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RISK MANAGEMENT ANALYSIS IN CPO PRODUCTION (CASE STUDY PTPN IV REGIONAL I PKS SEI SILAU)

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ABSTRACT

This study analyzes risk management in Crude Palm Oil (CPO) production with a case study at PTPN IV Regional I PKS Sei Silau. Palm oil is a major commodity in Sumatra with a significant contribution to the Indonesian economy, where this industry contributes 3.5% of the total national GDP and 13.5% of non-oil and gas exports. The purpose of the study was to identify risks in CPO production and determine risk management strategies. The research method used a descriptive qualitative approach with data collection through interviews and direct observation. Risk analysis was carried out using the Failure Mode and Effect Analysis (FMEA) method to identify, analyze, and evaluate risks. The results of the study showed five main sources of risk in CPO production, namely: shortage of FFB raw materials (18), sorting FFB with raw fruit (12), machine damage (60), delays in the production process (6), and substandard CPO quality (24). The mitigation strategies implemented include optimizing production machines, regular training for employees, and strict supervision during the production and distribution process. The implementation of these strategies has reduced raw material shortages by 30% and increased production efficiency. This study concludes that the systematic application of risk management can improve operational smoothness and the quality of CPO products.

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1. INTRODUCTION

The Indonesian agricultural sector in economic development is capable of making a significant contribution to the increase in national income. The agricultural sector consists of several sub-sectors, namely fisheries, food crops, forestry, livestock, and plantations. The plantation sub-sector is further divided into various types of plantation crops such as cinchona, coffee, cocoa, oil palm, rubber, sugarcane, tea, and tobacco.

The plantation sector is one of the mainstays of Indonesia's economy, contributing 96.86% of total agricultural exports. Of that amount, 73.83% comes from palm oil (palm oil = PO). The palm oil industry also contributes 3.5% of Indonesia's total GDP, 13.5% of total non-oil and gas exports, and employs more than 16 million workers (Fevriera & Safara Devi).

Oil palm (Elaeis guineensis Jacq.) is one of the main plantation commodities in Indonesia. Palm oil can be processed into palm oil known as Crude Palm Oil (CPO) and Palm Kernel Oil (PKO) (Blok no et al., 2018).

With the data available in the palm oil industry, which has the largest area in Indonesia with palm oil plantations covering 44 million MT (57%) of the world's total plantations, particularly the production of Crude Palm Oil (CPO) in Indonesia, with data for the year 2023 showing 45.5 million metric tons (MT), it can reach the number one position among Malaysia and Thailand. The regions of Sumatra and Kalimantan are the largest palm oil producing areas in Indonesia, with each region having palm oil processing factories. One of these is located in the PTPN IV REGIONAL I PKS SEI SILAU plantation, which is a palm oil processing factory situated in the Sei Silau plantation. The main product is Crude Palm Oil (CPO), which plays a very important role in Indonesia's economy. As one of the largest palm oil-producing countries in the world, Indonesia relies on this sector to create jobs, boost exports, and support economic development. The Plantation Sector currently plays a very important role in Indonesia's economy. This subsector of the Plantation Sector is one of the non-oil and gas foreign exchange sources, with exports amounting to US$19.095 billion in January, while in December the amount was US$21.921 billion, showing an increase of 2.8% for 2024.

Risk management in CPO production is a crucial aspect to ensure process smoothness, reduce potential losses, and enhance industry competitiveness. These risks include technical, operational, environmental, and economic factors that can hinder production and incur additional costs for the company. Therefore, an in-depth analysis of production risk management is necessary to identify, evaluate, and control various potential obstacles that may arise.

PTPN IV REGIONAL I PKS SEI SILAU, located in Asahan Regency, North Sumatra, in the Buntu Pane District, is a company engaged in the palm oil processing industry that produces CPO (Crude Palm Oil). In its production process, the processing of palm oil into palm oil or Crude Palm Oil begins at the Fresh Fruit Bunch Reception Station (Weighbridge, Sorting, Loading ramp), Sterilization Station, Threshing Station, Screw Press Station, Clarification Station, CPO Storage Tank, Kernel Station, Boiler Station, and Power House Station. Where the process at each station involves machines and equipment that can pose potential hazards to workers (Tarigan et al., 2023).

