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DEVELOPMENT OF QUALITY RISK MITIGATION PLAN WITH SUPPLY CHAIN OPERATION MODEL APPROACH*REFERENCE*(SCOR) TO IMPROVE CRUDE PALM OIL PRODUCT QUALITY INPT CITRA SAWIT INDAH LESTARI

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ABSTRACT

The quality of Crude Palm Oil (CPO) products is one of the indicators that producers need to fulfill so that the product is not rejected by consumers. In order to obtain good product quality, proper risk management is needed from suppliers to the Palm Oil Mill. In this case, the risk is from the quality of the fruit when it is harvested, the activities carried out after harvest, to the processing carried out at the Palm Oil Mill. Therefore, it is necessary to prepare a risk mitigation plan so that the quality of CPO products is maintained. Risk assessment is carried out using the SCOR and House of Risk model approaches in order to determine risk events, risk agents, and mitigation plans that need to be carried out so that the objectives can be achieved.

Keywords: ***SCOR model, House of risk, CPO quality, risk mitigation***

1. INTRODUCTION

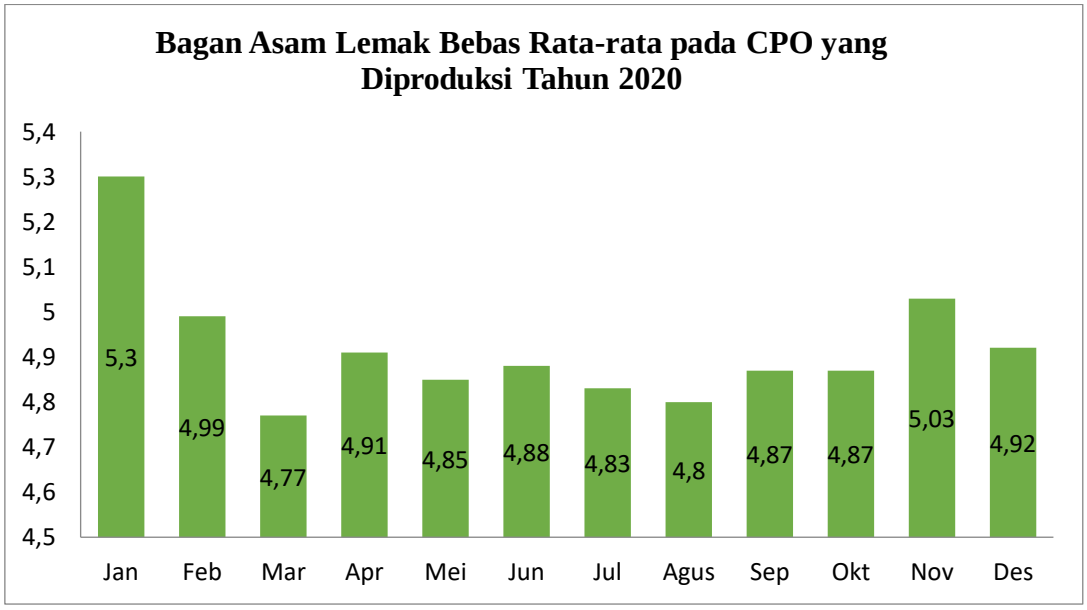
1.1 Background

The supply chain is related to the coordination of production, warehousing, location and transportation between parties in the supply chain with the aim of obtaining responsiveness and efficiency in the market under study (Azmi, 2018). To be able to reach consumers with the right quality, price, quantity and time, good coordination between these supply chains is needed.

Palm oil is one of the products that is easily damaged, especially in the process from plantations to Palm Oil Mills to be processed into Crude Palm Oil (CPO). obtained good quality (yield > 20%, Free Fatty Acids max 5%, and other specifications.

PT. Citra Sawit Indah Lestari is a potential producer of commodities in the form of CPO and Core/Kernel in North Sumatra, which is located in the Tanjung Balai area. PT. CSIL is the 3rd company after palm oil mills, refineries, and palm oil mills. The PT.CSIL factory manages raw materials from Fresh Fruit Bunches (FFB) into CPO, to derivative products such as bath soap, laundry soap, packaged cooking oil and telephone soap and is marketed to Asian regions, especially China.

