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Design of Risk Management Monitoring System Based on Supply Chain Operations Reference (SCOR): A Study Case at Dairy Industry in Indonesia

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Abstract. Agro-industrial products are the products that are ready to be consumed or as other raw material products. One of the agro-industrial product is milk. Supply chain flows began when breeders produced milk and sold them to cooperatives. When the milk, which carried by the breeders, arrive in the dairy cooperative, it were checked if its meets the standard of cooperatives. If the milk which have been cheked were not appropriate, then the sold milk will be rejected and returned to the breeders. After that process, the appropriate milk collected and delivered to the milk processing industry for later processing by the dairy industry. The purpose of this research aims to identify the risks that may occur in the supply chain of milk based on the company's activities, and it also identified based on the mapping using the SCOR (Supply Chain Operations Reference) method. The result of the risk identification with experts gained five risk factors that effect the supply chain of the milk of, such as the quality, production, delivery price and information. Thereby to reduce the risk of supply chain of milk, a system of monitoring in a form of Web-based application is required to designed in order to facilitate the milk industry to take preventative measures against the risks that will occur. The display which displayed from the monitoring system itself such as: a dashboard that can display risks that may harm the company based on the company's Key Performance Indicator (KPI) and data history from the risks that have occurred

Keywords: 1 Dairy Industry · 2 Supply Chain · 3 SCOR · 4 KPI · 5 Monitoring

1. INTRODUCTION

Milk is one of the agroindustrial product. In dairy supply chains, there may be risks. The risk itself is a condition that causes loss in a certain span of time (Badariah, Surjasa, & Trinugraha) Where the risks that occur in this milk supply chain can provide substantial loss when it not addressed. The occurrence of risk in the field of agroindustries has an influence in determining the decision in the supply chain of milk in order to minimize the greater damage.

That's why the concept of supply chain risk management is necessary to reduce the risks. This milk supply chain industry consists of three actors that influence supply chain among breeders, cooperatives and the milk processing industry. The task of breeder are produces milk and sell it to cooperatives, while cooperatives acted as a place to collect milk from the breeders and as a place to taste the quality of milk before it delivered to the milk processing company. In this supply chain there may be risks ocurred. The risks that occur can happen because several factors which inhibit

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supply chain sustainability. Thus the supply chain risk management is instrumental in identifying the risks that occur in the member of the supplychain. As for risk identification used SCOR (Supply Chain Operations Reference) method to determine the risks that occur from the company's activities based on SCOR matrix. SCOR is a reference for knowing the process in the supply chain, identifying each member involved in supply chains and analyzing supply chain performance (Chopra & Meindl, 2015). In order to prevent the risks that may occur, then a system montoring that can detect the risks that will occur is required so that cooperatives can reduce risks by measure it with Key Performance Indicator (KPI).

2. LITERATURE REVIEW

2.1 Supply Chain Management

Supply Chain Management includes the planning and management of all activities involved in the procurement process of resources and procurement, conversion, and all logistics management activities. Most importantly, supply chain management includes good coordination and collaboration with suppliers and customers. Briefly, supply chain management integrates negotiation management and demand within the company (Ismadhia, Ridwan, & Hadi, 2018)

2.2 Supply Chain Operation Reference (SCOR)

SCOR or Supply Chain Operation Reference is a method to measuring supply chain performance. This model presents a business process framework, performance indicators, best practices as well as technology to support communication and collaboration between supply chain partners, so as to increase the effectiveness of supply chain management and effectiveness of supply chain improvement (Siahaan, Ridwan, & Akbar, 2018). In SCOR there are 4 levels, level 1 company using SCOR to establish basic strategic objective about their company. Level 2 descibe the details of process in core prosess like make to stock, make to order and engineering to order. Level 3 descibe about process elevemnt level, in this level is detailed process element information from level 2 and last level 4 describe about relates to the implementation and decomposes the process elements into activities (Waaly, Ridwan, & Akbar, 2018)

2.3 Supply Chain Risk Management

Risk management of supply chain or supply chain management (Paul, 2014) refers to an activity that relates to the identification, assessment and mitigation of a possible disruption in the logistics network to mitigate the negative impacts that may be in a supply chain flow. As for the approach of supply chain risk management, there are three phases including risk identification phase, risk asessmen phase and last risk mitigation

2.4 Monitoring System

Monitoring system can be used as a tool to make decision that will later used to manage policies that come from the correct information. Monitoring System can describe as a system that wants to be monitored by interested agencies including the process of data input and display the results of the monitoring as expected. Monitoring system can simplify the actual data measurement and target data (Ardhanaputra, Ridwan, & Akbar, 2019)