The research conducted by Indriyani (2018) emphasizes the importance for companies to continuously maintain the implementation of risk management that has been running well, which includes the process of identifying aspects or hazards, analyzing impacts or risks, and controlling those impacts and risks. To maintain the effectiveness of risk management, companies are expected to routinely conduct reviews of the results of identifying environmental, safety, and occupational health aspects and impacts (LK3) on a continuous basis. In addition, it is important for the company to follow up on the results of risk evaluation and analysis by making improvements and taking appropriate mitigation actions based on those analysis results.

Meanwhile, the research conducted by Gunadi Muslih and Harniatun Iswarini (2022) discusses production management at the PT. Buluh Cawang Plantation factory, which starts from the input stage, namely the reception of raw materials through the security post, registration post, and weighbridge, and continues with the production sorting process such as loading ramp, sterilizer, thresher, digester, up to classification. The output of this process is the final product in the form of Crude Palm Oil (CPO). In its implementation, there are several frequent obstacles, especially at the input stage, such as weighing errors, administrative mistakes by workers, raw materials that do not meet the criteria, and security disturbances. Obstacles also arise during the production stage, particularly at the boiling station, where suboptimal steam distribution causes delays in the boiling cycle time. In addition, there are technical issues such as fuel shortages and damage to the boiler pipes. Output issues, such as the decline in CPO quality, also frequently occur and are mostly caused by human factors, such as negligence in checking the storage tank temperature and neglecting standard operating procedures (SOP).

Another study conducted by Deasy Kartika Rahayu Kuncoro, Putri Ayu Navy Pratiwi, and Yudi Sukmono (2018) used the Failure Mode and Effect Analysis (FMEA) method to identify risk events. In this study, 35 risk events along with their causes were identified. Out of the total, 18 risk events have the highest Risk Priority Number (RPN) and fall within the top 80% of the cumulative RPN values. Out of those 18 incidents, 7 risks with the highest Risk Priority Number (RPN) were selected to receive risk control proposals. Next, 17 control proposals were formulated based on the root causes of the seven risks, which were analyzed using Fault Tree Analysis (FTA). The purpose of these proposals is to significantly reduce the occurrence of risks in the company's operational environment.

Based on the above research, I am interested in continuing this study with the following objectives. (1) Identifying the risks occurring in CPO production at PKS SEI SILAU. (2) Determining strategies that can be applied to address various risks at PKS SEI SILAU.

2. RESEARCH METHODS

Production risk management refers to the identification, analysis, and management of risks that can hinder the smooth production of a product, in this case, crude palm oil (CPO).

According to Sri Sarjana, et al. (2022), risk management is an organizational process of identifying, assessing, and controlling various threats and challenges to achieving objectives.

According to Sotya Fevriera et al. (2023), CPO production will increase by 1.0384%, 1.0415%, and 1.011% respectively. So, palm oil production is elastic to the exchange rate, meaning palm oil production increases faster than the increase in the exchange rate.

According to Pungki Syaraswati et al. (2017), risk management is used to determine strategic steps related to decisions to prevent, minimize, or even bear potential risks. One of the methods that can serve as an alternative is Enterprise Risk Management (ERM).

According to Muhammad Arif et al. (2023), coordination between suppliers, producers, and distributors is necessary to distribute CPO as an output in the industry. Transportation policies will affect their production and distribution policies, so inventory policies and transportation policies must be integrated.

According to Anizar Anizar, et al. (2021), risk identification is one of the important things to do to prevent failure. One of them is the risk in the production process that leads to a decline in product quality in the factory. If not identified promptly, it will result in losses such as increased costs, longer production times, and unmet production capacity. In conducting risk identification, the Failure Mode and Effect Analysis (FMEA) method is used by scoring each potential risk based on the criteria of severity, occurrence, and detection.

According to Retna Kristiana (2022), the production process risks involve risks in purchasing fish raw materials. During certain seasons, fish prices tend to be high, but the sales of processed products do not increase.

