# ANALYSIS OF VENDOR MANAGED INVENTORY IMPLEMENTATION IN COLLABORATIVE SUPPLY CHAIN USING SIMULATION METHOD

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## AUTHENTICITY STATEMENT

In the name of Allah, I hereby certify that this research was conducted by myself based on my own work and studies, except for the citations and summaries in which of those are already mentioned the sources and rewrite by myself. If in the future statement is proved not right and violates the legal regulation of papers and intellectual property rights, Universitas Islam Indonesia has right to revoke my bachelor certificate.

Yogyakarta, September, 2017




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# DEDICATION PAGE

I dedicated this thesis for

*My beloved mother, Dra Erda Yulfi Amran*

*My beloved father, Ir. Krisnan Boy*

*My annoying-but-loving brother, Ghazi Falah*

*My beloved grandma and grandpa, Almh. Yulinar and Alm. Ali Amran : )*

*My beloved Almh. Nek-mami and Alm. Kek-papi*

*My thesis supervisor, Muhammad Ridwan Andi Purnomo, S.T., M.Sc., P.hD*

*My second family, Industrial Engineering – International Program 2013*

## MOTTO

بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

In the name of Allah, the Most Beneficent, the Most Merciful

*Satu perkara yang saya ketahui dengan terselesaikannya* thesis *ini pada waktu yang tepat adalah, terkabulnya do'a ibu saya.*

*"Tiga doa yang mustajab yang tidak diragukan lagi (kemakbulannya), yaitu doa orang tua, doa orang yang berpergian (safar), dan doa orang yang dizalimi."* (HR Abu Dawud)

يَٰٓأَيُّهَا ٱلَّذِينَ ءَامَنُواْ ٱسْتَعِينُواْ بِٱلصَّبْرِ وَٱلصَّلَوٰةِۚ إِنَّ ٱللَّهَ مَعَ ٱلصَّٰبِرِينَ ١٥٣

"O you who have believed, seek help through patience and prayer. Indeed, Allah is with the patient." (QS. Al-Baqarah: 153)

إِنَّ مَعَ ٱلْعُسْرِ يُسْرًا ٦ فَإِذَا فَرَغْتَ فَٱنصَبْ ٧ وَإِلَىٰ رَبِّكَ فَٱرْغَب ٨

"Indeed, with hardship [will be] ease. So when you have finished [your duties], then stand up [for worship]. And to your Lord direct [your] longing." (QS. Ash-Sharh: 6-8)

# PREFACE

*Assalamualaikum Wr. Wb.*

*Alhamdulillahi Rabbil'alamin*, gratitude and praise to Allah SWT for the strength, grace, and guidance, to help the Author in completing this thesis. During arranging this thesis, Author had faced so many challenges and problems. However, Author had obtained so many helps and supports, either directly or indirectly, from some parties involved. On this occasion, Author would like to appreciate and thank to all the parties below:

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Author realize that this thesis is still not perfect and still have some weaknesses so that Author really expect any criticism and suggestions from readers for the perfection of this report. Hopefully this report and information included will be useful for Author and give benefit to other parties who read this.

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Yogyakarta, September 2017

Nurul Lathifah

## ABSTRACT

In this competitive era, supply chain becomes one of the important aspects in industry. Industries have to respond faster to uncertain customer needs through faster product development and shorter delivery time. The uncertain demand makes manufacturer difficult to predict the production quantity and inventory control. Thus, to achieve a matching demand with supply, manufacturer and its suppliers need to collaborate in the supply chain which leads to the emergence of collaborative supply chain. Collaborative supply chain is the alliance of two or more independent companies to achieve greater success. It is considered better than conducted the processes independently. One of the examples of collaborative supply chain is the implementation of vendor managed inventory. Vendor managed inventory in collaborative supply chain could give some benefits for supplier and manufacturer such as lower inventory which leads to cost minimizing and profit increasing. This study performs an analysis of vendor amanged inventory in collaborative supply chain using Spreadsheet Simulation method for PT. Rakabu Sejahtera with its suppliers. The alternatives of collaborative supply chain used as the consideration to conduct the simulation are information sharing and decision synchronization. In this study, there are 6 scenarios built for the simulation. The result shows that the best scenario for the implementation of vendor managed inventory in collaborative supply chain is Scenario 6. Scenario 6 is the suppliers deliver raw material to the PT. Rakabu Sejahtera only when the inventory level reach the re-order point as much as safety stock amount added by demand on the day it reached the re-order point. The result of Scenario 6 shows that the supply chain cost is reduced as much as 84.32%.

Keyword: Collaborative Supply Chain, Vendor Managed Inventory, Spreadsheet Simulation

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# CHAPTER I

# INTRODUCTION

## 1.1 Background

In this decade, the competitiveness among industries in Indonesia is fiercer. Since its earliest appearance of supply chain management (SCM) in the 1980s which focused on purchasing and cost reduction activities, it has developed to be an important part of every business process in some industries. Supply chain management explains the business processes which begin from the supplier of raw material until the finished good is received by the customers. The impact of supply chain development is the fiercer industrial competition, it happens not only among the firms, but also among the supply chain systems. The condition brings the industries to focus on developing the supply chain that can increase their profit. One of the theories that started to emerge is the presence of collaborative supply chain theory in the industry with its upstream and downstream level.

According to Simatupang & Sridharan (2002), collaborative supply chain exists if two or more independent companies work together to plan and execute supply chain operation with greater success than when acting in isolation. Simatupang & Sridharan (2002) also stated that collaborative supply chain is differentiated based on its structure. There are vertical, horizontal and lateral collaboration. Vertical collaboration occurs when two or more organizations including manufacturer, distributor, and retailer share their responsibilities, resources, and performance information to serve similar end customer. The examples of vertical collaboration are Vendor Managed Inventory (VMI), Efficient Customer Response (ECR), and Collaborative, Planning, Forecasting, and Replenishment (CPFR). Horizontal Collaboration occurs when two or more unrelated organizations cooperate to share their private information or resources (Prakash & Deshmukh, 2010). The example of horizontal collaboration is joint distribution center

between two retailers. Lateral collaboration occurs when vertical and horizontal manners are combined by sharing capabilities with aims to gain more flexibility.

Low & Chen (2013) explained that collaborative supply chain can be used for performance measurement of inventory cost by showing how the delivery time and lead time of order give impact to the performance. Moreover, Lin (2016) was also conducted a research about lead-time variability reduction problem for integrated vendor-buyer supply chain system. The aims of the research are to gain optimal production and ordering strategy and investment policy to minimize joint total cost. A research about optimization for order distribution in the collaborative supply chain also has been done by Zhang et al. (2013). The aims of the research is to determine optimum order allocations to suppliers.

Vendor managed inventory (VMI) is one type of horizontal collaborations in collaborative supply chain. One of researches about vendor managed inventory have been carried out by Borade & Sweeney (2014). In the research, the relation between retailers and the supplier which operate vendor managed inventory in uncertain demand had been analyzed. The research conducted performance measurement in terms of cost, profit, stock-outs, and service level. The similar research had been conducted by Poorbagheri et al. (2015). The research was performed for a single-vendor multiple-retailer supply chain which based on vendor managed inventory policy. The research was aimed to get the optimal order quantity for the retailers, order points, and the number of replenishment which lead to minimizing the inventory cost. Li (2010) tried to analyze the effect of vendor managed inventory on the supply chain performance. The focus of the research is the supply chain coordination, cost reduction, and increasing profit.

