dalam proses produksi		Katup mesin minibean terbuka		Adanya jadwal maintenance yang teratur untuk bebeapa aset mesin yang ada di workshop	
A1-5	Zat tambahan dan minyak CPO dipisahkan dengan material yang lainnya dan ditempatkan ke tempat penyimpanan zat-zat aditif	R12	Operator memasukkan zat-zat dan CPO Oil ke tempat yang tidak sesuai	Zat aditif dan minyak CPO akan tercampur		Operator kurang memahami SOP untuk meletakkan raw material yang datang ke warehouse		Adanya SOP untuk penanganan raw material yang tertempel jelas di warehouse	
		R13	Terjadi pencampuran antara zat aditif dan minyak CPO	Zat aditif dan minyak CPO akan tercampur		Operator merasa kelelahan karena pekerjaan yang repetitif		Adanya rotasi operator untuk pekerjaan yang repetitif tiap shiftnya	
A2	**Grinding Process**								
A2-1	Operator memanaskan mesin grinding	R14	Operator grinding machine tidak standby	Operator harus mencari pengganti operator lain		Operator sedang mengerjakan hal lain		Adanya rotasi operator untuk pekerjaan yang repetitif tiap shiftnya	
		R15	Waktu setup mesin grinding yang terlalu lama	Performansi mesin tidak akan maksimal		Operator tidak memperhatikan		Adanya standar operasional untuk	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
						waktu pemanasan mesin		penanaganan mesin yang ditempel pada mesin	
		R16	Waktu setup mesin grinding yang terlalu cepat	Lifetime mesin akan menurun		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
		R17	Mesin grinding tidak dapat di setup	Proses produksi akan berjalan telat		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk bebeapa aset mesin yang ada di workshop	
A2-2	Operator memanaskan mesin intake	R18	Operator intake machine tidak standby	Operator harus mencari pengganti operator lain		Operator sedang mengerjakan hal lain		Adanya rotasi operator untuk pekerjaan yang repetitif tiap shiftnya	
		R19	Waktu setup mesin intake yang terlalu lama	Performansi mesin tidak akan maksimal		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
								ditempel pada mesin	
		R20	Waktu setup mesin intake yang terlalu cepat	Lifetime mesin akan menurun		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
		R21	Mesin intake tidak dapat disetup	Proses produksi akan berjalan telat		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk bebeapa aset mesin yang ada di workshop	
A2-3	Hard material dibawa menuju mesin grinding dengan menggunakan mesin intake	R22	Katup mesin intake hard material terbuka	Banyak material yang tumpah keluar		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk bebeapa aset mesin yang ada di workshop	
		R23	Mesin intake berhenti tiba-tiba selama proses pengiriman	Proses produksi akan terhenti sementara, dan akan menimbulkan kerugian		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk bebeapa aset mesin yang ada di workshop	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
		R24	Banyaknya hard material yang keluar dari mesin intake	Jumlah material akan berkurang dalam proses produksi		Katup mesin minibean terbuka		Adanya jadwal maintenance yang teratur untuk bebeapa aset mesin yang ada di workshop	
A2-4	Hard material dibentuk menjadi bentuk halus atau menjadi tepung dengan menggunakan mesin grinding	R25	Mesin grinding berhenti tiba-tiba selama proses grinding	Proses produksi akan terhenti sementara, dan akan menimbulkan kerugian		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk bebeapa aset mesin yang ada di workshop	
		R26	Hard material tidak seluruhnya tergrinding	Jumlah hasil produk akan berkurang / tidak sebanyak material yang diproses		Operator salah mengatur kecepatan mesin grinding karena tidak sesuai dengan ukuran material yang masuk dan diproses		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
		R27	Katup mesin grinding terbuka	Banyak material yang tumpah keluar		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk bebeapa aset mesin yang ada di workshop	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
A2-5	Operator mengecek mesin grinding apakah dapat berjalan baik	R28	Banyak material yang masih berbentuk kasar	Jumlah gross produk menjadi tidak sama dengan jumlah material yang masuk		Kecepatan grinder tidak sesuai dengan ukuran hard material yang masuk		Adanya jadwal maintenance dengan oemberian pelumas ke grinder-nya	
		R29	Operator melakukan cek mesin tidak sesuai dengan SOP	Banyak produk yang outspec / masih dalam bentuk kasar		Kurangnya pembelajaran atau sharing knowledge tentang penanganan mesin		Adanya sharing knowledge antar senior operator dengan junior operator	
A3	**Mixing Process**								
A3-1	Operator memanaskan mesin mixer	R30	Operator mesin mixer tidak standby	Operator harus mencari pengganti operator lain		Operator sedang mengerjakan hal lain		Adanya rotasi operator untuk pekerjaan yang repetitif tiap shiftnya	
		R31	Waktu setup mesin mixer yang terlalu lama	Performansi mesin tidak akan maksimal		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
		R32	Waktu setup mesin mixer yang terlalu cepat	Lifetime mesin akan menurun		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
		R33	Mesin mixer tidak dapat disetup	Proses produksi akan berjalan telat		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk bebeapa aset mesin yang ada di workshop	
A3-2	Operator menyiapkan zat aditif dan minyak CPO dan diletakkan pada mesin minibean	R34	Terlalu banyaknya zat aditif dan CPO oil ke dalam mesin minibean	Banyak material yang tidak bisa tertampung dalam mesin minibean		Operator tidak memperhatikan kondisi mesin minibean sebelum menuangkan zat aditif dan minyak CPO		Adanya alat sebagai penanda apabila minibean sudah penuh	
		R35	Minyak CPO banyak yang tumpah keluar	Jumlah material akan berkurang dalam proses produksi		Katup mesin minibean terbuka		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
		R36	Zat-zat kimia banyak yang tumpah keluar	Jumlah material akan berkurang dalam proses produksi		Katup mesin minibean terbuka		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
A3-3	Material yang lebih lembut dibawa menuju mixer dengan menggunakan mesin intake	R37	Katup mesin intake smooth material terbuka	Banyak material yang tumpah keluar		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
		R38	Some smoother materials are spilled out	Jumlah material akan berkurang dalam proses produksi		Katup mesin intake terbuka		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
		R39	Banyaknya zat-zat / kotoran tercampur dengan smoother material	Hasil produk akan menjadi outspec		Dilakukannya pembersihan terjadwal terhadap aset mesin perusahaan		Adanya jadwal pembersihan mesin dan aset lain yang ada di workshop	
A3-4	Material yang lebih lembut, zat aditif, dan minyak CPO dicampur	R40	Salah komposisi pencampuran bahan untuk setiap produk	Hasil produk akan menjadi outspec		Kurang pembelajaran atau sharing knowledge		Adanya sharing knowledge antar senior operator dengan junior operator	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
	menjadi satu pada mesin mixer					tentang resep produk			
		R41	Mesin mixer tiba-tiba berhenti saat proses mixing	Proses produksi akan terhenti sementara, dan akan menimbulkan kerugian		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
		R42	Katup mesin mixer terbuka	Banyak material yang tumpah keluar		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
		R43	Bahan tidak tercampur seluruhnya dalam setiap batch	Hasil produk akan menjadi outspec		Terjadinya kesalahan pemasukan frekuensi pengadukan dari mesin mixer		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
A3-5	Operator mengecek apakah mesin mixer beroperasi dengan baik atau tidak	R44	Kesalahan operator dalam pengecekan mesin mixer	Banyak produk yang outspec		Operator melakukan pengecekan ke mesin mixer tidak sesuai dengan SOP		Adanya sharing knowledge antar senior operator dengan junior operator	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
		R45	Terjadi kecelakaan pekerja saat proses pengecekan mesin mixer	Menimbulkan kerugian baik dari tingkat individu operator sampai tingkat perusahaan		Pekerja tidak menggunakan alat pengaman saat masuk ke workstation		Adanya pelatihan terkait K3 untuk menyadarkan pentingnya menggunakan alat keamanan	
A3-6	Operator melakukan kontrol kualitas terhadap gross produk yang telah diproses pada mesin mixer	R46	Banyak hasil produk diluar komposisi	Hasil produk akan menjadi outspec dan produk akan di proses ulang		Terdapat pengotor didalam mesin mixer		Adanya jadwal pembersihan mesin dan aset lain yang ada di workshop	
		R47	Alat pengambil sampel tidak steril	Dapat mengontaminasi atau tercampur ke hasil produk		Tidak ada penjadwalan kebersihan untuk alat pengambil sampel		Adanya jadwal pembersihan mesin dan aset lain yang ada di workshop	
		R48	Alat-alat pengecekan komposisi tidak steril	Dapat mengontaminasi atau tercampur ke hasil produk		Tidak ada penjadwalan kebersihan untuk alat pengecek komposisi		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
A4	**Pelleting Process**								
A4-1	Operator memanaskan mesin pellet	R49	Operator mesin pellet tidak standby	Operator harus mencari pengganti operator lain		Operator sedang mengerjakan hal lain		Adanya rotasi operator untuk pekerjaan yang	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
								repetitif tiap shiftnya	
		R50	Waktu setup mesin pellet terlalu lama	Performansi mesin tidak akan maksimal		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
		R51	Waktu setup mesin pellet terlalu cepat	Lifetime mesin akan menurun		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
		R52	Mesin pellet tidak dapat disetup	Proses produksi akan berjalan telat		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
A4-2	Gross produk yang telah diproses melalui proses pencampuran kemudian	R53	Beberapa gross produk are spilled out	Jumlah material akan berkurang dalam proses produksi		Katup mesin intake terbuka		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
	dibawa menuju mesin pellet dengan menggunakan mesin inake	R54	Banyaknya zat atau kotoran tercampur dengan gross produk	Hasil produk akan menjadi outspec		Dilakukannya pembersihan terjadwal terhadap aset mesin perusahaan		Adanya jadwal pembersihan mesin dan aset lain yang ada di workshop	
		R55	Banyaknya gross produk yang masih tersangkut di dinding-dinding mesin intake	Jumlah produk akan menjadi berkurang		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
A4-3	Gross produk dapat dibentuk menjadi bentuk silinder kecil (pellet) dengan menggunakan mesin pellet	R56	Mesin pellet tiba-tiba berhenti saat proses pelleting	Proses produksi akan terhenti sementara, dan akan menimbulkan kerugian		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
		R57	Katup mesin pellet terbuka	Banyak material yang tumpah keluar		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
		R58	Banyak produk pellet tumpah keluar saat proses pelleting	Jumlah produk pellet akan menjadi berkurang		Katup mesin pellet terbuka		Adanya jadwal maintenance yang teratur untuk beberapa	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
								aset mesin yang ada di workshop	