According to Anizar Anizar, et al. (2021), there are four processes that have the highest risk, namely crystallization, filtration, inspection, and bleaching. There are 2 categories of causes in the crystallization process, namely machine and human, 1 category in the filtration process, namely machine, and 3 categories in the inspection and bleaching processes, namely machine, human, and material. Improvement suggestions using the 5W + 1H method indicate that there are 13 proposals provided for each potential risk and its category.

According to HR. Abu Dawud, it is said that "Keep yourself away from envy because envy consumes good deeds just as fire consumes wood".

According to QS al-Nahl: 126 "If you are attacked, then retaliate in proportion to the harm that has been inflicted upon you".

According to QS Al-Baqarah: 60 "(Remember) when Moses asked for (a supply of) water for his people". Then, We said, "Strike the stone with your staff!" Then, twelve springs gushed forth from it (the rock). Each tribe knew its own drinking place. Eat and drink the sustenance (given) by Allah and do not commit evil on earth by causing corruption.

This research uses a case study at PTPN IV REGIONAL I PKS SEI SILAU employing a descriptive qualitative method by collecting data through interviews and CPO production data. Qualitative research according to Zuchri Abdussamad (2021:40) is research that seeks to understand phenomena in such a way that quantification is not required, or because these phenomena cannot be measured accurately.

In this study, primary data were obtained through direct observation in the oil palm production area. Observations were conducted meticulously to identify potential hazards that might occur in that environment. In addition, primary data is also supported by interviews with factory staff named Mr. Samsudin, who works in the risk management section of the factory area, to strengthen the accuracy and validity of the research findings. Meanwhile, secondary data were obtained through interviews conducted using pre-prepared questionnaires. This secondary data also includes publications from relevant institutions or agencies, as well as various literature sources such as journals, books, and other scientific references that support the primary data (Baroroh &

Fauziyah, 2021). In this study, the method used to analyze potential hazards and conduct risk assessments is the Failure Mode and Effect Analysis (FMEA) method.

FMEA (Failure Mode and Effect Analysis) is one of the most useful methods in risk management analysis for CPO (Crude Palm Oil) production. In the context of the palm oil industry, CPO production involves various complex processes, from harvesting fresh fruit bunches (FFB) to crude oil processing. During this process, there are many potential failures that can affect the quality and quantity of the produced CPO, as well as operational and environmental safety. Therefore, the application of FMEA can help identify high-risk failure modes, such as damage to processing machines, failures in separation systems, or product contamination due to negligence in the process.

Through FMEA, each potential failure is analyzed by evaluating its impact, the cause of the failure, as well as the likelihood of occurrence and the ability to detect it. For example, if there is a failure in the fresh fruit bunch cooking process (such as incorrect temperature), it could potentially reduce the quality of CPO, cause damage to the machinery, or even disrupt operational smoothness. Assessment of severity, occurrence, and detection allows management to calculate the Failure Risk Priority Number (FRPN) using the formula:

$$FRPN = Severity \times Occurrence \times Detection$$

a. Severity
   Measuring the severity level of the impact caused by a failure. The greater the impact caused, the higher the severity value. Usually rated on a scale of 1 to 10, where 1 means very low impact and 10 means very high impact (for example, it can cause significant damage to the product or even accidents).
b. Occurrence
   Measuring the likelihood of failure or damage occurring. The scale used is usually from 1 to 10, where 1 means very unlikely to happen, and 10 means very likely to happen.
c. Detection
   Measuring the ability to detect failures before a greater impact occurs. The scale used is usually from 1 to 10, where 1 means detection is very likely (failure is easy to detect), and 10 means detection is very unlikely (failure is hard to detect).

The calculation method using the FRPN formula analyzes the risk of a failure in the production process. Here are the given values:

1) Severity: 4 (significant impact if failure occurs)
2) Occurrence: 2 (the likelihood of failure occurring is quite low)
3) Detection: 3 (the likelihood of detecting failure is quite high)

So, the FRPN is:

$$FRPN = 8 \times 4 \times 3 = 96$$

The higher the FRPN value, the greater the priority to address the issue. On the contrary, a lower score indicates that the problem may not be as urgent to fix.