A research to gain an optimum inventory using Simulation has been carried out by Sezen et al. (2007). In the research, the supply chain inventory system was simulated for single distribution channel using Spreadsheet Simulation. As Ingolfsson & Thomas A. Grossman (2015), Leong (2017), and Seal (1996) has carried out before, other than analyzing the inventory system, Simulation also can be used to analyze the queueing system. Ingolfsson & Thomas A. Grossman (2015) used Spreadsheet Simulation to identify the customer length of time in the queueing by showing the long service time

that can cause delays for the customers. While Leong (2017) used the Spreadsheet Simulation to analyze the queue behavior in the multi-server queuing system. Moreover, Seal (1996) used Spreadsheet Simulation to analyze the machine repair problem. In the research, the number of technicians to be employed to keep the overall cost of lost revenue low was being analyzed by considering the queue level in the system.

Besides, the study about finding optimum number of employee also has ben done by Tan, et al. (2016) using Spreadsheet Simulation. In the research the number of employees in breakdown maintenance activities was the main focus of the Simulation in getting the optimum solution. The research for analyzing the patient flow in Emergency Department has been conducted by Klein & Reinhardt (2012) using Spreadsheet Simulation. The research was aimed to know the waiting time in the Emergency Department. Other than that, Fuentes, et al. (2016) has been done a research using Spreadsheet Simulation. The research was purposed to make strategy for dairy processors face in the interaction with the supplier and buyers by simulating and calculating the revenue and profit obtained. The Spreadsheet Simulation also used by Khan (1999) to minimize the production cost of a textile production.

Thus, based on the previous studies in the literature review, this research will analyze the implementation of vendor managed inventory in collaborative supply chain. This research will analyze the alternatives of collaborative supply chain that could be implemented and the optimum supply chain cost after implementing vendor managed inventory for the collaborative supply chain of an industry. The method will be used in this research is Spreadsheet Simulation model. Simulation will be used to find the optimum solution for supply cost by considering re-order point and inventory level for material from the supplier.

## 1.2 Problem Formulation

Based on the background of research elaborated above, the problem formulation in this research are:

1. How vendor managed inventory implemented in the collaborative supply chain?
2. How much the optimum supply chain cost based on the application of Spreadsheet Simulation?

## 1.3 Objective of Research

The objective of this research are:

1. Identifying the implementation of vendor managed inventory in collaborative supply chain.
2. Analyzing the application of Spreadsheet Simulation method to analyze optimum supply chain cost.

## 1.4 Scope of Problem

There are some limitations that exist in this research, as mentioned as follows:

1. The research only focuses on the raw material procurement in an industry by considering the collaborative supply chain between the manufacturer and its supplier.
2. The research focuses on the process in one manufacturer with multi-suppliers.
3. The method used in this research is spreadsheet simulation.
4. The input of the simulation only uses historical data for two months from the raw material warehouse of barecore production division of the company.

## 1.5 Benefit of Research

The following are the benefits of this research:

1. To increase the wealth of knowledge in the field of vendor managed inventory in collaborative supply chain.
2. To help the supply chain members increasing its profit by minimizing all costing activities in the supply chain.

## 1.6 Systematical Writing

The systematical writing in this study are:

**CHAPTER I INTRODUCTION**

This chapter explains the introduction of the research. In this chapter, there will be elaborated the problem background, problem formulation, research objective, scope of the problem, research benefit, and systematical writing.

**CHAPTER II LITERATURE REVIEW**

This chapter focuses to determine the current study of the related previous researches by finding the state of the art of the previous researches to make difference with other researches. In this chapter, there will be elaboration between inductive and deductive studies related to the topic. The chapter contains information about the result of related previous research and supporting literature underlying the research.

**CHAPTER III RESEARCH METHODOLOGY**

This chapter will describe the research methodology. In this chapter, there will be described the detailed series of research object, research flow, and method used for the research including data collecting, data processing, and analyzing method.

**CHAPTER IV DATA COLLECTING AND PROCESSING**

This chapter describes the data collection and processing, analysis and results, including images, graphics, and tables obtained. In addition, this chapter also explains thoroughly about the data processed using the aforesaid method. This chapter is a reference for the discussion of the results that will be written in Chapter V.

**CHAPTER V DISCUSSION**

This chapter contains the analysis about the result of the previous chapter. In this chapter, core discussion will be conducted in order to get a comprehensive understanding of the whole research.

**CHAPTER VI CONCLUSION AND SUGGESTION**

This chapter provides short and precise statements described in the previous chapter which answer the problem formulation of the research. Suggestion related to the current study in the purpose of the advancement of the future research is given based on the limitations of the current research.

**REFERENCES**

**APPENDIX**

# CHAPTER II

# LITERATURE REVIEW

## 2.1 Inductive Study

In this competitive era, supply chain becomes one of the important aspects in industry. In order to respond intensive competition in the marketplace, industries have to respond faster to customer needs through rapid product development and shorter delivery time (Simatupang & Sridharan, 2002). However, the demand from customers is very uncertain which makes the manufacturer difficult to predict the production quantity in order to fulfill the demand. To achieve a matching demand with supply, manufacturer and its suppliers need to collaborate in the supply chain (Fisher et al., n.d.). From this condition, the collaborative supply chain theory is starting to be emerged.

Lambert et al. (1999) stated that collaborative supply chain is a particular degree of relationship among supply chain members as a means to share risks and rewards that result in higher business performance. According to Bowersox & Donald (1990), collaborative supply chain means alliances among different firms offer opportunities to improve customer service and lower distribution and inventory operating costs. Lu (2011) also explained that the collaborative supply chain might be the collaboration of research and development which is aiming for technological advancement or new product design, the collaboration of logistics operational which is aiming to reduce logistic lead-time and cost, and collaboration of marketing which is aiming to increase sales. The collaborative supply chain might help in lower inventory, high capacity utilization, decrease lead time, and produce a high-quality product or low defect rate.

Some researches about collaborative supply chain has been conducted. Low & Chen (2013) explained about a model measurement system for collaborative supply chain partners. The study used signal-to-noise (SN) ratio which defined by Taguchi method to

evaluate the robustness of specific supply chain behavior. This study was conducted in the electronic component company which developed system dynamics model that describes supply chain process structure. The result of the research is the performance of inventory cost with uncertain demand by showing how the delivery time and lead time of an order give impact to the performance.

Other than that, Lin (2016) was also conducted a research about lead-time variability reduction problem for integrated supply chain system. The aims of the research were to gain optimal production and ordering strategy and investment policy to minimize joint total cost. The researcher used a logarithmic investment function to reduce lead time variability and computer code using Mathematica software to develop the optimal solution.

A research about optimization for order distribution in the collaborative supply chain also has been carried out by Zhang et al. (2013). The aim of the research was to determine optimum order allocation to suppliers. This research combined multi-criterion optimization genetic algorithm (MCOGA) with analytical hierarchy process (AHP) method to evaluate the fitness value.

The horizontal collaboration in flexible collaborative supply chain research has been conducted in order to face the market changes. The research about flexible supply chain (FCSs) and horizontal collaboration has been modeled using ARENA 7.0 simulation. In this research that conducted by Prakash & Deshmukh (2010), the performance measurement was done by considering ordering cost, inventory cost, and backorder cost.