3. RESULT AND ANALYSIS

3.1 Milk Supply Chain Overview

Supply Chain flow of milk can be started from breeders, cooperatives and ends in the milk processing industry. Money flow comes from milk processing company to breeders, while the flow of products started from breeder until milk processing company. Supply chain flows begin when breeders produce milk and sell it to cooperatives but before arriving at the breeder's cooperative deposit to the group to be delivered the milk that has been collected to the cooperative. After arriving at the dairy cooperative brought by the breeders then check the contents of whether

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according to the standards prescribed by the cooperative. If the milk that does not match the standard directly returned to the group that is sending the milk in accordance with the cooperative standards, the milk will be inserted directly into the cooling unit that is in the cooperative and subsequent milk that already

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collected in the cooling unit will be sent to the milk processing company and when reached in the milk processing company milk that is sent back is made by milk processing company whether the melamine contamination when the road or not.

3.2 Identification of Supply Chain Risk

To facilitate the risk identification can be done by looking at the activities of the company that has been mapped before then analyze the risk events that occur in the milk supply chain based on the SCOR mapping that has been created.

3.2.1 Risk based on SCOR's source activities

Risk mapping based on SCOR at source level can be seen in table 1 the source activity itself is the process of ordering, sending, accepting and transferring raw materials in the form of goods or services where cooperatives do the system source stocked product because milk that get from breeders delivered daily to cooperatives because the cooperative has a dependents to send milk to the milk processing industry. So that the source risk mapping based on SCOR can be seen in table 1.

Table 1. Risk based on source activity

Sub Process	Risk Event
Schedule Product Deliveries	Overdue acceptance of milk from breeders
Receive Product	Milk damages caused by mixing milk from every group Milk damage due to distribution to the cooperative
Verify Product	Milk contaminated by bacteria Milk contaminated by antibiotics Milk pH does not fit to standards
Transfer Product	Mistakes in dairy handlers when moved into cooling unit

3.2.2 Risk based on SCOR's make activities

Milk industry on the mapping SCOR make no activity company because activities that occur against the product does not give value added thus the breeder sells milk to the cooperative and cooperatives directly send the appropriate milk standard to milk processing company that cooperate with cooperatives so that the process does not occur adding value to the goods.

3.2.3 Risk based on SCOR's delivery activities

SCOR mapping by self-deliver has a sense of order management process from downstream to upstream where the downstream of the milk supply chain is breeder and upstream for this milk supply chain is in milk processing company. So for the configuration of the deliver process is to deliver stocked product because milk processing company require milk every day from the cooperative with whatever quantity of the origin of milk is in accordance with the standard of milk processing company. So that the mappingSource Riskbased onScorcan be seen on table 2.

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Table 2. Risks based on delivery activities

Sub Process	Risk Event
Process Inquiry and Quote	Lack of milk supply requested by milk processing company
Receive, Enter, and Validate Order	Lack of milk supply to be shipped to milk processing company
Reserve Inventory and Determine Delivery Date	Overdue acceptance of milk from breeders, Excess milk stock in cooling unit
Consolidate Orders	Inconsistency of data information with real condition in cooling unit
Build Loads	Quantity sent less than break even cooperative points
Route Shipments	Long distribution period
Select Carriers and Rate Shipments	Milk is damaged when arriving at milk processing company
Receive Product from Source or Make	Wrong moving process of milk in the cooling unit to the ignition tank
Pick Product	Milk is damaged by contamination
Pack Product	Milk contaminated by unsterile car tank condition
Load Vehicle and Generate Shipping Documents	Inaccuracy of employee in examining documents
Ship Product	Car tank isn't ready to departed because the tank car has not been sterile
Receive and Verify Product by Customer	Mismatch of data information when milk is up to milk processing company
Install Product	Wrong moving process of milk from tank cars to cooling unit
Invoice	Late acceptance of receipts so that late payment to the breeder

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3.2.4 Risk based on SCOR's return activities

The return process is the process of moving goods back from consumers through the supply chain to handle product damage can be a return of goods to the supplier and return of goods from consumers. In cooperative process of return also occurs between breeders with cooperatives and cooperatives and milk processing company. Details of the return process activities can be seen in table 3 where source return defective product comes from breeder and deliver return defective product derived from milk processing company.