A good CPO product is a CPO product that meets quality standards such as Free Fatty Acids below 5% and Yield above 20%. However, based on a field review conducted with PT CSIL, the average Free Fatty Acid obtained from production fluctuated between 4.77% to 5.3% as shown in Figure 1.1. Meanwhile, the yield obtained from the process carried out only reached 19.59% as shown in Table 1.1.



Source: PT. CSIGRP

Figure 1.1 Chart of Average Monthly Free Fatty Acids Obtained

1.2 Problem Formulation

As for the formulation of the problem based on the background in this study, in order to obtain an appropriate product quality (Free Fatty Acids of 5%, and yields above 20%), it is necessary to analyze and plan for mitigation of risks that can affect its quality decline along the chain. supply from plantations to palm oil mills.

1.3. Research Objectives

The research objectives to be achieved are:

1. To obtain risk events that can affect the quality of CPO
2. To obtain a risk agent that causes quality risk events to occur
3. To obtain a risk mitigation action plan that can improve the quality of the CPO produced

1.4. Problem Limitation

The problems in this research are:

1. The scope of the research study was only carried out at PT. Citra Sawit Indah Lestari and the plantation as a supply of fresh fruit bunch.
2. Research based on receipt of raw materials, processed FFB.
3. The discussion from beginning to end will be researched based on the plantations of PT. Citra Sawit Indah Lestari whose role is as a supply of Fresh Fruit Bunch.

The research assumptions used are:

1. There were no machine failures in production processing and the factory was running normally with good results and in accordance with the installed processing of 30 tons/h.
2. The system for receiving factory raw materials has not changed during the research.

1.5. Research Benefits

The benefits of this research are:

1. For the author, this research can provide additional solutions in solving problems for the sustainability of a production process within the scope of oil palm.
2. For the author's agency, this research is expected to be a reference material in the development of human resources who carry out a production activity, especially in the scope of oil palm so that sustainability can meet the needs of work.

2. THEORY BASIS

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2.1.Quality Risk

Risk is an uncertain situation and has a negative impact on a goal to be achieved. Risk management is something that companies need to implement to find out the risks that may occur and the handling steps that need to be taken to reduce their impact.

The 8 principles of risk management according to ISO 31000:2018, namely:

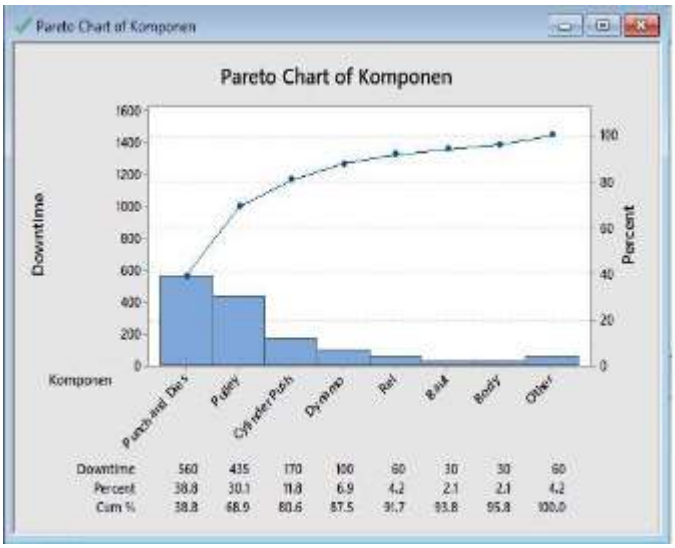
1. Integrated
   It is an integral part of all organizational activities.
2. Structured and Comprehensive
   Contributes to consistent and comparable results
3. Can be customized
   The risk management framework and processes can be adapted according to the proportion of the organization's external and internal context in relation to its objectives
4. Inclusive
   Engagement with the right stakeholders at the right time.
5. Dynamic
   Risks that arise can disappear and change according to the internal and external context of the organization.