		R59	Produk tidak seluruhnya terbentuk menjadi pellet	Hasil produk akan menjadi outspec		Terjadinya kesalahan pemasukan frekuensi kecepatan dari mesin pellet		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
A4-4	Operator mengecek mesin pellet apakah beroperasi dengan baik atau tidak	R60	Banyak zat pengotor yang menempel pada produk pellet	Hasil produk akan menyebabkan perbedaan warna dan dapat dikatakan sebagai outspec produk		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
		R61	Banyak produk pellet yang berbeda warna pada permukaan produknya	Hasil produk tidak sesuai dengan hasil ekspektasi produk jadinya		Kemungkinan banyak zat pengotor yang mengkontaminasi produk jadi		Adanya jadwal pembersihan mesin dan aset lain yang ada di workshop	
A5	**Crumbling Process**								
A5-1	Operator memanaskan mesin crumbler	R62	Operator mesin crumbler tidak standby	Operator harus mencari pengganti operator lain		Operator sedang mengerjakan hal lain		Adanya rotasi operator untuk pekerjaan yang repetitif tiap shiftnya	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
		R63	Waktu mesin setup crumbler terlalu lama	Performansi mesin tidak akan maksimal		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
		R64	Waktu mesin setup crumbler terlalu cepat	Lifetime mesin akan menurun		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
		R65	Mesin crumbler tidak dapat disetup	Proses produksi akan berjalan telat		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
A5-2	Gross produk yang telah diproses kemudian dibawa menuju mesin crumbler dengan	R66	Banyaknya produk pellet yang menempel pada dinding mesin intake	Proses produksi akan terasa lebih lama karena kalau terjadi lebih lama akan menjadi penyumbat		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
	menggunakan mesin intake			saluran mesin intake					
		R67	Banyaknya produk pellet yang terbuang dengan tidak sengaja	Jumlah produk pellet akan menjadi berkurang		Katup mesin intake terbuka		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
A5-3	Gross produk diproses menjadi bentuk bola bola kecil (crumble) dengan menggunakan mesin crumbler	R68	Mesin crumbler tiba-tiba berhenti saat proses pebuatan crumbling	Proses produksi akan terhenti sementara, dan akan menimbulkan kerugian		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
		R69	Katup mesin crumbler terbuka	Banyak produk pellet yang tumpah keluar		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
		R70	Produk pellet tidak seluruhnya terbentuk menjadi crumbling (ball form)	Hasil produk akan menjadi outspec		Terjadinya kesalahan pemasukan frekuensi kecepatan dari mesin crumbler		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
		R71	Banyak produk crumbling tumpah keluar saat proses crumbling	Jumlah produk crumble akan berkurang, dan menimbulkan kerugian		Katup mesin crumbler terbuka		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
A5-4	Operator mengecek mesin crumbling apakah beroperasi dengan baik atau tidak	R72	Banyak zat pengotor yang menempel pada produk crumbling	Hasil produk akan menyebabkan perbedaan warna dan dapat dikatakan sebagai outspec produk		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
A6	**Cooling Process**								
A6-1	Operator memanaskan mesin cooler	R73	Operator mesin cooler tidak standby	Operator harus mencari pengganti operator lain		Operator sedang mengerjakan hal lain		Adanya rotasi operator untuk pekerjaan yang repetitif tiap shiftnya	
		R74	Waktu setup mesin cooler terlalu lama	Performansi mesin tidak akan maksimal		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
		R75	Waktu setup mesin cooler terlalu cepat	Lifetime mesin akan menurun		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
		R76	Mesin cooler tidak dapat disetup	Proses produksi akan berjalan telat		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
A6-2	Pellet dan crumble yang telah dibentuk kemudian dibawa menuju mesin pendingin dengan menggunakan mesin intake	R77	Banyaknya produk hasil pellet dan crumbling menempel pada dinding mesin intake	Proses produksi akan terasa lebih lama karena kalau terjadi lebih lama akan menjadi penyumbat saluran mesin intake		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
		R78	Terjadi kebocoran pada pipa mesin intake	Jumlah produk akan menjadi berkurang		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
A6-3	Pellet dan crumble yang panas dapat mendingin setelah melalui proses pendinginan di mesin cooler	R79	Katup mesin cooler terbuka	Banyak produk crumble yang tumpah keluar		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
		R80	Mesin cooler tiba-tiba berhenti saat proses pendinginan	Proses produksi akan terhenti sementara, dan akan menimbulkan kerugian		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
		R81	Kipas didalam mesin cooler tiba-tiba tidak berfungsi	Proses produksi akan terhenti sementara, dan akan menimbulkan kerugian		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
		R82	Produk pellet maupun crumbling tidak seluruhnya menjadi dingin	Produk akan tetap dalam kondisi panas		Terjadinya kesalahan pemasukan frekuensi kecepatan kipas dari mesin cooler		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
A6-4	Operator mengecek mesin cooler apakah	R83	Kesalahan SOP saat operator mengecek	Produk jadi tidak seluruhnya bisa terinspeksi		Kurangnya pembelajaran atau sharing		Adanya sharing knowledge antar senior operator	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
	beroperasi dengan baik atau tidak		produk yang sudah melewati proses cooling			knowledge tentang penanganan produk		dengan junior operator	
A7	**Sieveing Process**								
A7-1	Operator memanaskan mesin sieve	R84	Operator mesin sieve tidak standby	Operator harus mencari pengganti operator lain		Operator sedang mengerjakan hal lain		Adanya rotasi operator untuk pekerjaan yang repetitif tiap shiftnya	
		R85	Waktu setup mesin sieve terlalu lama	Performansi mesin tidak akan maksimal		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
		R86	Waktu setup mesin sieve terlalu cepat	Lifetime mesin akan menurun		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
		R87	Mesin sieve tidak dapat di setup	Proses produksi akan berjalan telat		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
A7-2	Pellet dan crumble yang telah dingin ditransfer menuju mesin sieve dengan menggunakan mesin intake	R88	Banyaknya zat dan kotoran yang mengkontaminasi hasil produk yang sudah dingin	Hasil produk akan menjadi outspec		Banyaknya pengotor yang menempel pada mesin intake		Adanya jadwal pembersihan mesin dan aset lain yang ada di workshop	
A7-3	Pellet dan crumble dipisahkan dari pengotornya dengan menggunakan mesin ayakan (sieve)	R89	Katup mesin sieve terbuka	Banyak produk setelah melalui proses ayakan yang tumpah keluar		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
		R90	Mesin sieve tiba-tiba berhenti saat proses pengayakan	Proses produksi akan terhenti sementara, dan akan menimbulkan kerugian		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
		R91	Terlalu sedikit jumlah produk hasil proses ayakan	Jumlah net produk yang dihasilkan menjadi berkurang		Lubang ayakan pada mesin sieve banyak tersumbat oleh pengotor		Adanya jadwal penggantian untuk komponen kecil sebagai langkah *corrective maintenance*	
		R92	Banyak pengotor yang lolos dari proses ayakan	Net produk akan menjadi outspec		Terjadi kebocoran pada lubang ayakan mesin sieve		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
A7-4	Sisa hasil ayakan diproses ulang dan ditransferkan menuju tong penyimpan material dengan menggunakan mesin intake	R93	Butiran hasil ayakan mengendap didasar mesin sieve sehingga tidak dapat di transferkan ke material storage	Jumlah produk yang dapat diproses kembali menjadi berkurang		Kondisi mesin intake terlalu lembab		Adanya jadwal pembersihan mesin dan aset lain yang ada di workshop	
A7-5	Operator mengecek mesin sieve apakah beroperasi dengan baik atau tidak	R94	Kesalahan operator dalam pengecekan mesin sieve yang tidak sesuai dengan SOP	Banyaknya produk yang menjadi outspec		Kurangnya pembelajaran atau sharing knowledge tentang penanganan mesin		Adanya sharing knowledge antar senior operator dengan junior operator	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
A8	**Packaging Process**								
A8-1	Operator memanaskan mesin packaging	R95	Operator mesin packaging tidak standby	Operator harus mencari pengganti operator lain		Operator sedang mengerjakan hal lain		Adanya rotasi operator untuk pekerjaan yang repetitif tiap shiftnya	
		R96	Waktu setup mesin packaging terlalu lama	Performansi mesin tidak akan maksimal		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
		R97	Waktu setup mesin packaging terlalu cepat	Lifetime mesin akan menurun		Operator tidak memperhatikan waktu pemanasan mesin		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
		R98	Mesin packaging tidak dapat di setup	Proses produksi akan berjalan telat		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
A8-2	Produk Pellet dan crumble ditimbang terlebih dahulu sebelum dibungkus	R99	Pengukuran mesin penimbang yang kurang akurat	Berat produk menjadi tidak konsisten antar produk satu dengan yang lain		Kesalahan operator dalam mengatur ulang kondisi mesin timbangan		Adanya standar operasional untuk penanganan mesin tertentu ditempel pada mesin	
		R100	Operator lupa mengatur ulang kategori berat berdasarkan jenis kemasan sack	Jumlah / berat produk yang keluar dari katup kran tidak sesuai dengan ukuran sak		Kurang adanya aktivitas transfer knowledge secara intens antar operator		Adanya peningkatan intensitas kegiatan sharing knowledge antar operator	
		R101	Katup pembatas produk saat penimbangan tidak berjalan lancar	Proses produksi akan terhenti sementara, dan akan menimbulkan kerugian		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
A8-3	Pellet dan crumble dapat diisikan kedalam kemasan sak dengan menggunakan kran besar pada mesin packaging	R102	Katup kran tersumbat	Proses produksi akan terhenti sementara, dan akan menimbulkan kerugian		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
A8-4	Operator mengatur letak dan disesuaikan dengan mulut kran dari mesin packaging sak sehingga pajkan ternak dapat dimasukkan kedalamnya	R103	Sack tempat untuk membungkus produk rusak	Saat pengisian produk ke sak akan terjadi kebocoran		Operator tidak mengecek sak terlebih dahulu sebelum pengisian dimulai		Adanya standar penanganan terhadap pemakaian material handling	
		R104	Banyak produk tumpah saat pengisian produk	Jumlah produk akan menjadi berkurang		Operator merasa kelelahan karena pekerjaan yang repetitif		Adanya rotasi operator untuk pekerjaan yang repetitif tiap shiftnya	
		R105	Tali pengikat sack yang kurang kuat	Apabila sak terjatuh produk akan tumpah keluar		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	
		R106	Operator tidak standby saat pengisian produk	Operator harus mencari pengganti operator lain		Operator sedang mengerjakan hal lain		Adanya rotasi operator untuk pekerjaan yang repetitif tiap shiftnya	
		R107	Mesin packaging tiba-tiba berhenti saat proses pengisian produk ke kemasan	Proses produksi akan berjalan telat		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	