Table 3. Risk based on return activity

Sub Process	Risk Event
Identify Defective Product Condition (From Source)	Milk contaminated by bacteria Milk contaminated by antibiotics Milk pH does not fit to standards
Disposition Defective Product	Receiving milk with TPC between the specified range
Request Defective Product Return Authorization	Lack of milk supply to be shipped to milk processing company
Schedule Defective Product Shipment	Lack of milk supply to be shipped to milk processing company
Return Defective Product	Lack of milk supply to be shipped to milk processing company
Authorize Defective Product Return	Cooperative suffer from the loss of milk
Schedule Defective Return Receipt	Cooperative suffered losses because they could not sell milk
Receive Defective Product (includes verify)	Cooperative must make milk payments to breeders
Transfer Defective Product	Unutilized milk is discarded

3.3 Risk Grouping

Based on the risk identification, the risks were grouped into five groups. The five large include the risk of production, quality, deliver, information and price that is determined based on expert brainstorming. The risk management can be seen in table 4.

Table 4. Risk Gruping

Risk Event	Group	Risk Event	Group
Slow acceptance of milk from breeders	Delivery	Milk contaminated by a car tank condition that has not been streil	Quality
Milk damages caused by mixing milk from any group	Quality	Incompliance with the delivery time of milk to milk processing company	Deliver

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Milk damage due to cooperative travel	Delivery	Car tank isn't ready to depart because the tank car has not been sterile	Deliver
Milk contaminated bacteria	Quality	Mismatch of data information when milk is up to milk processing company	Information
Milk-contaminated antibiotics	Quality	Late acceptance of receipts so that late payment to the breeder	Price
Milk pH does not conform to standards	Quality	Milk contaminated by bacteria	Quality
Lack of milk supply requested by milk processing company	Production	Milk-contaminated by antibiotics	Quality
Shortage of milk supply to be shipped to milk processing company	Production	Milk pH does not conform to standards	Quality
Lack of milk stock in the cooling unit	Production	Lack of milk supply to be shipped to milk processing company	Production
Excess milk stock in cooling unit	Production	Lack of milk supply to be shipped to milk processing company	Production
Inconsistency of data information with real state in cooling unit	Information	Lack of milk supply to be shipped to milk processing company	Production
Quantity sent less than break even cooperative points	Price	Cooperative suffer from the loss of milk	Price
Long distibution period	Deliver	Cooperative suffer from the loss of milk	Price
Milk is broken when arriving at milk processing company	Quality	Cooperative suffer from the loss of milk	Price
Milk is damaged by contamination	Quality	Unutilized milk is discarded	Price

3.4 Key Performance Indicator

Key Performance Indicator is a management instrument that can be run according to the company's control (Lubis & Kusumanto, 2018). The key performance indicator is used for the establishment of a system of monitoring based on the risks that occur where the KPI determination is based on the company's decision. The specified KPI can be seen in the table 5 which will be later in this KPI to be input in the idea system designed.

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Table 5. Key Performance Indicator

KPI	Formula
Shortage of milk delivery	$(1 - (\frac{\text{(Amount of milk sent to milk processing company)}}{\text{(Amount of milk requested by milk processing company)}} \text{ x } 100\%))$
Shortage of milk supplies	$(1 - (\frac{\text{(Amout of milk in cooling unit)}}{\text{(Maximum amount of milk capacity in cooling unit)}} \text{ x } 100\%))$
Excess Milk Supplies	$\frac{\text{(Excess milk amount)}}{\text{(Maximum amount of milk capacity in cooling unit)}} \text{ x } 100\%$
Precision Source sends milk	$(1-(\frac{\text{(Number of breeder who send milk)}}{\text{(Total number of breeder)}} \text{ x } 100\%))$
Milk rejection due to bacterial contamination	$\frac{\text{(Milk contaminated bacteria)}}{\text{(All rejected milk)}} \text{ x } 100\%$
Rejection of milk due to antibiotic contamination	$\frac{\text{(Milk contaminated antibiotic)}}{\text{(All rejected milk)}} \text{ x } 100\%$
Rejection of milk due to not standard pH	$\frac{\text{(Inappropriate milk pH)}}{\text{(All rejected milk)}} \text{ x } 100\%$
Milk rejection from milk processing company	$\frac{\text{(Total delivery of damaged milk when arriving)}}{\text{(Total delivery)}} \text{ x } 100\%$
Number of late arrival milk from breeder	$(1 - (\frac{\text{(Number of breeders arrivals on schedule)}}{\text{(Number of target arrival breeders)}} \text{ x } 100\%))$
Inconformity of delivery time	$\frac{\text{(Total mismatch delivery to milk processing company)}}{\text{(Total delivery)}} \text{ x } 100\%$
Shipment does not match break even point	$\frac{\text{(Total deliver to MPC less than break even point)}}{\text{(Total delivery)}} \text{ x } 100\%$
Late payment to the breeder	$\frac{\text{(Total late payment)}}{\text{(Total payment)}} \text{ x } 100\%$
Milk returns from milk processing company	$\frac{\text{(Total return milk to cooporative)}}{\text{(Total delivery)}} \text{ x } 100\%$
Milk returns from milk processing company that cannot be utilized	$\frac{\text{(Amount of milk that can not be utilized)}}{\text{(Total milk returned)}} \text{ x } 100\%$