The purpose of FRPN:

By using FRPN, the company can prioritize corrective actions in areas with the highest risk, ensuring that resources are used effectively to prevent the most impactful failures, and identifying areas that need more attention. Failures with the highest FRPN will be prioritized for repair or mitigation through measures such as machine repairs, enhanced operator training, or improved preventive maintenance systems.

By using the FRPN formula in the FMEA method to reduce the subjectivity of assessments and improve the accuracy of risk prioritization. In this case, CPO production risk management, the company can be proactive in addressing potential issues that could lower product quality or disrupt production smoothness. This allows the company to minimize downtime, improve operational efficiency, and ensure that the CPO products produced meet the expected quality standards and are safe for consumers. Additionally, FMEA can also enhance workplace safety in processing plants by identifying potential accident risks that may occur during the production process. Overall, the application of FMEA in the risk management analysis of CPO production will support the company's efforts to achieve more stable, efficient, and sustainable operations.

3. RESULT AND ANALYSIS

The results of the data collected during the research serve as a reference to identify the risks present at the PTPN IV REGIONAL I PKS SEI SILAU factory. In the effort to optimize CPO (Crude Palm Oil) production, risk management becomes an important factor that must be considered. The CPO (Crude Palm Oil) production process, which involves various stages from plantations to processing, is not free from various types of risks that can affect the efficiency and sustainability of production. These risks can arise from both internal and external factors, such as fluctuations in palm oil prices, climate change, government policies, and challenges in natural resource management.

Identification of Risk Sources

A factory faces many risks. The initial step taken in the risk analysis process is the identification of the risks that occur. There are several risk sources that hinder the production process activities at the PTPN IV REGIONAL I PKS SEI SILAU factory in Buntu Pane District, Asahan Regency. The results of the interview with the factory's risk identification department, according to Mr. Samsudin "We face several types of risks, such as planning discrepancies, shortages of Fresh Fruit Bunches (FFB) raw materials, delays in the production process, vehicle damage during distribution, and CPO quality that does not meet standards," he stated.

To address these challenges, PTPN IV REGIONAL I PKS SEI SILAU uses the SCOR (Supply Chain Operations Reference) approach to map production activities and the Fuzzy FMEA method to analyze risk priority levels. Fuzzy Logic with Failure Mode and Effect Analysis (FMEA) to identify and manage risks in a system or process, particularly in the context of quality management and engineering. FMEA itself is a tool used to identify potential failures in a system or process, evaluate their impact, and determine corrective actions. "From that analysis, we can determine the appropriate mitigation steps," he added. The mitigation strategies implemented include regular training for employees, optimization of production machines, and strict supervision during the distribution process. He also emphasized that the results of this strategy were quite significant. "With regular training, we managed to reduce raw material shortages by 30%, while machine optimization helped improve production efficiency," he explained. The hope for the future is to continue strengthening the risk management system to ensure smoother operations and produce high-quality CPO products for customers.

Production risks identified in the factory using FMEA analysis include:

Table 1. Analysis of Risk Sources and Risk Values

No	Source of Production Risk	S	O	D	Risk Value
a.	Shortage of raw materials for fresh fruit bunches (FFB)	6	1	3	18
b.	Sorting involves raw fruit in fresh fruit bunches (FFB).	3	2	2	12
c.	The machine damage that occurred at the factory	4	3	5	60
d.	Delays in the production process	2	1	3	6
e.	The quality of the produced CPO oil does not meet the standards.	3	2	4	24

Risk Analysis Results

In each production risk, the FMEA method is used to identify the risks involved by explaining what risks occur in production. With explanations of each risk source identification and the solutions offered for controlling the risks that occur in the table above using the FMEA method:

a. The risk of raw material shortages of Fresh Fruit Bunches (FFB) at palm oil mills can be caused by various factors, such as weather uncertainty, market price fluctuations, suboptimal agricultural practices, and logistical issues. With an analyzed risk value showing a score of 18, indicating a low risk level. To address this risk, strategic measures need to be implemented, including better weather monitoring with advanced technology, market diversification, improved agricultural practices, transportation infrastructure upgrades, and the development of post-harvest monitoring systems. Closer cooperation between farmers, factories, and the government is also important to ensure a stable supply of Fresh Fruit Bunches (TBS), maintain smooth production, and meet market demand.