Kode Aktivitas	Aktivitas	Kode Risiko	Risiko	Potential Effect	Impact	Risk Driver	Likelihood	Risk Control	Detection
A8-5	Operator membawa produk yang sudah jadi dalam kemasan sak menuju gudang produk jadi	R108	Sack pembungkus produk bocor	Mengurangi volume pada sak		Operator tidak mengecek sak terlebih dahulu sebelum pengisian dimulai		Adanya standar penanganan terhadap pemakaian material handling	
		R109	Operator salah menempatkan finished goods ke klasifikasi tempat penyimpanan di warehouse	Finished akan tercampur antar kategori volume masing-masing sak		Operator merasa kelelahan karena pekerjaan yang repetitif		Adanya rotasi operator untuk pekerjaan yang repetitif tiap shiftnya	
		R110	Mesin handtruck tiba-tiba berhenti saat proses pengiriman produk ke warehouse	Proses transfer finished goods ke warehouse terganggu		Kurang adanya jadwal maintenance teratur pada aset perusahaan		Adanya jadwal maintenance yang teratur untuk beberapa aset mesin yang ada di workshop	

Terima kasih atas kesedian bapak atau ibu dalam pengisian kuisioner ini. Semoga dapat bermanfaat bagi perusahaan dan penelitian ini kedepannya.

TTD

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ENCLOSURE 2

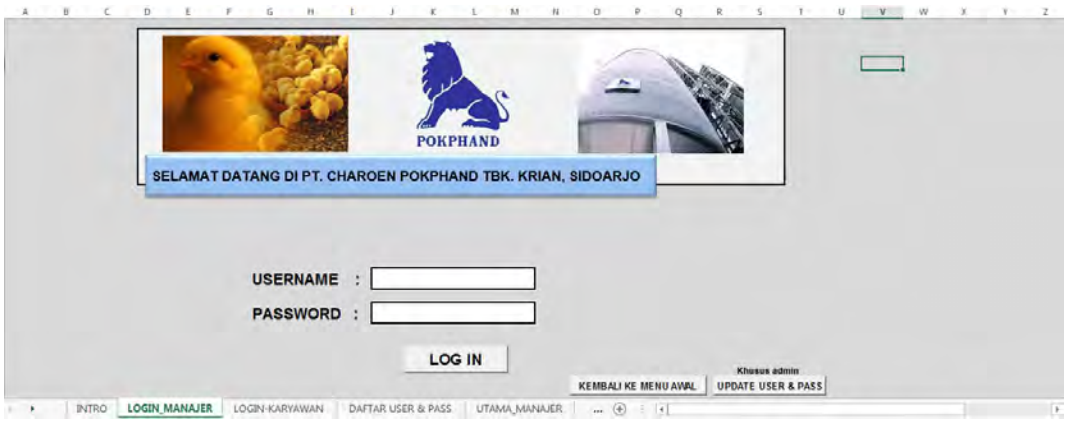
RISK ASSESSMENT DASHBOARD CODING

A. Dashboard Home Interface


```
Private Sub
CommandButton1_Click()
Sheet2.Activate
End Sub
```

```
Private Sub
CommandButton2_Click()
Sheet3.Activate
End Sub
```

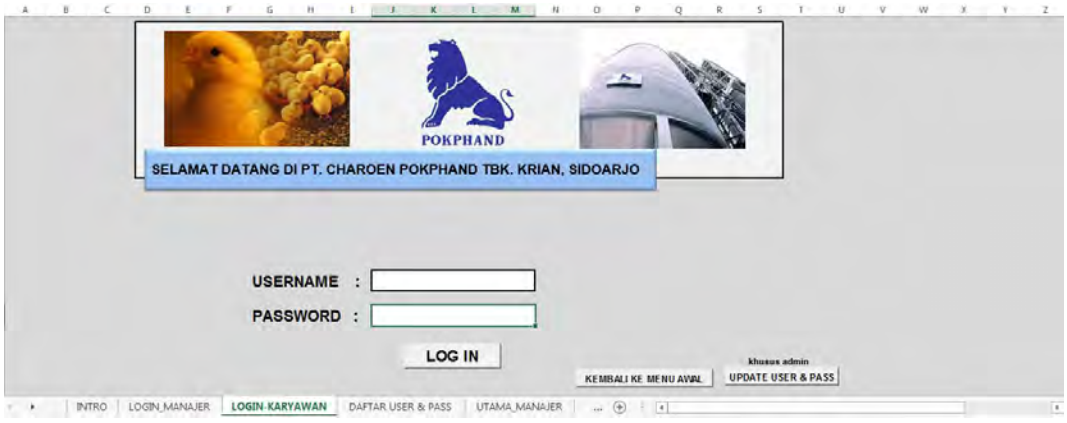
B. Login Manager




```
Private Sub
CommandButton1_Click()
Dim c As Integer
For c = 1 To 6
   If Cells(21, 10) = Sheet4.Cells(2,
9) And Cells(23, 10) =
Sheet4.Cells(2, 10) Then
   Cells(20, 14) = "a"
Sheet5.Activate
Sheet5.Cells(15, 5) = Cells(19, 10)

Cells(19, 10) = ""
Cells(21, 10) = ""
Cells(23, 10) = ""
Else
End If
```

```
Next
If Sheet2.Cells(20, 14) = "" Then
MsgBox ("Password atau nama
salah")
End If
End Sub

Private Sub
CommandButton2_Click()
passadmin = InputBox("Silakan
Masukkan Password")
If passadmin = 135 Then
Sheet4.Activate
Else
End If
End Sub

Private Sub
CommandButton3_Click()
Sheet1.Activate
End Sub
Private Sub Worksheet_Activate()
Cells(20, 14) = ""
End Sub

Private Sub
Worksheet_SelectionChange(ByVal
Target As Range)
Cells(20, 14) = ""
End Sub
```