2.2.Supply Chain Operation Reference (SCOR) Model

The SCOR model is a model that is divided into 5 groups, namely: Plan, Source, Make, Deliver, and Return (Hartati, 2018). This division is at level 1. Meanwhile, risk events are events that are risks that may occur in relation to the expected goals, such as quality.

2.3.Pareto Diagram

Pareto diagram is a method of managing defects or errors so that problems can be determined that need to be prioritized to be resolved. The types of causes of disability are arranged by ranking. In order to focus on problem solving efforts, not all causes of disability can be resolved in an effort to cost efficiency. The concept commonly used is Pareto 80:20, which means that 80% of defects can be reduced by correcting 20% of the causes of disability. Thus, it will (Siregar, 2018)



Source: Siregar (2018)

Figure 2.1. Pareto Charts

2.4.Risk Mitigation

Risk mitigation in the supply chain can be structured using the House of Risk (HOR) approach. The House of Risk consists of two phases, namely determining the dominant risk agent with the help of a Pareto Diagram, and in phase II the determination of effective action to deal with

the dominant risk agent. The stages that need to be carried out in mitigating risk are as follows: (Immawan, 2018 and Ratnasari, 2018)

1. Assessment of the relationship of risk mitigation actions with the Risk Agent
   The assessment of the relationship between mitigation actions and the risk agent is done by grading the level of the relationship according to the level in Table 2.4.

Table 2.4. The Meaning of the Value of the Relationship between Risk Mitigation Actions and the Risk Agent

Score	Description
0	Not related
1	Low linkage (low)
3	Medium linkage (moderate)
9	High linkage (high)

Source: Pujawan and Geraldin, 2009

2. Difficulty rating
   The assessment of the level of difficulty is carried out according to the level of the Difficulty value in Table 2.5.

Table. 2.5. Meaning of Difficulty Value

Score	Description
3	Low difficulty (low)
4	Moderate difficulty (medium)
5	High difficulty (high)

Source: Pujawan and Geraldin, 2009

*Total Effectiveness*shows the relationship between how effective the risk mitigation action plan prepared is with the risk agent. Total Effectiveness can be calculated using the following formula:

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

Where:
TEk is the total effectiveness of the kth risk mitigation action plan
ARPj is Aggregate Risk Potential
EJK is Effectiveness (level of relationship between risk mitigation action plan and risk agent)

*Effectiveness to Difficulty Ratio*shows the relationship between the level of effectiveness and the level of difficulty of the risk mitigation action plan to be implemented. The ETD calculation is done using the following formula:

$$ETD_k = \frac{TE_k}{D_k}$$

Where:
ETDk :*Effectiveness to Difficulty Ratio*
TECH :*Total Effectiveness*
Dk :*Difficulty*(level of difficulty)

Thus, it will be possible to obtain priority risk mitigation plans to be more effective and efficient in the improvement activities carried out. The Effectiveness to Difficulty Ratio (ETD) value will be arranged in a ranking so that the focus of risk mitigation can be prioritized for action plans that provide greater effectiveness and impact. (Ratnasari, 2018 and Immawan, 2018)

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3.RESEARCH METHOD

The research was conducted at PT. Citra Sawit Indah Lesatari, which is a Palm Oil Mill company, the main raw material is Fresh Fruit Bunches which will be processed into CPO, Fiber, Shell, Kernel. Data collection is done through observation and interviews with companies that produce raw materials into raw materials. Direct observation includes the production process operator, and Staff Estate, mill. Data processing begins with mapping the company's supply chain activities using the SCOR method consisting of Plan, Source, Make, Delivery, and Return.

FromProcessing activities of food companies are identified the risks that occur and those that have the potential to occur. Each risk is further analyzed to find the risk agent. Next is risk assessment with weighting to determine the severity of each risk; the level of probability of the risk agent; and the correlation value between risk events and risk agents (cause).