Other than horizontal collaboration, the lateral collaboration was conducted by determining the impact of inventory policies on supply chain performance. This research used simulation model using ARENA 9.0, by considering several costs such as inventory holding cost, backorder cost, and ordering cost. The result shows that the efficacy of lateral collaboration outperforms horizontal collaboration due to having the individual supply chain members at more liberty to make decisions (Chan & Prakash, 2012).

Risk assessment factor in the collaborative supply chain has been conducted by Badea et al. (2014). In the research, the potential risk factors of collaboration concept between vertical and horizontal collaboration in the supply chain have been analyzed. The research proposed five attributes for a good collaboration which are information sharing, decision synchronization, incentive alignment, resource and skill sharing, and knowledge management. The researchers identified 16 risk factors and used analytical hierarchy process (AHP) method to analyze the risk factor.

Simatupang & Sridharan (2002) stated that one example of the collaborative supply chain is by implementing vendor managed inventory. Research about vendor managed inventory has been done by Borade & Sweeney (2014). The research was analyzed the relation between retailers and the supplier that operate vendor managed inventory in uncertain demand. The research conducted performance measurement in terms of cost, profit, stock-outs, and service level. The research applied genetic algorithm (GA) based decision support system (DSS) method in vendor managed inventory.

The similar research had been conducted by Poorbagheri et al. (2015). The research was conducted for a single-vendor multiple-retailer supply chain which based on vendor managed inventory policy. The research aims to get the optimal order quantity for the retailers, order points, and number of replenishment which lead to minimize the inventory cost. The method used genetic algorithm (GA) to solve the problem and firefly algorithm (FA) to validate and verify the result. In order to get a better solution, Taguchi method also used to calibrate the parameter of both GA and FA method.

Moreover, Li (2010) analyzed the effect of vendor managed inventory on the supply chain performance. The focus of the research is the supply chain coordination, cost reduction, and increasing profit. The research used MATLAB program and computer simulation to analyze the effect of VMI on supply chain performance and important function of VMI in promoting supply chain coordination, reducing cost, and increasing profit.

The relationship between distributor backorder performance and its inventory level under vendor managed inventory have been analyzed by Yao et al. (2004). This research used EDI transaction data collected from the electronic component and truck part industry to test the result from analytical modeling. The result showed that there is a strong adverse relationship between inventory level and back order conversion rate.

Tyan & Wee (2003) in their research stated that vendor managed inventory not only has the ability to reduce cost but also to improve service levels and create business opportunities for parties in the supply chain. While Marqu et al., (2010) stated that vendor managed inventory is currently used to monitor manufacturer's inventory replenishment. Their research explained that beyond the short-term pull system inventory replenishment, partners have to share their vision of demand, their requirements, and their constraint to fix long term common objectives.

A research to gain an optimum inventory using Simulation has been performed by Sezen et al. (2007). In the research, the supply chain inventory system was simulated for single distribution channel using Spreadsheet Simulation. In this research, there are three different scenarios reflecting various levels of demand fluctuation which are high, medium and low demand. The result of the research is by analyzing total cost and shortage risk that occur for each scenarios.

Ingolfsson et al. (2015) used Spreadsheet Simulation to know the customer length of time in the queueing by showing the long service time can cause delays for the customers. In this research, the arrival time, service time, start of service, and end of service time is being analyzed. Besides, Leong (2017) also used the Spreadsheet Simulation to analyze the queueing behavior in the multi-server queuing system.

Moreover, Seal (1996) used Spreadsheet Simulation to analyze the machine repair problem. In the research, the number of technicians to be employed to keep the overall cost of lost revenue low was being analyzed by considering the queue level in the system. The research result is shown in average for 100 hours of operation by analyzing the number of technicians needed, total machine broken, total machines repaires, total hours

tecnicians worked, total number of machine waiting/100 hours, lost revenue for waiting, lost revenue for service, and total lost revenue. From the simulation, it can be seen that recommended number of technicians to keep the overall cost of lost revenue and service charge low is two to three technicians.

Besides, the study about finding optimum number of employee also has been carried out by Tan, et al. (2016) using Spreadsheet Simulation. In this research, the number of employees in breakdown maintenance activities was the main focus of the Simulation in getting the optimum solution. Data for the simulation are time to repair and time between failures which are generated randomly. The simulation results show that the optimum number of employee obtained when utilization of maintenance employee is maximized while the number of machine and waiting time in queueing for maintenance employee was minimized which lead to optimum cost of breakdown maintenance.

The research for analyzing the patient flow in Emergency Department has been conducted by Klein & Reinhardt (2012). The research aimed to know the waiting time in the Emergency Department using Spreadsheet Simulation. In this simulation, the waiting time was measured in waiting area, bed occupancy, medical doctor bedsite visits, and queue of admitted patients waiting for discharge or transfer into in-patient wards was being analyzed.

Other than that, Fuentes, et al. (2016) conducted a research using Spreadsheet Simulation for small-scale dairy plant. The research was aimed to make strategy for dairy processors face in the interaction with the supplier and buyers. The research used simulation to select product portfolio according to market opportunities and design milk payment system encouraging dairy farmers to supply good quality and quantity of milk. The spreadsheet simulation helps in calculating daily profit obtained and gross revenue obtained. In the simulation, some scenarios related to the initial plant situation were being constructed. The simulation results show that the company could increase profit by having modification on the initial current portfolio towards higher value products, the company did not adequately compensate farmers who delivered good quality milk but

overpaid some farmers who delivered poor quality milk, and the profict could be increased by adoption of a payment system based on milk quality.

The Spreadsheet Simulation also used by Khan (1999) to minimize the production cost of a textile production. The simulation was run for 45 weeks period and could be seen that the steady state is reached at about after 23 weeks. The result of the simulation shows that four hired repairmen and four rented backup machines combination is best and could minimize overall production cost.

Other than that, Koch, et al. (2016) used monte carlo simulation to get improvement for better inventory level and fulfill customer order in a cost effective manner. In the simulation, two different capacity planning strategies have been compared. The simulation is used as a tool to mitigate production variation and its impacts in the overall business. By doing the simulation, the bullwhip effect was reduced as assessed by the production's coefficient of variation from 30% to lower than 5%. The inventory balance was maintained to fulfill sales orders, but defining capacity based on historical data avoided multiples ramp up projects and eventual sizing initiatives, which lead to addition expenses.

Gocken et al. (2017) conducted Optimization via Simulation (OvS) approach to determine the best inventory control system with supplier selection and obtained remarkable amount of saving while increasing the competitive edge in stochastic suply chain environment. In this research, the focus was to find which review model should be used, which objective function of review model should be used to increase competitiveness of the supply chain, and how to find the optimal values of initial inventory, reorder point, and opder-up-to level for each Distribution Center and each Supplier. The simulation results show that the total supply chain cost can be improved at least 22%, and at most 66% on average with the proposed continuous review model.

Moreover, the improvement of performance for Distribution Center using Simulation also has been conducted by Bahrami et al. (2016). In this condition, the most demanded items to be distributed are stored in forward area while reserve area stored

goods in pallets and bulk. Placing sufficient inventory in most convinient locations in the forward area results in less travel and less stockout. This research proposed an approach to reduce number of stockout in forward area while decreasing the total traveled distance. Then, the simulation was used for efficiency test of the proposed model before being applied in the real system. This research was conducted by using Flexsim 6.0 simulation software. The objective of the simulation is to compare the performance of the initial situation with the proposed model in term of number of stockouts and total travel distance of operator.