C. Login Employee




```
Private Sub
CommandButton1_Click()
Dim c As Integer
For c = 1 To 9
   If Cells(21, 10) = Sheet4.Cells(1 +
c, 5) And Cells(23, 10) =
Sheet4.Cells(1 + c, 6) Then
   Cells(20, 14) = "a"
   Sheet6.Activate
   Sheet6.Cells(15, 5) = Cells(19, 10)
   Else
   End If
Next
If Sheet3.Cells(20, 14) = "" Then
MsgBox ("Password atau nama
salah")
```

```
Else
End If
End Sub

Private Sub
CommandButton2_Click()
passadmin = InputBox("Silakan
Masukkan Password")
If passadmin = 135 Then
Sheet4.Activate
Else
End If
End Sub
```

```
Private Sub
CommandButton3_Click()
Sheet1.Activate
End Sub

Private Sub Worksheet_Activate()
Cells(20, 14) = ""
End Sub

Private Sub
Worksheet_SelectionChange(ByVal
Target As Range)
Cells(20, 14) = ""
End Sub
```

D. User and Pass List

KARYAWAN	USER	PASS
WAREHOUSING	K1	1111
GRINDING	K2	2222
MIXING	K3	3333
PELLETING	K4	4444
COOLING	K5	5555
SIEVING	K6	6666
PACKAGING	K7	7777

KABIRO	USER	PASS
MANAJER PRODUKSI	LUCKY	12345
	ADMIN	135

KELUAR

INTRO | LOGIN_MANAJER | LOGIN-KARYAWAN | DAFTAR USER & PASS | UTAMA_MANAJER

```
Private Sub CommandButton1_Click()
Sheet1.Activate
End Sub
```

E. Manager Home Interface


```
Private Sub CommandButton1_Click()
    If Cells(15, 5) = Sheet4.Cells(2, 8) Then
    Sheet8.Activate
    Sheet8.Cells(3, 3) = Sheet4.Cells(2, 5)
    Sheet8.CommandButton1.Visible = False
    Sheet8.CommandButton2.Visible = False
    Sheet8.CommandButton3.Visible = True
    Sheet8.CommandButton4.Visible = False
   ElseIf Cells(15, 5) = Sheet4.Cells(3, 8) Then
   Sheet27.Cells(3, 3) = Sheet4.Cells(3, 5)
   Sheet27.Activate
   Sheet27.CommandButton1.Visible = True
   Sheet27.CommandButton2.Visible = True
   Sheet27.CommandButton3.Visible = False
   Sheet27.CommandButton4.Visible = True
   Sheet27.CommandButton5.Visible = False
   Sheet27.CommandButton7.Visible = False
   Sheet27.CommandButton6.Visible = False
   ElseIf Cells(15, 5) = Sheet4.Cells(4, 8) Then
   Sheet9.Activate
   Sheet9.Cells(3, 3) = Sheet4.Cells(4, 5)
   Sheet9.CommandButton1.Visible = False
   Sheet9.CommandButton2.Visible = False
    Sheet9.CommandButton3.Visible = True
```

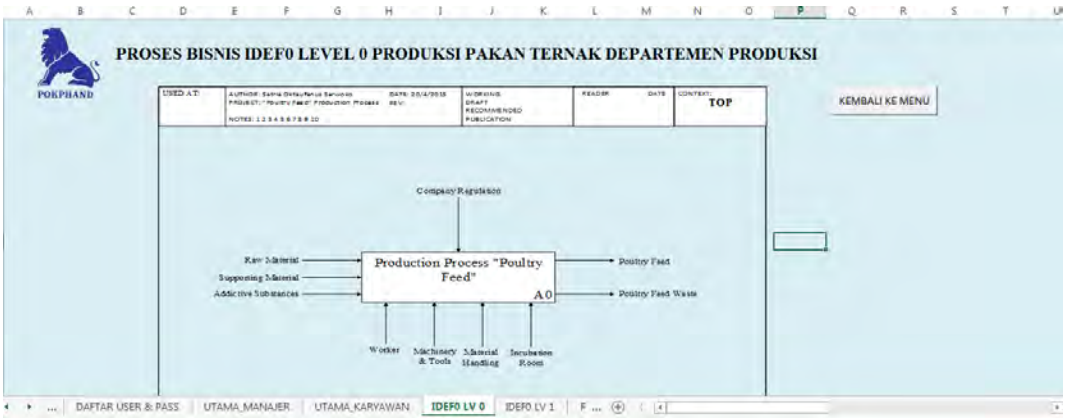
```
  Sheet9.CommandButton4.Visible
= False
  ElseIf Cells(15, 5) =
Sheet4.Cells(5, 8) Then
  Sheet10.Activate
  Sheet10.Cells(3, 3) =
Sheet4.Cells(6, 5)
  Sheet10.CommandButton1.Visible
= False
  Sheet10.CommandButton2.Visible
= False
  Sheet10.CommandButton4.Visible
= True
  Sheet10.CommandButton5.Visible
= False
  ElseIf Cells(15, 5) =
Sheet4.Cells(6, 8) Then
  Sheet11.Activate
  Sheet11.Cells(3, 3) =
Sheet4.Cells(7, 5)
  Sheet11.CommandButton1.Visible
= False
  Sheet11.CommandButton2.Visible
= False
  Sheet11.CommandButton4.Visible
= True
  Sheet11.CommandButton3.Visible
= False
  End If
End Sub

Private Sub
CommandButton2_Click()
Sheet81.Activate
End Sub

Private Sub
CommandButton3_Click()
Sheet80.Activate
End Sub

Private Sub
CommandButton4_Click()
Sheet2.Activate
End Sub

Private Sub
CommandButton5_Click()
Sheet32.Activate
End Sub

Private Sub
CommandButton6_Click()
Sheet33.Activate
End Sub
```

F. Employee Home Interface


```
Private Sub CommandButton1_Click()
Sheet8.Activate
End Sub
```

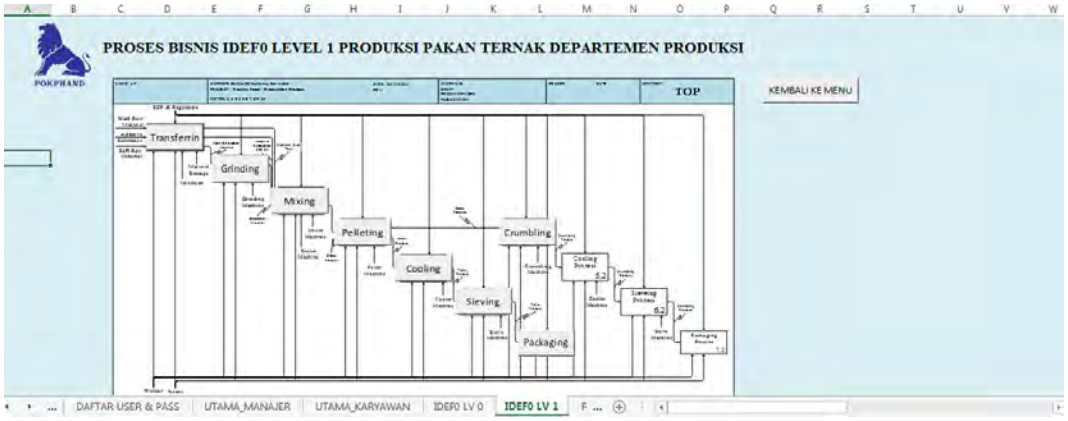
```
Private Sub CommandButton4_Click()
Sheet3.Activate
End Sub
```

G. IDEF0 LV 0



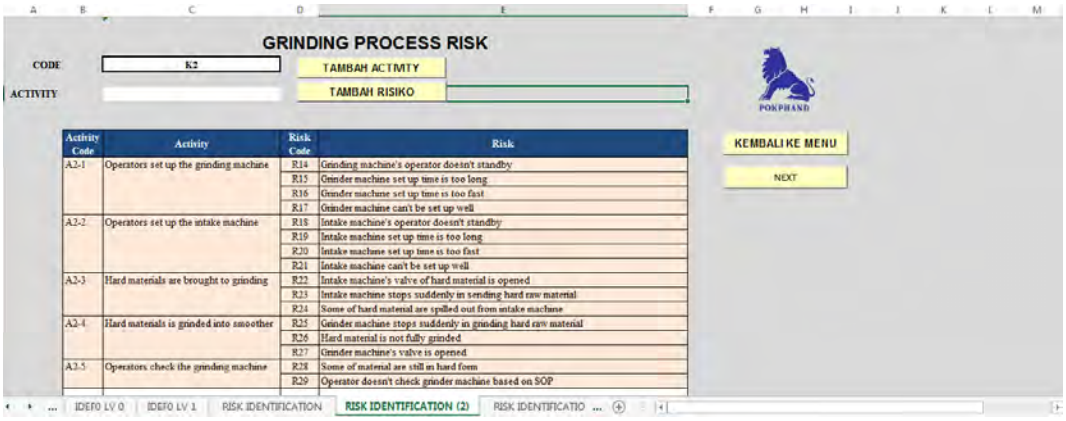

```
Private Sub CommandButton1_Click()
Sheet5.Activate
End Sub
```