3.1 Types of Research

This study uses a qualitative and quantitative research approach. Qualitative descriptive approach is used to describe the results of the collection and processing of qualitative data obtained from interviews, brainstorming and questionnaires. While the quantitative descriptive approach is used to describe the results of the collection and processing of quantitative data obtained from observations and research reference data.

3.2 Research Object and Time

The place used as the object of research is PT. Beautiful Lestari Palm Oil Image. This company is engaged in the Palm Oil Mill industry.

3.3. Research variable

The conceptual model used in this study can be seen in Figure 3.1. the following.

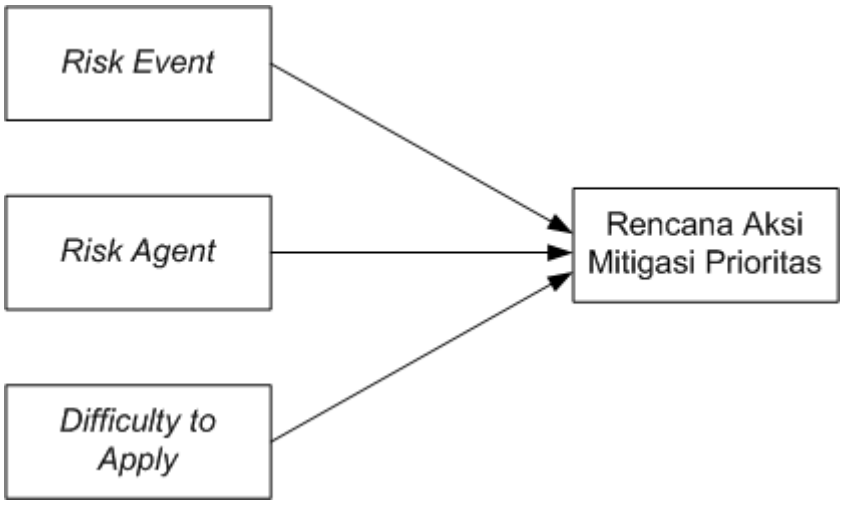

Figure 3.1. Research Conceptual Model

Operational definition

The operational definitions of the Conceptual Research Model above are:

1. *Risk Event*, is a risk event that occurs, which will cause a decrease in the quality of CPO produced from processing in oil palm plantations and mills. This is reviewed on a supply chain basis from Plan, Source, Make, Deliver, and Return. Risk Event is assessed through the level of impact (severity).
2. *Risk Agent*, is the causative agent of the occurrence of the risk of decreasing the quality of CPO. This is closely related to the causative actor. The risk agent is assessed by the level of occurrence (occurrence) and the level of its relationship with the risk event.

3.4. Data Collection and Data Processing Techniques

PT. Citra Sawit Indah Lestari is a company that processes palm oil raw materials and produces for the process oil, fiber, kernels, and shells, the source of the FFB comes from the plantation and is sent by the factory and processed into raw materials.

Risk identification is carried out to find out the risks that occur in company activities that have the potential to occur and can affect the company's supply chain activities. identification is carried out based on supply chain activities using the SCOR method consisting of plan, source, make, deliver, and return. Risk identification is done by interviewing the divisions related to the company's business processes and observing for less than 1 month.

Based on supply chain activities in table 1, the identification of risk events and risk agents as well as an assessment of determining the severity, occurrence and correlation values is carried out. Table 2 contains the identification of risk events and table 3 contains data on risk agents. In accordance with the activities carried out within the company, the activities carried out are source (2,3, and 4), make and delivery.

After identification is done, then perform an assessment (assessment) the severity level, namely the severity of a risk event and occurrence assessment, namely the level of opportunity for a risk event to occur on a scale of 1-10 (Shahin, 2004). After that, the relationship assessment is carried out, namely the relationship between the risk event and the risk agent. After that, an assessment is carried out using the House of Risk approach by including the difficulty to apply factor, in order to obtain a risk mitigation sequence so that the solution becomes more effective and efficient.