While table 6 explains the maximum target of cooperatives of each key performance indicator in accordance with the characterisitics of each key performance indicator where these values will be the benchmark for cooperatives whether these risks will be cooperative.

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Table 6. Cooperative's target

KPI	Cooperative Target	Characterisitics
Shortage of milk delivery	15%	Smaller the better
Shortage of milk supplies	20%	Smaller the better
Excess Milk Supplies	5%	Smaller the better
Precision Source sends milk	50%	Smaller the better
Milk rejection due to bacterial contamination	0%	Smaller the better
Rejection of milk due to antibiotic contamination	0%	Smaller the better
Rejection of milk due to not standard pH	0%	Smaller the better
Milk rejection from milk processing company	0%	Smaller the better
Number of late arrival milk from breeder	20%	Smaller the better
Inconformity of delivery time	10%	Smaller the better
Shipment does not match break even point	5%	Smaller the better
Late payment to the breeder	5%	Smaller the better
Milk returns from milk processing company	0%	Smaller the better
Milk returns from milk processing company that cannot be utilized	0%	Smaller the better

3.5 Usecase Diagram

In establishing an interaction monitoring system between described elements using the use case diagram. Use case diagram itself is a model to describe the behavior of the system made, where the use case diagram is done to understand the function that occurs in the system (Novar, Ridwan, & Santosa, 2018).

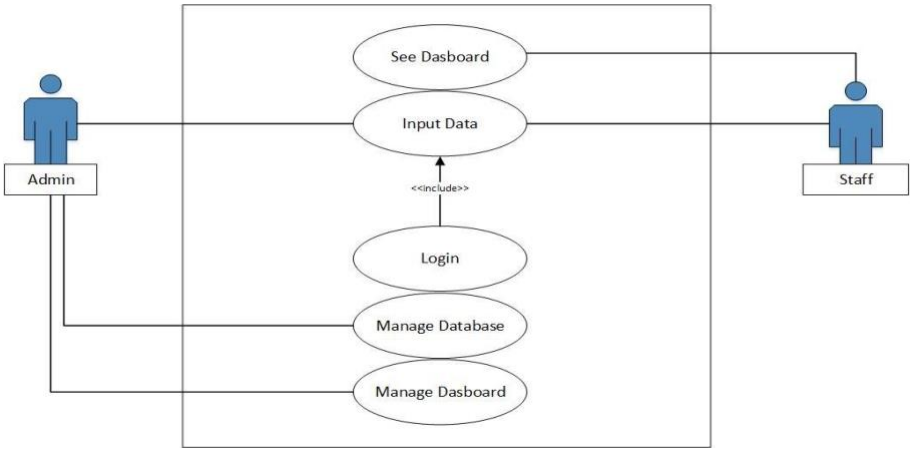

Fig. 1 Usecase Diagram

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In fig.1 explained there are two actors who role in the system such as admin and staff. Admin are depicted can do some activities that manage the dasboard, manage databases and can input data. Where to manage dashboard here can be doing maintenance of the system monitoring created if needed while managing the data bases is an admin interaction with the system to manage data basesed it data in the system monitoring. In addition, admins can conduct data input in the form of baseline determination of each risk specified by the company. While the staff actors can do two activities in the system including input data and see the dasboard. Where Input data performed by staff be report each day from the KPI defined by the company and staff can also see dashboard from the results of analysis done by the system, where the system can tell if a risk will arise seen from baseline company- defined.