H. IDEF0 LV 1




```
Private Sub
CommandButton1_Click()
Sheet27.Activate
End Sub

Private Sub
CommandButton2_Click()
Sheet29.Activate
End Sub

Private Sub
CommandButton3_Click()
Sheet35.Activate
End Sub

Private Sub
CommandButton4_Click()
Sheet36.Activate
End Sub

Private Sub
CommandButton5_Click()
Sheet42.Activate
End Sub

Private Sub
CommandButton6_Click()
Sheet43.Activate
End Sub

Private Sub
CommandButton7_Click()
Sheet44.Activate
End Sub

Private Sub
CommandButton8_Click()
Sheet49.Activate
End Sub

Private Sub
CommandButton9_Click()
Sheet5.Activate
End Sub
```

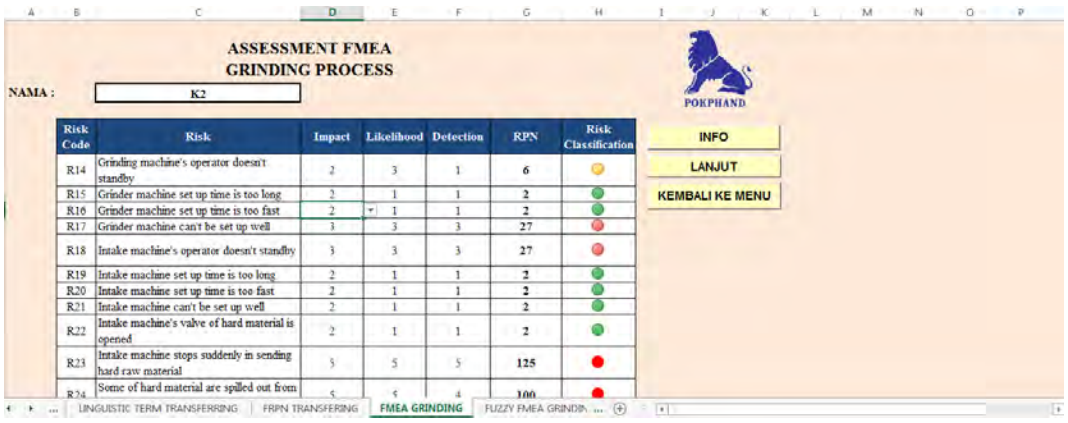
I. Risk Identification




```
Private Sub CommandButton1_Click()
If Cells(5, 3) <> "" Then
a = Cells(1, 2) + 1
b = Cells(1, 1) + 1
Cells(b + 8, 3) = Cells(5, 3)
Cells(b + 8, 2) = a
'Cells(b + 8, 4) = b
Cells(b + 8, 1) = b
Sheet12.Cells(a + 4, 2) = a
Sheet12.Cells(a + 4, 3) = Cells(5, 3)
Sheet17.Cells(a + 4, 2) = a
Sheet22.Cells(a + 4, 2) = a
Sheet7.Cells(a + 4, 1) = a
Cells(5, 3).Clear
CommandButton2.Visible = True
Else
MsgBox ("Lengkapi Data Anda Terlebih Dahulu")
End If
End Sub
Private Sub CommandButton2_Click()
a = Cells(1, 2) + 1
b = Cells(1, 4) + 1
isi = InputBox("Masukkan Risiko Aktivitas Perusahaan Anda")

If isi = "" Then
MsgBox ("Anda belum mengisi rincian risiko")
Else
Cells(b + 8, 4) = b
Cells(b + 8, 1) = b
Cells(b + 8, 5) = isi
End If
End Sub

Private Sub CommandButton3_Click()
Sheet33.Activate
End Sub

Private Sub CommandButton4_Click()
Sheet52.Activate
```

```
End Sub

Private Sub CommandButton5_Click()
Sheet6.Activate
End Sub

Private Sub CommandButton6_Click()
Max = Sheet29.Cells(1, 4)
Selection.Copy
Sheet29.Activate
'ActiveWorkbook.Sheets("").Range(
Cells(27 + 9, 5).Address).Select
Sheet29.Cells(9 + Max, 5).Select
ActiveSheet.Paste
End Sub

Private Sub CommandButton7_Click()
nomor = InputBox("Tacit Ke-")
ActiveWorkbook.Sheets("").Range(
Cells(nomor + 8, 5).Address).Insert
(xlShiftDown)
ActiveWorkbook.Sheets("").Range(
Cells(nomor + 8, 2).Address & ":" &
Cells(nomor + 8, 3).Address).Insert
(xlShiftDown)
isi = InputBox("Masukkan Tacit
Knowledge")
ActiveWorkbook.Sheets("").Range(
Cells(nomor + 8, 5).Address) = isi
Max = Cells(1, 4)
max2 = Cells(1, 1)
Cells(9 + Max, 4) = Max + 1
Cells(9 + max2, 1) = max2 + 1
End Sub

Private Sub Worksheet_Activate()
CommandButton2.Visible = False
End Sub
```

J. FMEA Grinding

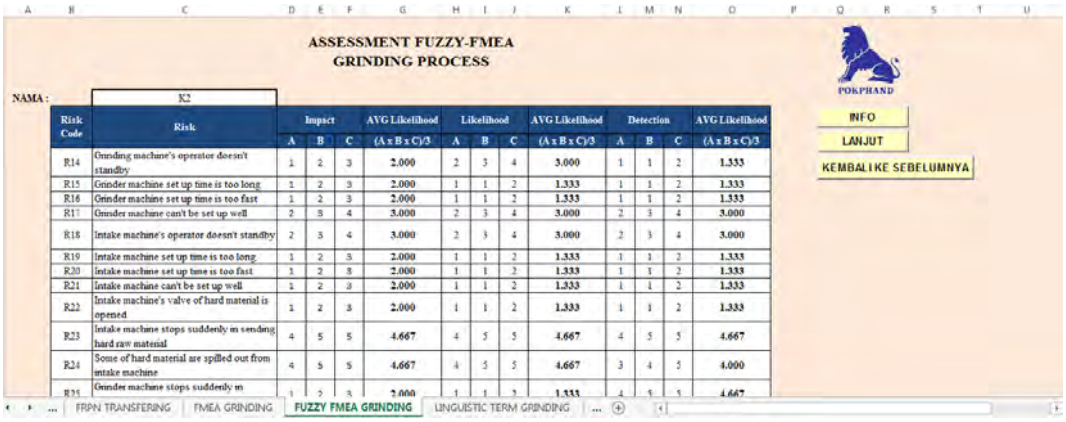



```
Private Sub CommandButton1_Click()
Sheet53.Activate
End Sub
```

```
Private Sub
CommandButton2_Click()
Sheet37.Activate
End Sub
```

```
Private Sub
CommandButton3_Click()
Sheet33.Activate
End Sub
```

K. Fuzzy FMEA Grinding



ASSESSMENT FUZZY-FMEA
GRINDING PROCESS

NAMA : K2

POKPHAND

INFO
LANJUT
KEMBALI KE SEBELUMNYA

Risk Code	Risk	Impact			AVG Likelihood	Likelihood			AVG Likelihood	Detection			AVG Likelihood
		A	B	C	(A x B x C)/3	A	B	C	(A x B x C)/3	A	B	C	(A x B x C)/3
R14	Grinding machine's operator doesn't standby	1	2	3	2.000	2	3	4	3.000	1	1	2	1.333
R15	Grinder machine set up time is too long	1	2	3	2.000	1	1	2	1.333	1	1	2	1.333
R16	Grinder machine set up time is too fast	1	2	3	2.000	1	1	2	1.333	1	1	2	1.333
R17	Grinder machine can't be set up well	2	3	4	3.000	2	3	4	3.000	2	3	4	3.000
R18	Intake machine's operator doesn't standby	2	3	4	3.000	2	3	4	3.000	2	3	4	3.000
R19	Intake machine set up time is too long	1	2	3	2.000	1	1	2	1.333	1	1	2	1.333
R20	Intake machine set up time is too fast	1	2	3	2.000	1	1	2	1.333	1	1	2	1.333
R21	Intake machine can't be set up well	1	2	3	2.000	1	1	2	1.333	1	1	2	1.333
R22	Intake machine's valve of hard material is opened	1	2	3	2.000	1	1	2	1.333	1	1	2	1.333
R23	Intake machine stops suddenly in sending hard raw material	4	5	5	4.667	4	5	5	4.667	4	5	5	4.667
R24	Some of hard material are spilled out from intake machine	4	5	5	4.667	4	5	5	4.667	3	4	5	4.000
R25	Grinder machine stops suddenly in	1	2	3	2.000	1	1	2	1.333	4	5	5	4.667