Sharda & Akiya (2012) conducted research by implementing discrete event simulation for making a guideline to select inventory management policy for a chemical plant that produces products with limited shelf life. The policy for the product was selected based on cost-benefit analysis using multiple objectives of maximizing the on-time order fulfillment, minimizing production and inventory cost. In the research, discrete event simulation was used to generate realistic cost estimation that includes demand variability, planning and scheduling policies, and operational details. The policies to be considered in the research are make-to-stock, postponement, and combination between make-to-stock and postponement. Make-to-stock policy is applied to maximize order fulfillment on time, reduce cleaning cost, and the number of storage units. Postponement policy is applied to optimize the number of storage units for the product selected. While the combination of make-to-stock and postponement policy is applied to the product with low to medium demand and high expiration.

Duong & Wood (2016) conducted research that focused on solving the problem related to the perishable inventory management that can be secured by reducing waste accruing from deterioration. The research explained that discrete event simulation can be used for evaluating complex inventory systems. The research showed that discrete event simulation can be used as a tool to determine optimal inventory policies accounting for perishability and substitution.

After making the inductive study, the research position for the researches can be seen in Table 2.1 below:

Table 2.1 Research Position

| Author | Topic of Study | Focus of Study | | | Method | |
|---|---|---|---|---|---|---|
| | | CSC | Inventory Optimization | Others | Simulation | Others |
| Low & Chen (2013) | A model measurement system for collaborative supply chain partners | v | v | | | Taguchi method (Signal to noise ratio) |
| Lin (2016) | Investing in lead-time variability reduction in a collaborative vendor-buyer supply chain model with stochastic lead time | v | v | | | Mathematica Software |
| Zhang et al. (2013) | A modified multi-criterion optimization genetic algorithm for order distribution in collaborative supply chain | v | v | | | MCOGA and AHP |
| Prakash & Deshmukh (2010) | Horizontal collaboration in flexible supply chains: a simulation study | v | v | | ARENA 7.0 | |

| Author | Topic of Study | Focus of Study | | | Method | |
|---|---|---|---|---|---|---|
| | | CSC | Inventory Optimization | Others | Simulation | Others |
| Chan & Prakash (2012) | Inventory management in a lateral collaborative manufacturing supply chain: a simulation study | v | v | | ARENA 9.0 | |
| Badea et al. (2014) | Assessing Risk Factors in Collaborative Supply Chain with the Analytic Hierarchy Process (AHP) | v | | Risk Assessment | | AHP |
| Borade & Sweeney (2014) | Decision support system for vendor managed inventory supply chain: a case study | | v | | | GA and DSS |
| Poorbagheri et al. (2015 | Vendor Managed Inventory of a Supply Chain under Stochastic Demands | | v | | | GA and FA |
| Li (2010) | A VMI Model in Supplier-Driven Supply Chain and Its Performance Simulation | | v | SC Performance | Spreadsheet | MATLAB |

| Author | Topic of Study | Focus of Study | | | Method | |
|---|---|---|---|---|---|---|
| | | CSC | Inventory Optimization | Others | Simulation | Others |
| Yao et al. (2004) | Managing Supply Chain Backorders under Vendor Managed Inventory: A Principal-Agent Approach and Empirical Analysis | | v | Relationship Performance | | EDI |
| Sezen et al. (2007) | Spreadsheet simulation for the supply chain inventory problem | | v | Distribution | Spreadsheet | |
| Ingolfsson et al. (2015) | Graphical Spreadsheet Simulation of Queues | | | Queue system | Spreadsheet | |
| Leong (2017) | Simpler Spreadsheet Simulation of Multi-Server Queues | | | Queue System | Spreadsheet | |
| Seal (1996) | Spreadsheet simulation of a queue with arrivals from a finite population: The machine repair problem | | | Optimum Number of Employee and Queue in Repair Machine | Spreadsheet | |
| Tan, et al. (2016) | Spreadsheet simulation-based optimization for personnel capacity requirement in breakdown maintenance | | | Optimum Number of Employee and Queue in Maintenance | Spreadsheet | |

| Author | Topic of Study | Focus of Study | | | Method | |
|---|---|---|---|---|---|---|
| | | CSC | Inventory Optimization | Others | Simulation | Others |
| Klein & Reinhardt (2012) | Emergency Department Patient Flow Simulations Using Spreadsheets | | | Waiting Time (Queue Analysis) | Spreadsheet | |
| Fuentes, et al. (2016) | Supporting small-scale dairy plants in selecting market opportunities and milk payment systems using a spreadsheet model | | | Strategy | Spreadsheet | |
| Khan (1999) | Performance Comparison of spreadsheet simulation and simulation languages : a case example to minimize textile production cost | | | Production Cost Optimization | Spreadsheet | |
| Koch, et al. (2016) | Application of Monte Carlo Simulation as a tool for Capacity Planning Strategy in a multi-level global supply chain focused to reduce the bullwhip effect | | v | | Monte Carlo | |

| Author | Topic of Study | Focus of Study | | | Method | |
|---|---|---|---|---|---|---|
| | | CSC | Inventory Optimization | Others | Simulation | Others |
| Gocken et al. (2017) | Optimization Via Simulation for Inventory Control and Supplier Selection | | v | | v | |
| Bahrami et al. (2016) | Using Simulation to Improve Performance of a Real World Distribution Center | | | Performance of Stockout and Distance | DES, Flexsim 6.0 | |
| Sharda & Akiya (2012) | Selecting make-to-stock and postponement policies for different products in a chemical plant: A case study using discrete event simulation | | v | | DES | |
| Duong & Wood (2016) | Discrete Event Simulation in Inventory Management | | v | | DES | |

From the inductive studies that have been done above, the state of the art that will be used for this research can be found. The using of Spreadsheet Simulation for vendor managed inventory in the collaborative supply chain has not been conducted yet by other researchers. From the inductive study, it can be seen that vendor managed inventory in collaborative supply chain could give some benefits for supplier and manufacturer such as lower inventory which lead to cost minimizing and profit increasing. By considering this condition, the implementation of vendor managed inventory in collaborative supply chain could be beneficial for the manufacturer. Thus, the using of Spreadsheet Simulation for vendor managed inventory in the collaborative supply chain will be the topic of this research. The research will show the optimum solution for the supply chain cost by considering inventory and ordering level. The Spreadsheet Simulation will consist of some scenarios that will be analyzed and chosen to be the best solution.

## 2.2 Deductive Study

### 2.2.1 Collaborative Supply Chain

A supply chain consists of interdependent firms involved in the flow and transformation of goods, services, and related information, as well as funds from point of origin through to the end customers. Those chain members often become involved in supply chain management to integrate planning, implementing, and controlling the effective flow of goods and services, related information, and associated funds for the purpose of conforming to customer requirements (Lambert et al., 1998). The basic of supply chain concept can be seen in Figure 2.1 below:

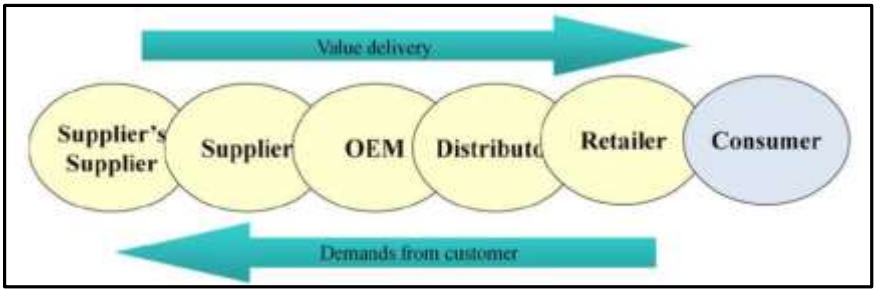



Figure 2.1 Basic of Supply Chain Concept
Source: Lu (2011)

The supply chain includes not only the manufacturer and suppliers, but also transporters, warehouses, retailers, even customer themselves. Within each organization, the supply chains includes all function involved in receiving and filling customer request, new product development, marketing, operations, distribution, finance, and customer service. The main purpose of any supply chain is to satisfy customer needs and generate profit as much as possible.