3.6 Design of Monitoring System

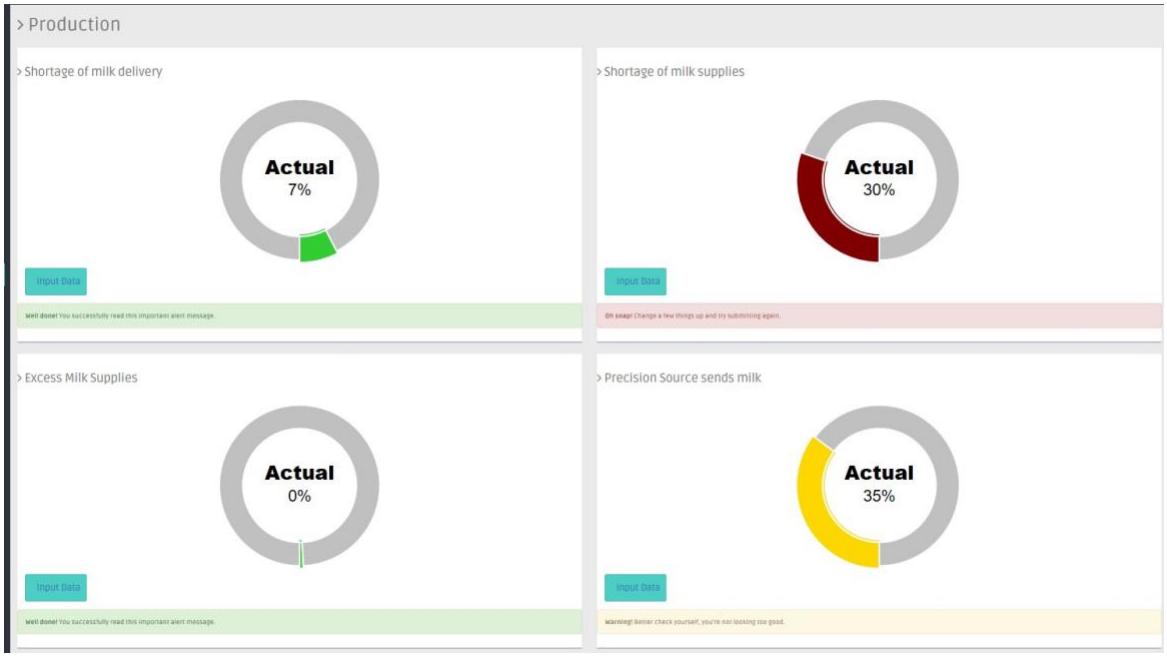

Fig. 2 Design of Monitoring System

Fig. 2 refers to the results of the dashboard of monitoring systems made where a good dashboard can provide an attractive look to display information affecting productivity and user efficiency (Mahtamtama, Ridwan, & Santosa, 2018). Fig. 2 is an example of a production risk where each risk can show the actual state that is taking place in the cooperative with color threaded warning, if the green color means safe, while the yellow color indicator inform that cooperatives should be careful with the occurrence of risk that may occur while red has the aarti that risk events already exceed the maximum of the target risk specified.

4 CONCLUSTION

Based on the results of risk identification known risk in the supply chain of milk caused by several risk factors including production risk that has four risk events are: shortage of milk supply that must be sent to the milk processing company, deficiency milk stock that is in the cooling unit, excess milk stock is in the cooling unit and decreased the number of source. The second risk factor is the risk of quality that has five risk events including: bacterial contaminated milk, antibiotic-contaminated milk, non-conformed milk pH, milk is broken when it comes to milk processing company and milk storage inconsistency. The third risk factor is the risk of delivery which has

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five risk events including: the slow acceptance of milk from breeders, the breakdown of milk due to the journey to the cooperative, too long in the trip, the inconsistency of delivery time milk to milk processing company and a fleet that is not ready to be departed because the tank car has not been sterile. The fourth risk is the risk of information with the occurrence of risk occurring: inconsistency of data information with the real state in the cooling unit and the inconsistency of data information when milk is in the milk processing company and the last risk factor is price risk with five risk events including: quantity sent less than break even cooperative points, delay acceptance of receipts so that the delay of payment to the breeder, cooperatives suffer losses because it can not sell milk, cooperatives are obliged to pay milk to breeders, even if milk is rejected by milk processing company and unutilized milk is discarded. While the monitoring system for the research is designed for the dairy supply chain industry where a web-based monitoring system is used to facilitate cooperatives to try out the risks that may occur in this supply chain where Monitoring system that can be generated in this research in the form of a dashboard that can display risks that may harm the company based on the company's defined Key Performance Indicator (KPI) and data history from the risks happened.

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