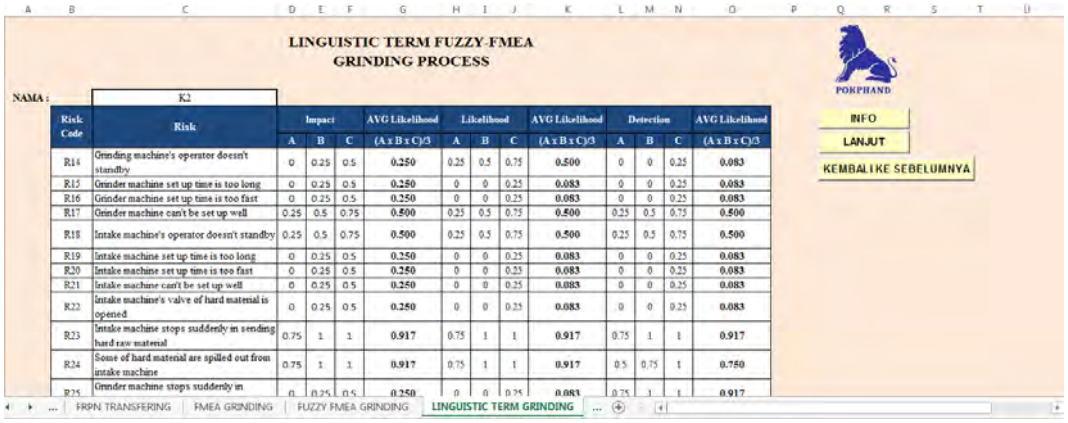
FRPN TRANSFERING | FMEA GRINDING | FUZZY FMEA GRINDING | LINGUISTIC TERM GRINDING

```
Private Sub
CommandButton1_Click()
Sheet54.Activate
End Sub

Private Sub
CommandButton2_Click()
Sheet30.Activate
End Sub

Private Sub
CommandButton3_Click()
Sheet52.Activate
End Sub
=IF('FMEA
GRINDING'!D7=1,"1",IF('FMEA
GRINDING'!D7=2,"1",IF('FMEA
GRINDING'!D7=3,"2",IF('FMEA
GRINDING'!D7=4,"3","4"))))
```

```
=IF('FMEA
GRINDING'!D7=1,"1",IF('FMEA
GRINDING'!D7=2,"2",IF('FMEA
GRINDING'!D7=3,"3",IF('FMEA
GRINDING'!D7=4,"4","5"))))
=IF('FMEA
GRINDING'!D7=1,"2",IF('FMEA
GRINDING'!D7=2,"3",IF('FMEA
GRINDING'!D7=3,"4",IF('FMEA
GRINDING'!D7=4,"5","5"))))
=IF('FMEA
GRINDING'!E7=1,"1",IF('FMEA
GRINDING'!E7=2,"1",IF('FMEA
GRINDING'!E7=3,"2",IF('FMEA
GRINDING'!E7=4,"3","4"))))
=IF('FMEA
GRINDING'!E7=1,"1",IF('FMEA
GRINDING'!E7=2,"2",IF('FMEA
```

GRINDING'!E7=3,"3",IF('FMEA GRINDING'!E7=4,"4","5"))))
=IF('FMEA GRINDING'!E7=1,"2",IF('FMEA GRINDING'!E7=2,"3",IF('FMEA GRINDING'!E7=3,"4",IF('FMEA GRINDING'!E7=4,"5","5"))))
=IF('FMEA GRINDING'!F7=1,"1",IF('FMEA GRINDING'!F7=2,"1",IF('FMEA GRINDING'!F7=3,"2",IF('FMEA GRINDING'!F7=4,"3","4"))))
=IF('FMEA GRINDING'!F7=1,"1",IF('FMEA GRINDING'!F7=2,"2",IF('FMEA GRINDING'!F7=3,"3",IF('FMEA GRINDING'!F7=4,"4","5"))))
=IF('FMEA GRINDING'!F7=1,"2",IF('FMEA GRINDING'!F7=2,"3",IF('FMEA GRINDING'!F7=3,"4",IF('FMEA GRINDING'!F7=4,"5","5"))))

L. Linguisttic Term Grinding



Risk Code	Risk	Impact			AVG Likelihood	Likelihood			AVG Likelihood	Detection			AVG Likelihood
		A	B	C	(AxBxC)/3	A	B	C	(AxBxC)/3	A	B	C	(AxBxC)/3
R14	Grinding machine's operator doesn't standby	0	0.25	0.5	0.250	0.25	0.5	0.75	0.500	0	0	0.25	0.083
R15	Grinder machine set up time is too long	0	0.25	0.5	0.250	0	0	0.25	0.083	0	0	0.25	0.083
R16	Grinder machine set up time is too fast	0	0.25	0.5	0.250	0	0	0.25	0.083	0	0	0.25	0.083
R17	Grinder machine can't be set up well	0.25	0.5	0.75	0.500	0.25	0.5	0.75	0.500	0.25	0.5	0.75	0.500
R18	Intake machine's operator doesn't standby	0.25	0.5	0.75	0.500	0.25	0.5	0.75	0.500	0.25	0.5	0.75	0.500
R19	Intake machine set up time is too long	0	0.25	0.5	0.250	0	0	0.25	0.083	0	0	0.25	0.083
R20	Intake machine set up time is too fast	0	0.25	0.5	0.250	0	0	0.25	0.083	0	0	0.25	0.083
R21	Intake machine can't be set up well	0	0.25	0.5	0.250	0	0	0.25	0.083	0	0	0.25	0.083
R22	Intake machine's valve of hard material is opened	0	0.25	0.5	0.250	0	0	0.25	0.083	0	0	0.25	0.083
R23	Intake machine stops suddenly in sending hard raw material	0.75	1	1	0.917	0.75	1	1	0.917	0.75	1	1	0.917
R24	Some of hard material are spilled out from intake machine	0.75	1	1	0.917	0.75	1	1	0.917	0.5	0.75	1	0.750
R25	Grinder machine stops suddenly in	0	0.25	0.5	0.250	0	0	0.25	0.083	0.75	1	1	0.917

Private Sub CommandButton1_Click()
Sheet55.Activate
End Sub

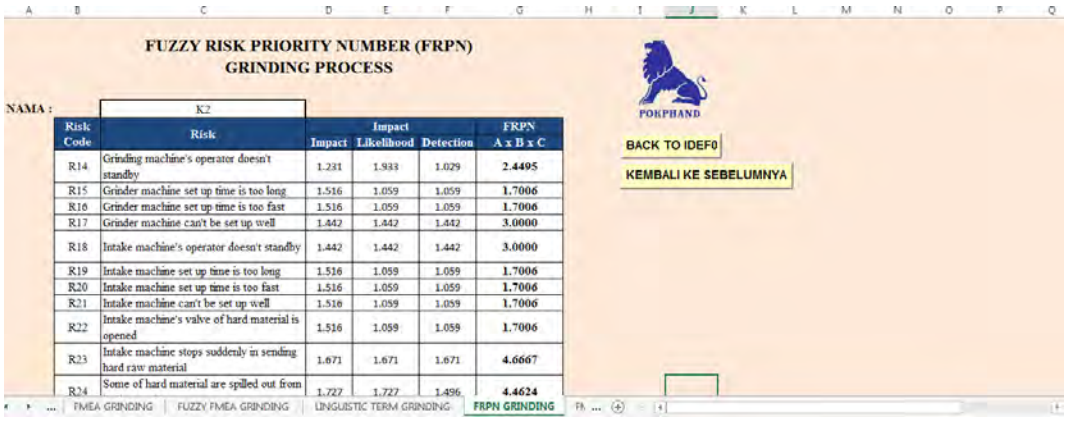
Private Sub CommandButton2_Click()
Sheet30.Activate
End Sub