4. RESEARCH RESULTS

4.1. Analysis of Palm Oil Supply Conditions

Palm oil supply conditions that affect the final quality of CPO are influenced by the stages experienced by Fresh Fruit Bunches (FFB) from plantations to being sent to Palm Oil Mills (PKS) and processed into Crude Palm Oil (CPO). The following is a condition analysis that can be done by mapping the supply chain and analyzing the stages of the production process.

4.2. Analysis of the Supply Chain Condition of Fresh Fruit Bunches

Fresh Fruit Bunches (FFB) are cultivated by two groups, namely the company and by the community which is often referred to as community plantation. FFB maturity level is determined by looking at the fallen loose fruit. If there are 5 loose lollipops that have fallen, then the FFB is ripe and can be harvested. After that, harvesting is scheduled using harvesters, and the necessary transportation. . The structure of the Palm Oil supply chain in general can be seen in Figure 4.1. the following.

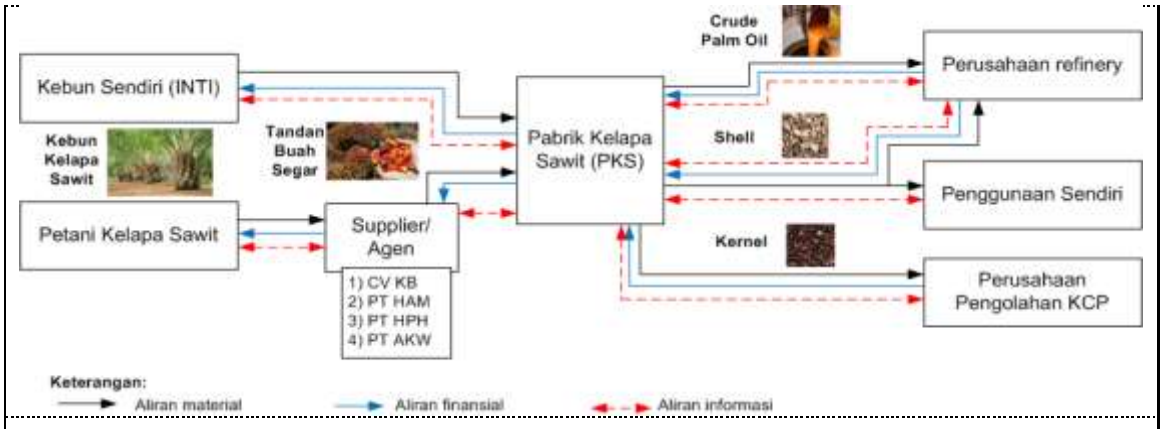

Figure 4.1. Palm Oil Supply Chain Structure

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As can be seen in Figure 4.1. above, the structure of the Palm Oil supply chain from the actual conditions that occurred experienced several obstacles. PT CSIL currently does not have sufficient plantation capacity for its production (production capacity is 420 tons per year while the supply capacity of FFB from its own plantations is around 80 – 120 tons per year), so the company must receive FFB from community plantations and other private plantations.

4.2. Analysis of Palm Oil Process Stages

The stages of the palm oil process from plantations in the form of FFB are transported by truck and weighed, after that the FFB goes through the stages of checking by the company's fruit reception department to determine the quality and price that can be paid to FFB suppliers. After the quality grading is done, the fruit acceptance department will determine whether the FFB will be accepted or rejected. After the FFB is received, the FFB will be stored in the warehouse.

4.3. Risk Identification Using the SCOR Model Approach

Mapping activities that have been identified are classified based on the SCOR model. This is the initial stage in the House Of Risk (HOR) method and is carried out by means of interviews at PT. CSIL. Based on the results of the interviews, the activity mapping was obtained as shown in the table below.