In the supply chain, there are two processes happen which are pull processes and push processes. In pull processes, the organization responses to a customer's order or the process occurs based on the information that comes from customer. Thus, the pull processes operate in an environment in which customer demand have been identified. Vice versa, push processes is process that occurs based on the forecast on existing customer's order or respond to speculation than actual demand. The push processes operate in an uncertain environment because customer demand is not yet acknowledged.

All processes occur in supply chain can be caegorizes in three main areas which are processes focused downstream, processes focused internally, and processes focused upstream (Chopra et al. 2013). Those classification used to define three macro supply chain process as follows:

1. Customer Relationship Management (CRM)

   Customer Relationship Management is a process that focused to the downstream level of an organization. This process aims to generate customer's demands and facilitate the placement and tracking orders. The processes include marketing, pricing, sales, order amnagement and call center management.

2. Internal Supply Chain Management (ISCM)

   Internal Supply Chain Management is a process focused to the internal of the organization. This process aims to fulfill demand generated by CRM process

in the shortest time and at the lowest cost. The processes include the planning of internal production and storage capacity, preparing inventory management policies, preparation of demand and supply plans, and fulfillment of actual orders.

3. Supplier Relationship Management (SRM)

   Supplier Relationship Management is a process that focused to the upstream level of an organization. This process aims to arrange and manage supply sources for various goods and services. The processes includes the evaluation and selection of suppliers, negotiation of supply terms includes pricing and delivery time, sharing of demand and supply plans with suppliers, placement of replenishment orders, and communication regarding new products and order with suppliers.

As the performance of an organization is linked to its supply chain system, it is important for the organization to focus on those three macro processes. A good supply chain coordinates all the macro processes across all stages. The well integrated of the three macro processes is a crucial things for the organization. The lack of integration of the process might impact the supply chain's ability to match supply and demand effectively, leading to dissatisfied of customer and high cost in each organization.

Collaborative supply chain simply means that two or more independent organizations work jointly to plan and execute supply chain operations with greater success than when acting in individually. Chopra et al., (2013) stated that nowadays between 50 to 70 percent of spending at manufacturing company comes from the procurement, compared to only 20 percent several decades ago. Thus, this important issue emerges collaboration between manufacturer and suppliers. Although collaboration is based on a mutual objective, collaboration is a self-interested process in which firms will participate only if it contributes to their own survival. By having collaboration, both of manufacturer and suppliers can keep the product costs remain low. Collaborative can lower the material purchasing costs, logistic costs, and manufacturing costs.

Nevertheless, the focus of a mutual objective should be on the outcome and experience of joint offers to end customers. By sharing their resources and capabilities, supply chain members can exploit profit-making opportunities that they cannot create alone.

Vanpoucke & Vereecke (2011) stated that there are three types of behavioral factors in supply chain, which labelled as collaboration attributes, communication behavior, and collaboration management. The overview of these behavioral factors and how they are linked to performance is presented in the Figure 2.2 below:

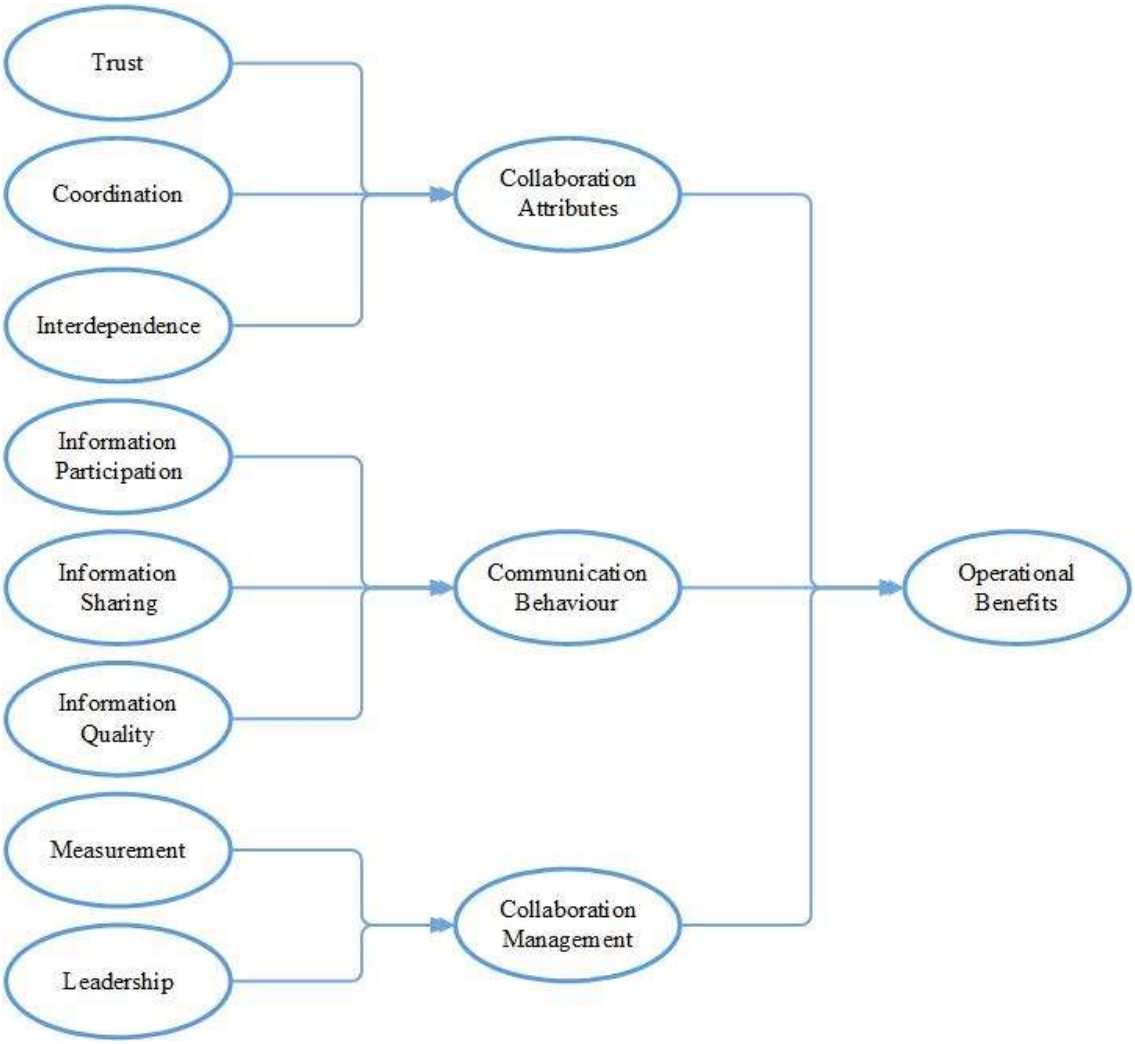



Figure 2.2 Relation of Behavioral Factors and Its Performance
Source: Vanpoucke & Vereecke (2011)

Collaboration attributes are relational characteristics such as trust, interdependence and coordination among the partners in the relationships. Communication behavior refers to the level of information sharing, the quality of this information (including its reliability and timeliness), and how this information is used and translated into the partner's business processes. Collaboration management refers to management practices that must be implemented with the collaborative practice to achieve better performance.