b. Production risks in the sorting of Fresh Fruit Bunches (FFB) at palm oil mills are often caused by the presence of unripe fruit, which can reduce the quality and profitability of the product. With the analyzed risk value showing a score of 12, indicating a low risk level. To address this, it is important to enhance training for farmers and factory workers on proper harvesting techniques, as well as to implement modern technology such as applications to detect fruit ripeness. Additionally, strengthening the monitoring and evaluation system and improving the relationship between farmers and factories will help ensure that the quality of the received Fresh Fruit Bunches (TBS) meets standards, thereby increasing production efficiency and the quality of the final product.
c. Production risk on machinery breakdowns in palm oil mills can disrupt production efficiency and are often caused by a lack of routine maintenance, the use of old machines, operational errors, or power supply disruptions. With the analyzed risk value showing a score of 60, which is the highest risk value. To manage this risk, it is important to implement a preventive maintenance program, provide adequate training to the workforce, and invest in modern technology. These measures will ensure that the machines operate optimally, minimize downtime, and maintain the smoothness of the production process in the factory.
d. Delays in the production process at palm oil mills can be caused by supply chain issues, machinery breakdowns, lack of skilled labor, logistics problems, and extreme weather. These factors slow down the delivery of Fresh Fruit Bunches (FFB) and disrupt the processing. With the analyzed risk value showing a score of 6, indicating the lowest risk level. To address this risk, the factory needs to implement thorough planning, improve communication with suppliers, and conduct regular maintenance on equipment to ensure smooth production and meet market demand on time.
e. The risk of CPO oil quality not meeting standards can be caused by the low quality of Fresh Fruit Bunches (FFB), machine damage, and improper harvesting and processing practices. With an analyzed risk value of 24, indicating a medium risk level. To address this, the factory needs to conduct regular training for the workforce, implement quality control methods such as Six Sigma or DMAIC (Define, Measure, Analyze, Improve, Control), and improve communication with farmers regarding harvest timing and TBS quality. Additionally, regular inspections of machines and equipment are also important to maintain cleanliness and reliability, ensuring that the quality of CPO remains up to standard.

With these results, the highest risk value occurring in the CPO production processing is indicated by a risk value of 60 for machine damage in the palm oil mill, while the lowest risk value occurs in the delay of the production process in the palm oil mill with a risk value of 6 with an RPN value.

4. CONCLUSION

Research on risk management analysis in CPO production at PTPN IV Regional I PKS Sei Silau identified five main sources of risk in the production process, namely the shortage of raw materials (18), sorting of raw fruit bunches (12), machine damage (60), production process delays (6), and the quality of CPO not meeting standards (24). Through the application of the Failure Mode and Effect Analysis (FMEA) method and the SCOR approach, this research successfully analyzed the priority levels of risks and determined effective mitigation strategies.

The risk management strategies implemented include regular training for employees, optimization of production machines, and strict supervision during the production and distribution processes. The implementation of these strategies has shown positive results, including a 30% reduction in raw material shortages and an overall increase in production efficiency. Additionally, to address the risk of sorting raw fruit, the factory has enhanced training for farmers and workers on harvesting standards and implemented technology to detect fruit ripeness. Machine damage, which poses the highest risk (60), is addressed through preventive maintenance programs and investments in modern technology, while production process delays are mitigated through better planning and improved communication with suppliers. To ensure the quality of CPO meets standards, the factory implements quality control methods such as Six Sigma and improves communication with farmers regarding optimal harvest times.

This research concludes that the systematic and structured implementation of risk management is crucial to ensure the smooth operation and quality of CPO products. By continuously strengthening the risk

management system, PTPN IV Regional I PKS Sei Silau can enhance its competitiveness in the palm oil industry and make a greater contribution to the Indonesian economy.

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