Table 4.1. Mapping Activities from Plantation to POM Based on SCOR Model

Major Process	***Sub-Process***
Plan	1. Planning for fruit production areas
	2. Oil palm fruit (FFB) production planning
	3. Smallholder production planning
	4. Manpower planning
	5. Machine capacity planning
	6. CPO production planning
	7. Financial planning
	8. Planning cooperation with plasma farmers
Source	1. Checking the harvesting area of Own Farm
	2. Checking the harvesting area of plasma farmers
	3. Scheduling of FFB delivery to PKS
	4. Transportation/traction
	5. FFB quality checking
	6. Material quality check
	7. Administration process for receiving materials
Make	1. Loading FFB to loading ramp
	2. FFB sterilization with high pressure steam
	3. Threshing process to separate Empty Bunches with loose fruit
	4. Digesting process for fruit ripening
	5. The process of pressing with a screw press to separate the oil from the pressed cake (palm kernel, fiber, and shell)
	6. Clarification process to reduce impurities
	7. Purification of oil into CPO
	8. Storage of CPO to storage tanks
	9. Checking the quality of the obtained CPO
Deliver	1. Determination of CPO delivery schedule

	2. Determination of CPO transportation means
	3. CPO delivery administration process
	4. Acceptance of verification and administration from refinery companies
Return	1. Acceptance of sanctions in the form of price cuts/fines
	2. Return of CPO to the mill
	3. Receipt of warning letter resulting from CPO verification

The stages carried out with the SCOR model are as follows:

1. Risk identification

   Is a stage with the aim of knowing the risk events that interfere with supply chain activities in the company and to find out the risk agents that cause these risk events.
2. Determination of Risk Event

   Events that can disrupt supply chain activities in the company. Risk events are obtained from the results of interviews which are then coded with the letter E which aims to make it easier for readers.

Table 4.2. Risk Event on Activities from Plantation to PKS

Major Process	***Sub-Process***	***Risk Event***	***Code***
Plan	1. Planning for fruit production areas	Production area is not enough to meet capacity	EP1
	2. Oil palm fruit (FFB) production planning	The production plan has not considered the fruit production area	EP2
	3. Smallholder production planning	The production plan does not include plasma farmers to meet their capacity needs	EP3
	4. Manpower planning	The available manpower is not sufficient to carry out harvesting	EP4a
		The available workforce is not sufficient to carry out production	EP4b
	5. Machine capacity planning	The machine capacity is too large so it becomes unproductive	EP5
	6. CPO production planning	The CPO production plan has not considered the available stock	EP6
	7. Financial planning	Financial needs for increased production are not sufficient	EP7
	8. Planning cooperation with plasma farmers	The cooperation with plasma farmers that have been established is not yet close enough	EP8
Source	1. Checking the harvesting area of Own Farm	Production activities are disrupted because the fruit is not ripe enough	ES1
	2. Checking the harvesting area of plasma farmers	Production activities are disrupted because the fruit is not ripe enough	ES2
	3. Scheduling of FFB delivery to PKS	The fruit may be overripe due to the late delivery schedule to PKS	ES3
	4. Transportation/traction	The available means of transportation do not support the field of oil palm	ES4

		plantations	
	5. FFB quality checking	The quality of FFB is not properly checked	ES5
	6. Material quality check	The quality of the ingredients is not up to the required standard	ES6
	7. Administration process for receiving materials	There is an administrative process that is not carried out	ES7a
		The administrative process is complicated	ES7b
Make	1. Loading FFB to loading ramp	Lack of FFB included in the loading ramp	EM1
	2. FFB sterilization with high pressure steam	Unstable steam pressure	EM2
	3. Threshing process to separate Empty Bunches with loose fruit	Damage to the threshing machine	EM3
	4. Digesting process for fruit ripening	Damage to the digestion machine	EM4
	5. The process of pressing with a screw press to separate the oil from the pressed cake (palm kernel, fiber, and shell)	Lack of pressure so the press machine does not work optimally	EM5a
		Damage to the pressing machine	EM5b
	6. Clarification process to reduce impurities	Damage to clarify machine	EM6
	7. Purification of oil into CPO	Not optimal purification process	EM7
	8. Storage of CPO to storage tanks	CPO storage is too long so that it affects the quality	EM8
	9. Checking the quality of the obtained CPO	Checked CPO quality is less accurate	EM9
Deliver	1. Determination of CPO delivery schedule	Late CPO delivery schedule	ED1
	2. Determination of CPO transportation means	The conveyance used is not appropriate	ED2
	3. CPO delivery administration process	There is an administrative process that is not carried out	ED3a
		The administrative process is complicated	ED3b
	4. Acceptance of verification and administration from refinery companies	The verification and administration process carried out by the refinery company uses different standards	ED4
Return	1. Acceptance of sanctions in the form of price cuts/fines	The company is penalized	ER1
	2. Return of CPO to the mill	Companies affected by CPO returns	ER2
	3. Receipt of warning letter resulting from CPO verification	The company is subject to a warning letter	ER3