According to Badea et al. (2014), there are five alternatives for collaboration in supply chain. The alternatives are the most important activities in order to fulfill a new strategy in collaborative suply chain which can increase competitive advantage and organizational performance. The alternatives are:

1. Information sharing

   Information sharing is the main factor to have a successful collaborative supply chain which has to ensure transparency across the supply chain ecosystem including supply capacity and delivery lead time. The objective of information sharing is to keep the business up to date with the forecast, future plans, and promotion. The supply chain members have to share information in both forward and backward flows that provide adequate visibility across both internal functions and organization of the supply chain (Badea et al., 2015). Confidentiality is one of the biggest issues for this subject. There are some obstacles might occur such as antitrust regulations, the timeliness and accuracy of the provided information, and differing technologies between the supply chain partners (Cao & Qingyu, 2013).

2. Decision synchronization

   In a collaborative supply chain, all decisions should be coordinated including planning and operation activities to optimize supply chain benefits. According to Badea et al. (2015), supply chain decision refers to the following actions:

combining information and plans, resolving differences and conflicts, and establishing procedures and rules. Moreover, some problems in decision synchronization process might occur when there is no clear authority structure and the information is widely dispersed (Cao & Qingyu, 2013).

3. Incentive alignment

Incentive alignment aims to realign benefits and burdens that are incurred when there is a process change occur in the supply chain by aligning all supply chain member behaviour with over all chain goals. Incentive alignment could make the companies respond the customer's needs faster by having rapid product development and shorter delivery lead time (Badea et al., 2014). If misaligned incentive occurs, then excess inventory, stockouts, incorrect forecast, inadequate sales efforts, and poor customer service might be happening (Simatupang & Sridharan, 2002).

4. Resource and skill sharing

According to Badea et al. (2014), resource and skill sharing refers to the process of mutual asset and investments among supply chain partners and a sustainable and a sustainable collaboration must be supported with shared resource investments. Skill sharing helps organization to share information technology knowledge to construct linked information system. However, potential risk should be considered for this alternative is disruptions of the material in technological information flow between supply chain members (Aleksander, et al., (2005)

5. Knowledge management

Knowledge management is an important determinant of higher performance and greater competitiveness (Badea et al., 2014). Knowledge management in collaborative supply chain provide a sustainable supply chain in production

innvation, reducing project time, and improving quality and customer satisfaction (Maqsood et al., 2003).

### 2.2.2 Inventory Management

Inventory in the supply chain exist because of the mismatch between the supply and demand. The importance of inventory in the supply chain is to increase the amount of demand that can be satisfied by having ready and available product when the demand from the customer arrive. Chopra et al. (2013) explained that inventory impacts the assets held, the costs incurred, and the responsiveness provided in the supply chain. High levels of inventory in supply chain improve responsiveness but also leave the supply chain vulnerable to the need of lowering profit margins. Low levels of inventory improve inventory turns but may result in lost sales if customers are unable to find products they are ready to buy.

The quantity and location of inventory might allow the supply chain to range from being very low cost to very responsive. Large amount of goods in inventory make customer allow the supply chain to be responsive but with a high cost for the organization. The aims of good supply chain is to find the right quantity and location of inventory that provides the right level of responsiveness at the lowest possible cost.

Inventory management is the activity which organizes the availability of items to the customers which coordinates the purchasing, manufacturing and distribution functions to meet the marketing needs. This role includes the supply of current sales items, new products, consumables, spare parts, obsolescent items and all other supplies. Inventory enables a company to support the customer service, logistic or manufacturing activities in situations where purchase or manufacturer of the items is not able to satisfy the demand (Wild, 2002). Lack of satisfaction could arise either because of the speed of purchasing or manufacturing is too protracted, or because quantities cannot be provided without stocks.

Inventory management has to contribute to the welfare of the whole organization. The logistic operation must aim to contribute to profit by servicing the marketing and financial needs of the company. The aim is not to make all items available at all times, which will make the company's financial is loss. The normal role for stock control is to meet the required demand at a minimum cost. The purpose of the inventory control function in supporting the business activities is to optimize the three targets (Wild, 2002):

1. Customer service

   Customer service can be considered in several ways, depending on the type of demand. In a general stores environment the service will normally be taken as availability ex stock, whereas in a supply to customer specification, the service expected would be delivery on time against customer requested date.

2. Inventory costs

   Inventory costs require a minimum of cash tied up in stock. This target has to be considered carefully, since there is often the feeling that having any stock in stores for a few months is bad practice. In reality, minimizing the stock usually means attending to the major costs which is very low-value items are not considered a significant problem. Low inventory can also be considered in terms of space, or other critical resource. Where the item is voluminous, or the stores space restricted, the size of the items will also be a major consideration.

3. Operating costs

   Operating cost has become one of the issues that should be a focus in inventory management. The prime operating costs covers stores operations, inventory control, purchasing and the associated services. The development of logistics, linking distribution costs with inventory, has added this new set of transportation costs to the analysis.

Optimizing the balance of these three objectives is the focus of stock control. The better the balance is, the bigger profits will be provided for the company. The purpose of controlling the inventory is to drive the stocks toward their proper level which is determined by the characteristics of supply and demand patterns. The major factors are:

1. Supply lead time
2. Average demand rate
3. Variability of demand
4. Supply frequency
5. Customer delivery time allowed

#### 2.2.2.1 Safety Stock

Safety stock is important to reduce the possibility of stock-out happen and minimize the high level of inventory. The aim in having safety stock is to maintain a balanced inventory so that customer service for each stock item is maintained within its proper limits. The time at which can influence the stock levels most effectively is when the order placed, and it is at this point that the major opportunity occurs for ensuring a balanced inventory. This is the major control mechanism for ensuring a balanced inventory. This condition is also the point at which customer satisfaction or excess inventories are created. Stock-recording systems used to include safety stock levels as minimum and maximum stock levels. In a safety stock system, there is a need for both reorder level and minimum stock level. The safety stock control is shown in Figure 2.3 below:

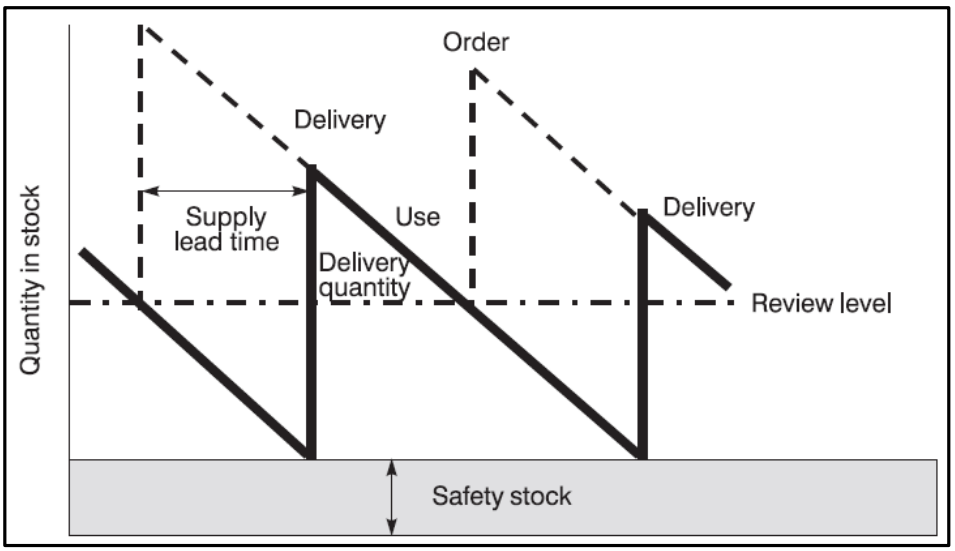



Figure 2.3 Safety Stock Control
Source: Wild (2002)

Minimum stock has also been replaced by the safety stock and allowing for lead time. Maximum stock is a result of negotiation with suppliers on delivery quantities. The maximum stock level should be a result, rather than a direct control. It is therefore necessary to control the delivery quantities directly by using three parameters to carry out simple and effective stock control. There is a formula that can be used to calculate safety stock level. According to Gonzalez et al. (2010) the formula for calculating safety stock is shown in the Equation 2.1 below:

$$Safety\ Stock = Z\ x\ \sigma \qquad \text{Equation (2.1)}$$

Where:

Z = Service level value

σ = Standard deviation

However, according to Wild (2002) the longer the sample period the less the relative safety stock need. Thus, this would be a square root relationship. As the variation in demand is largely a statistical effect, the square root relationship occurs very frequently in stock control. The full formula for safety stock is shown in the Equation 2.2 below:

$$Safety\ Stock = Z\ x\ \sigma\ x\ \sqrt{l} \qquad \text{Equation (2.2)}$$

Where:

Z = Service level value

σ = Standard deviation

l = Lead time

#### 2.2.2.2 Reorder Point

One of the best ways to maintain safety stock is by knowing the re-order point. Chen (1998) stated that re-order point quantity reflects the level of inventory that triggers the placement of an order for additional units. Re-order point is the number of units on hand when an order for more inventory is placed. According to Gonzalez et al. (2010), re-order point can be calculated using the formula in Equation 2.3 below:

$$Reorder\ point = \bar{d}l + Z\sigma\sqrt{l} \qquad \text{Equation (2.3)}$$

Where:

đ = Average demand

l = Lead time

Z = Service level value

σ = Standard deviation

### 2.2.3 Vendor Managed Inventory

Vendor managed inventory is a relation of an organization with its upstream of downstream such as retailer and supplier. In this theory, supplier is the one who determine the amount of products and when the product will be dispatched to the retailer in order to fulfill the customer demand which based on the agreement between supplier and retailer. In vendor managed inventory system, the supplier knows the information about customer

demand and inventory level of the supplier. The system of vendor managed inventory is shown in Figure 2.4 below:




Figure 2.4 Vendor Managed Inventory System

Vendor managed inventory is aimed to reduce a company's inventory holding costs by keeping inventory on the supplier's books until it is needed for production or sale. Vendor managed inventory is implemented in order to reduce inventory costs and increase customer service levels. Vendor managed inventory can also be used to address these three common supply chain related problems (E2open, 2011):

1. Lost sales due to parts shortages or poor on-time delivery performance by a supplier
2. Excess and obsolete inventory provisions exceeding 0.3% of materials spend
3. Inventory turns of less than 10 for key parts

Marqu et al., (2010) analyzed how the term vendor managed inventory is qualified in the literature. In the research literature, the researcher found twenty-four expressions used to qualify vendor managed inventory that can be organized around five families:

1. Concept: This is expressions used in a very large and generic sense.
2. Process: This is expressions show a functional, a process oriented approach of vendor managed inventory.
3. Cooperation: This is expressions emphasize the relationship between partners.
4. Cooperative process: This is a family inherits process and cooperation families.
5. Technology: This is expressions focus on technologies that support vendor managed inventory.

Forecast collaboration with the supplier should be a top priority for manufacturer's idea on implementing vendor managed inventory. Forecast collaboration is both an important part of demand planning, as well as an effective means of introducing the organizational changes needed to get vendor managed inventory up and running quickly. When suppliers do not have ongoing visibility into customer demand forecasts, suppliers manage inventory based on agreed-upon safety stock and min-max inventory levels, historic purchase patterns, or simply the ability to fulfill a purchase order once it arrives. In order to accommodate changing demand patterns and meet service levels, suppliers often increase their own finished goods inventory, which means additional finished goods locations and higher overall inventory costs. Ultimately, these costs are passed on to the customer in the form of higher prices.

### 2.2.4 Simulation

Simulation is the imitation of a dynamic system using a computer model in order to evaluate and improve system performance (Harrell et al., 2004). In practice, simulation is usually performed using computer program or simulation software that has modeling the behavior of real systems. Commonly, simulations are classified according to the following characteristics:

1. Static or dynamic
2. Stochastic or deterministic
3. Discrete-event or continuous

Simulation provides insights into the complex dynamics of a system that cannot be obtained using other analysis techniques because simulation accounts for interdependencies and variation. Simulation helps in giving unlimited freedom to try out different ideas, which named scenarios, for giving improvement, risk free with virtually no cost, no waste of time, and no disruption to the real system. Furthermore, the results are both visual and quantitative with performance statistics automatically reported on all measures of interest.

Spreadsheet simulation is one of simulation techniques that used as a platform to represent the simulation model and perform simulation experiment. The common spreadsheet used by many people today is Microsoft Excel which is part of Microsoft office. Spreadsheet is frequently used for many activities including inventory modeling. In order to evaluate the replenishment policy, the value must be sampled when the simulation experiment is run. From this experiment, the observations of periodic costs resulting from excess inventory and shortages associated with the policy can be analyzed. The experiment will be repeated for several policies or scenario to find the inventory policy that could cause the minimum mean cost.

Seila (2006) stated that spreadsheet should have several features for supporting the simulation. The features that available in most spreadsheet to make the process quick and reliable are:

1. Large number of functions to do mathematical, statistical, database, time, financial and other calculations.
2. Database representations and database access.
3. Charting and graphing.
4. Display and documentation features such as fonts, colors, and geometric shapes to improve presentation.
5. Automation through scripting lenguages such as VBA

Other than that, Seila (2006) also explained that there are some features that required by simulation platform. The capabilities that must be available in order to conduct simulation are:

1. Can represent mathematical and logical relationship among variables
2. Can generate distributed random number which used to sample observation from various distributions.
3. Can repeat the computations or conduct replications of the model.