Private Sub CommandButton3_Click()
Sheet53.Activate
End Sub

=IF('FMEA GRINDING'!D7=1,"0",IF('FMEA GRINDING'!D7=2,"0",IF('FMEA GRINDING'!D7=3,"0.25",IF('FMEA GRINDING'!D7=4,"0.5",IF('FMEA GRINDING'!D7=5,"0.75","0")))))

```
=IF('FMEA GRINDING'!D7=1,"0",IF('FMEA GRINDING'!D7=2,"0.25",IF('FMEA GRINDING'!D7=3,"0.5",IF('FMEA GRINDING'!D7=4,"0.75",IF('FMEA GRINDING'!D7=5,"1","0")))))
=IF('FMEA GRINDING'!D7=1,"0.25",IF('FMEA GRINDING'!D7=2,"0.5",IF('FMEA GRINDING'!D7=3,"0.75",IF('FMEA GRINDING'!D7=4,"1",IF('FMEA GRINDING'!D7=5,"1","0")))))
=IF('FMEA GRINDING'!E7=1,"0",IF('FMEA GRINDING'!E7=2,"0",IF('FMEA GRINDING'!E7=3,"0.25",IF('FMEA GRINDING'!E7=4,"0.5",IF('FMEA GRINDING'!E7=5,"0.75","0")))))
=IF('FMEA GRINDING'!E7=1,"0",IF('FMEA GRINDING'!E7=2,"0.25",IF('FMEA GRINDING'!E7=3,"0.5",IF('FMEA GRINDING'!E7=4,"0.75",IF('FMEA GRINDING'!E7=5,"1","0")))))
=IF('FMEA GRINDING'!E7=1,"0.25",IF('FMEA GRINDING'!E7=2,"0.5",IF('FMEA GRINDING'!E7=3,"0.75",IF('FMEA GRINDING'!E7=4,"1",IF('FMEA GRINDING'!E7=5,"1","0")))))
=IF('FMEA GRINDING'!F7=1,"0",IF('FMEA GRINDING'!F7=2,"0",IF('FMEA GRINDING'!F7=3,"0.25",IF('FMEA GRINDING'!F7=4,"0.5",IF('FMEA GRINDING'!F7=5,"0.75","0")))))
=IF('FMEA GRINDING'!F7=1,"0",IF('FMEA GRINDING'!F7=2,"0.25",IF('FMEA GRINDING'!F7=3,"0.5",IF('FMEA GRINDING'!F7=4,"0.75",IF('FMEA GRINDING'!F7=5,"1","0")))))
=IF('FMEA GRINDING'!F7=1,"0.25",IF('FMEA GRINDING'!F7=2,"0.5",IF('FMEA GRINDING'!F7=3,"0.75",IF('FMEA GRINDING'!F7=4,"1",IF('FMEA GRINDING'!F7=5,"1","0")))))
```

M. FRPN Grinding



FUZZY RISK PRIORITY NUMBER (FRPN)
GRINDING PROCESS

NAMA : K2

POKPHAND

BACK TO IDEF0

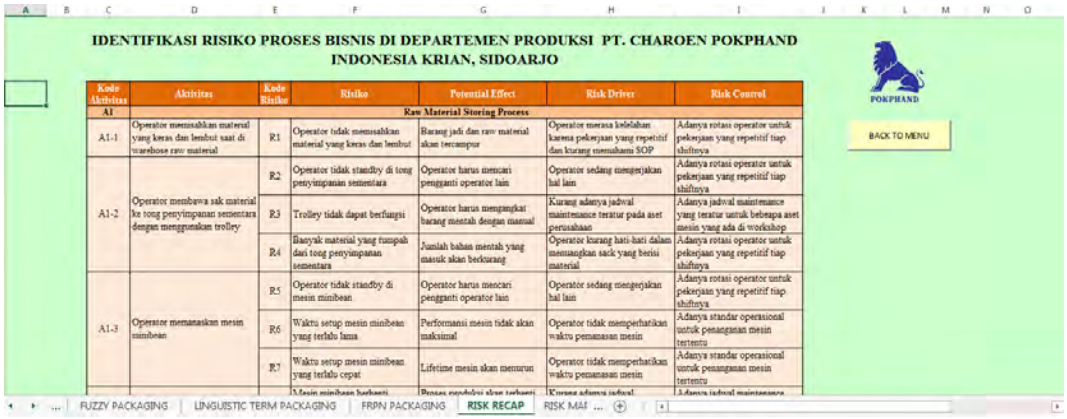
KEMBALI KE SEBELUMNYA

Risk Code	Risk	Impact	Likelihood	Detection	FRPN A x B x C
R14	Grinding machine's operator doesn't standby	1.231	1.933	1.029	2.4495
R15	Grinder machine set up time is too long	1.516	1.059	1.059	1.7006
R16	Grinder machine set up time is too fast	1.516	1.059	1.059	1.7006
R17	Grinder machine can't be set up well	1.442	1.442	1.442	3.0000
R18	Intake machine's operator doesn't standby	1.442	1.442	1.442	3.0000
R19	Intake machine set up time is too long	1.516	1.059	1.059	1.7006
R20	Intake machine set up time is too fast	1.516	1.059	1.059	1.7006
R21	Intake machine can't be set up well	1.516	1.059	1.059	1.7006
R22	Intake machine's valve of hard material is opened	1.516	1.059	1.059	1.7006
R23	Intake machine stops suddenly in sending hard raw material	1.671	1.671	1.671	4.6667
R24	Some of hard material are spilled out from	1.727	1.727	1.496	4.4624

FMEA GRINDING | FUZZY FMEA GRINDING | LINGUISTIC TERM GRINDING | FRPN GRINDING

```
Private Sub CommandButton1_Click()
Sheet33.Activate
End Sub

Private Sub CommandButton2_Click()
Sheet54.Activate
End Sub
='FUZZY FMEA GRINDING'!G8^(('LINGUISTIC TERM GRINDING'!G8)/('LINGUISTIC TERM GRINDING'!G8+'LINGUISTIC TERM GRINDING'!K8+'LINGUISTIC TERM GRINDING'!O8))
='FUZZY FMEA GRINDING'!K8^(('LINGUISTIC TERM GRINDING'!K8)/('LINGUISTIC TERM GRINDING'!G8+'LINGUISTIC TERM GRINDING'!K8+'LINGUISTIC TERM GRINDING'!O8))
='FUZZY FMEA GRINDING'!O8^(('LINGUISTIC TERM GRINDING'!O8)/('LINGUISTIC TERM GRINDING'!G8+'LINGUISTIC TERM GRINDING'!K8+'LINGUISTIC TERM GRINDING'!O8))
```

N. Risk Recap

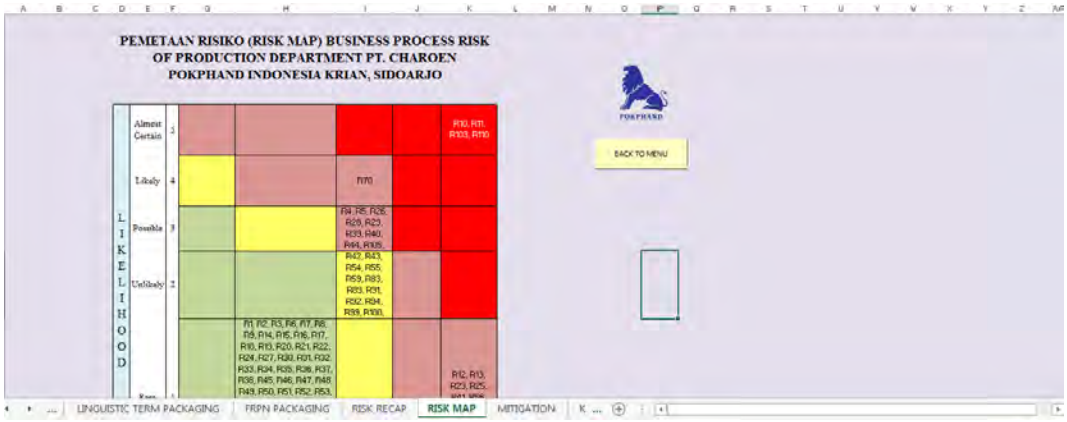


Private Sub CommandButton2_Click()

Sheet6.Activate

End Sub

O. Risk Mapping

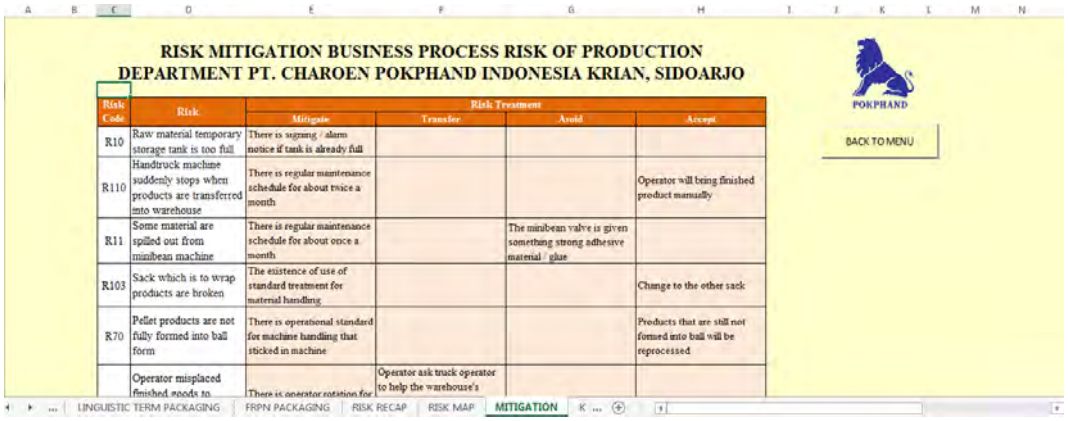


Private Sub CommandButton1_Click()