Determination of Risk Agent

*risk agent*are things that can cause a risk event to occur so that it can disrupt supply chain activities in the company. The risk agent is obtained from the results of the interview which is then coded using the letter A which aims to facilitate further reading. The company's risk agent can be seen in the table.

5. DISCUSSION

5.1 Analysis of Risk Event

In analyzing the causes of the non-achievement of the expected CPO quality, the Supply Chain Operation Reference (SCOR) approach is used. The risk of causing a decrease in the quality of the CPO produced is analyzed at each stage, from Plan, Source, Make, Deliver, and Return. At this stage, 35 risk events were obtained. Among these incidents, most of the problems arise in the Plan, Source, and Make stages. The Deliver problem occurs at the stage of sending FFB from the plantation to the PKS. This indicates that the main problem that causes CPO quality to not be achieved is due to the chain of plantations to mills. Even though from the existing risk events, for each stage of Plan, Source, Make, Deliver, and Return there are 8, 7, 9, 4, and 3 events, respectively. Although it appears that the most occurrences are in the Make process as many as 9 events, this indicates the risk of quality loss is in the Make event. Therefore, in the next stage, the agent causing the incident will be analyzed in order to find out more clearly the cause of the incident.

5.2 Analysis of Risk Agent

At this stage, it is identified what causes the occurrence of the risk event that has been discussed previously. At this stage, 31 risk agents were obtained with 4 events originating from the same risk agent. From this stage, it can be seen that there are causes caused by the production capacity of FFB, and the delivery of FFB to the POM on time so that the expected quality can be achieved.

After calculating, obtained 10 risk agents that cause 80% of events that cause the CPO quality target is not achieved. Thus, the focus on solving quality problems is focused on the 10 risk agents first.

6. CONCLUSIONS AND SUGGESTIONS

6.1 Conclusion

To be able to achieve the target of CPO product quality in conditions of limited production capacity, in terms of the SCOR approach, it is necessary to do the following things:

1. Provision of maintenance in the form of heavy equipment and materials to cover damaged/perforated roads
2. Performing Preventive on the selection of good fruit for harvesters
3. Evaluate the failures that occur
4. Inviting Oil Palm Smallholders to work together with companies to achieve mutual benefits both individually and as a company
5. Conducting outreach to Fruit Suppliers
6. Conducting directives to the plantations so that palm oil can be achieved continuously so that it achieves optimal results
7. Provide a more competitive purchase price than competitors
8. Coordinate with the garden and outside so that FFB is on time during the production process
9. Checking spaciousness so that DO (Delivery Order) items are immediately available

6.2 Suggestion

The suggestions that can be given regarding this research are:

1. It is advisable to form a team to evaluate the application of the risk mitigation action plan that has been prepared
2. Regarding the FFB supply capacity, it would be better if the company runs a cooperative system with oil palm farmers. Companies can provide partial capital, technology and harvesting assistance, while farmers can provide labor and capital assistance. This is with the aim that the FFB yields obtained by PKS are also better in terms of quantity and quality.
3. There is a need for a review of the composition of the FFB blending from multilevel collectors. This is because the quality of the FFB supplied can cause the quality of CPO to decline.

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