Sheet5.Activate

End Sub

P. Mitigation Process



RISK MITIGATION BUSINESS PROCESS RISK OF PRODUCTION DEPARTMENT PT. CHAROEN POKPHAND INDONESIA KRIAN, SIDOARJO

POKPHAND

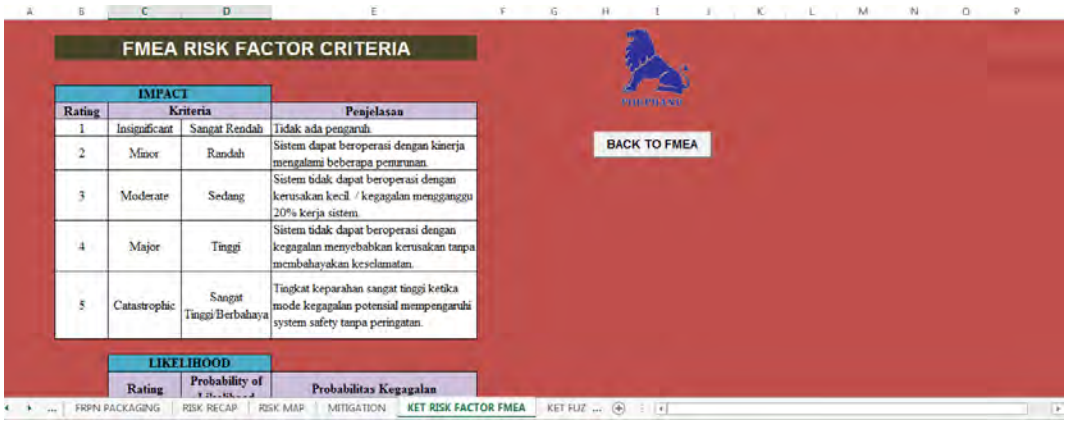
BACK TO MENU

Risk Code	Risk	Risk Treatment			
		Mitigate	Transfer	Avoid	Accept
R10	Raw material temporary storage tank is too full	There is signing / alarm notice if tank is already full			
R110	Handtruck machine suddenly stops when products are transferred into warehouse	There is regular maintenance schedule for about twice a month			Operator will bring finished product manually
R11	Some material are spilled out from minibean machine	There is regular maintenance schedule for about once a month		The minibean valve is given something strong adhesive material / glue	
R103	Sack which is to wrap products are broken	The existence of use of standard treatment for material handling			Change to the other sack
R70	Pellet products are not fully formed into ball form	There is operational standard for machine handling that sticked in machine			Products that are still not formed into ball will be reprocessed
	Operator misplaced finished goods to		Operator ask truck operator to help the warehouse's		

LINGUISTIC TERM PACKAGING | FRPN PACKAGING | RISK RECAP | RISK MAP | MITIGATION | K ...

```
Private Sub CommandButton1_Click()
Sheet5.Activate
End Sub
```

Q. Ket Risk Factor FMEA



FMEA RISK FACTOR CRITERIA

POKPHAND

BACK TO FMEA

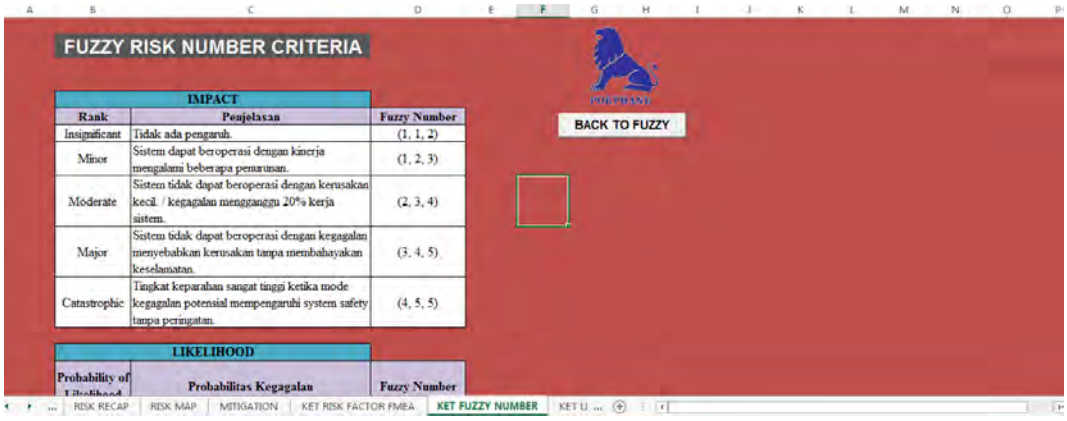
IMPACT			
Rating	Kriteria		Penjelasan
1	Insignificant	Sangat Rendah	Tidak ada pengaruh.
2	Minor	Rendah	Sistem dapat beroperasi dengan kinerja mengalami beberapa penurunan.
3	Moderate	Sedang	Sistem tidak dapat beroperasi dengan kerusakan kecil / kegagalan mengganggu 20% kerja sistem.
4	Major	Tinggi	Sistem tidak dapat beroperasi dengan kegagalan menyebabkan kerusakan tanpa membahayakan keselamatan.
5	Catastrophic	Sangat Tinggi/Berbahaya	Tingkat keparahan sangat tinggi ketika mode kegagalan potensial mempengaruhi system safety tanpa peringatan.

LIKELIHOOD		
Rating	Probability of	Probabilitas Kegagalan

FRPN PACKAGING | RISK RECAP | RISK MAP | MITIGATION | KET RISK FACTOR FMEA | KET FUZ ...

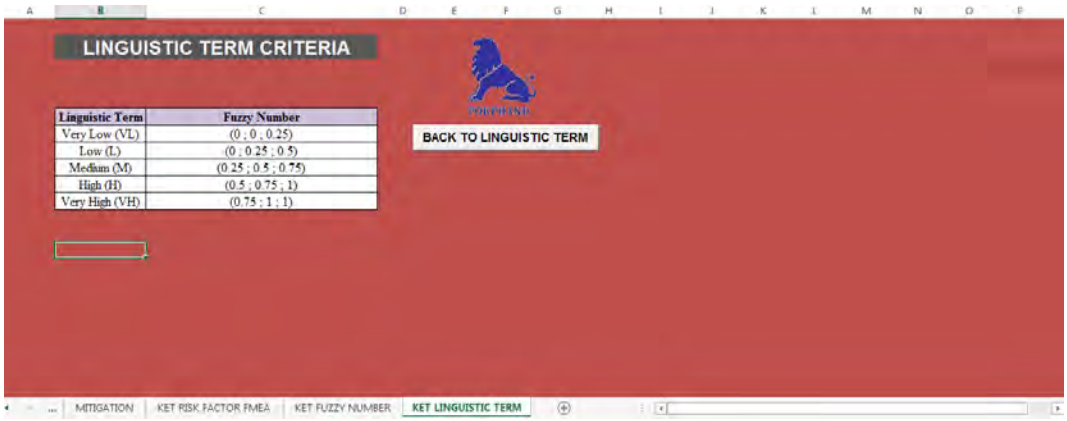
```
Private Sub CommandButton1_Click()
Sheet12.Activate
End Sub
```

R. Ket Fuzzy Number




```
Private Sub CommandButton1_Click()
Sheet17.Activate
End Sub
```

S. Ket Linguistic Term




```
Private Sub CommandButton1_Click()
Sheet50.Activate
End Sub
```

BIOGRAPHY

Satria Oktaufanus Sarwoko was born in Blitar, October 11th, 1992. He was been living in Sidoarjo since he was 4 years old. He is the first child in his family. He was graduated from TK Hang Tuah 22 Sidoarjo in 1999, SD Hang Tuah 9 Candi, Sidoarjo in 2005, SMPN 1 Candi Sidoarjo in 2008, and SMAN 1 Sidoarjo in 2011. He also attended one of the best institutes in Indonesia, Sepuluh Nopember Institute of Technology majoring Industrial Engineering Department.

He was active in several student organizations since senior high school. He joined student organization called OSIS SMA as treasurer 2. In his college, he was active in Industrial Engineering Youth Club under Dikesma Department. And also he joined as a laboratory assistant of Industrial Management and System Development Laboratory in 2013-2015.

He got a lot of experiences of both hard skill and soft skill during his study. He has joined Student Exchange at Universiti Teknikal Malaysia Melaka (UTeM Malaysia) in semester 3. He attended some soft skill training such as Managerial Skill of Student Training Basic Level. In hard skill side, he got training for AutoCad, 3DSMax, MS. Project, Arena, and Knowledge Management System.

He likes adventuring and meeting new things. He likes gathering and having a good conversation. He likes to playing music and travelling. And also he likes to question share to others. He can be found in this email: satria.o.sarwoko@gmail.com.