# CHAPTER III

# RESEARCH METHODOLOGY

## 3.1 Research Flowchart

The research flowchart of this study is depicted in Figure 3.1 below:

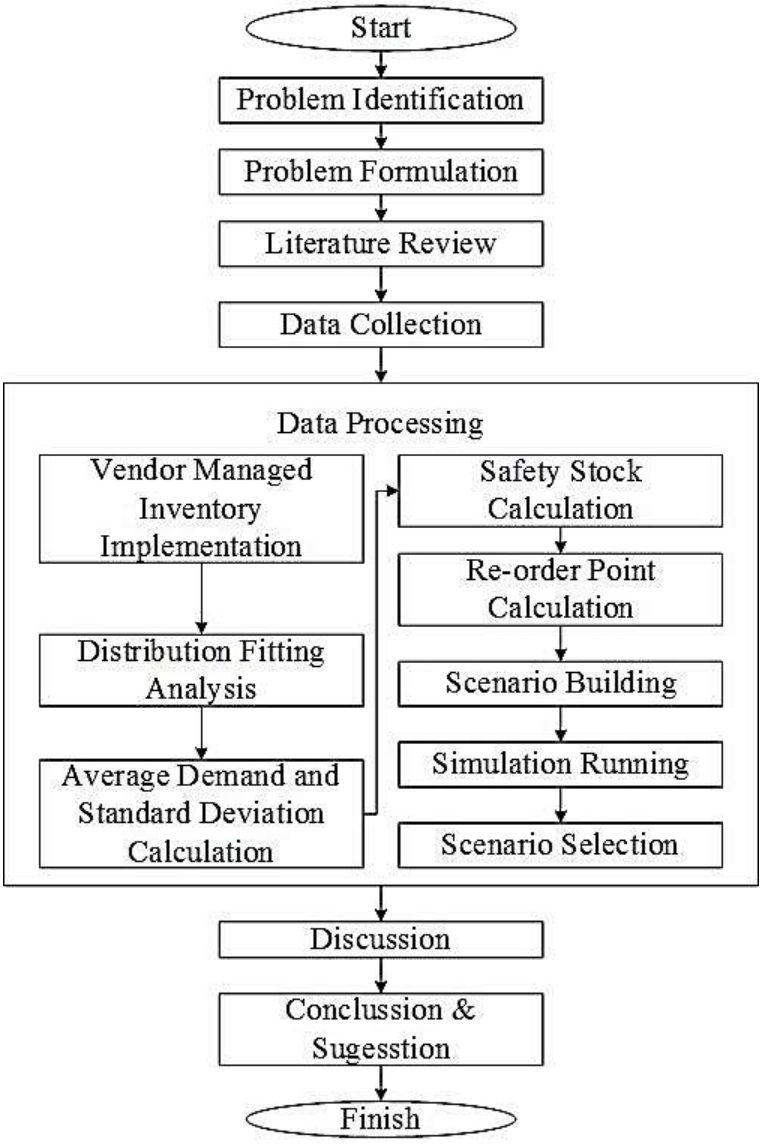



Figure 3.1 Reseach Flowchart

## 3.2 Problem Formulation

Problem identification is the early step of this study. The problem identification is obtained from the literature review that has been conducted. According to the literature review, the collaborative supply chain is needed by industries in order to increase the effectiveness of the company. In this term, the company should maintain the relationship with its supplier. Because of the high demand of product from the customer, the company should have high attention to the raw material procurement process. This problem identification is organized as question form which will be answered and explained in the discussion and conclusion.

This research was conducted in PT. Rakabu Sejahtera, one of the manufacturing companies in Solo, Central Java and its suppliers which are Supplier A, Supplier B, and UD. Trenggalek Lestari. PT. Rakabu Sejahtera is a company that produces bare core and furniture. The Bare core is produced from some Balken wood with varieties of size, and make to be specified size. Then, the bare core will be ordered and used by production division of furniture product and other parties. Some of the furniture products are exported to other countries. The company has a high demand of furniture, which means that the company also has a high demand of the bare core. The bare core has been ordered almost every day by production division of furniture and the direct customers. Besides, the suppliers that located in East Java, always deliver Balken wood as the raw material almost everyday to PT. Rakabu Sejahtera which leads to high inventory in PT. Rakabu Sejahtera.

## 3.3 Problem Identification

The research is focused on analyzing the implementation of vendor managed inventory in the collaborative supply chain for wood manufacturing. This research will analyze whether the alternatives of collaborative supply chain could be implemented and the optimum supply chain cost after implementing vendor managed inventory for the collaborative supply chain. In order to support the research, spreadsheet simulation method will be used to analyze the optimum result. This research will analyze the supply

chain cost by considering re-order point and inventory level for material from the supplier.

## 3.4 Literature Review

The literature review is used to find out the gap between the previous study and the recent research would be conducted. Literature review is also designed for gaining the state of the art of the study which will support the problem identification. Literature review is divided into two studies, which are inductive study and deductive study. Inductive study is a study from previous researches that already have significant reputation. Besides, the deductive study is a study that explains about the basic theory, derived from the text books and accredited literatures that have relation with recent research.

## 3.5 Data Collection

The data were collected at PT. Rakabu Sejahtera on April 2017 and three of Balken wood suppliers. The data that collected from the company are the primary data. The primary data obtained will be used for the main calculation and information for this research. The data are:

1. Raw material ordering system
2. Number of raw material received from to supplier
3. Demand of product
4. Inventory level of raw material
5. Production process of bare core
6. Production capacity of suppliers each day
7. Supply capacity of suppliers each day
8. Costing activities for manufacturer and suppliers.

## 3.6 Data Collecting Method

There are two methods to be used in order to get the data. There are:

1. Interview

   The interview was conducted with the manager in PT. Rakabu Sejahtera and also the suppliers. From the interview, the information about the relation of the company with its supplier, raw material ordering system, production system, inventory control, and costing activities are gathered.

2. Observation

   The data from observation are the data that is not obtained from the interview. The observation is conducted by observing the condition in the raw material warehouse and bare core production process only in PT. Rakabu Sejahtera.

## 3.7 Vendor Managed Inventory

This sub-chapter will explain how vendor managed inventory related with collaborative supply chain. This part will also discuss the implementation of collaborative supply chain alternatives that could be implement in PT. Rakabu Sejahtera and its suppliers. The alternatives could be considered in this research are information sharing and decision synchronization.

## 3.8 Data Processing

### 3.8.1 Distribution Fitting

Before running the simulation, the distribution pattern of the historical data should be identified. The distribution fitting can be recognized with the help of XLSTAT application which already installed in Microsoft Excel. This distribution fitting will be considered as the hypothesis:

H0 = The data follows normal distribution
H1 = The data does not follow normal distribution

with the significance level ($\alpha$) is 0.05, thus:

H0 is accepted if the p-value or $\alpha > 0.05$
H1 is not accepted if the p-value or $\alpha < 0.05$

### 3.8.2 Data Calculation

Before conducting simulation, some data needed for being processed or calculated. The data will be the input of the simulation. The data are average demand, standard deviation, safety stock, reorder point, and costing activities. The average demand and standard deviation, are derived from the XLSTAT result in Microsoft Excel. The safety stock and re-order point will be obtained from the calculation of the formula. The formula of safety stock is as mentioned in Equation (2.2) while the formula for re-order point is mentioned in Equation (2.3). The formula are:

$$Safety\ Stock = Z\ x\ \sigma\ x\ \sqrt{l}$$

Where:

Z = Service level value

σ = Standard deviation

l = Lead time

$$Reorder\ point = \bar{d}l + Z\sigma\sqrt{l}$$

Where:

đ = Average demand

l = Lead time

Z = Service level value

σ = Standard deviation

Other than that there are some costs needed such as holding cost, ordering cost, and shortage cost. These cost data is obtained from the historical data after interviewing the expert from PT. Rakabu Sejahtera.

### 3.8.3 Scenario Building

After calculating the average demand, standard deviation, safety stock and re-order point from the historical data, the scenario to get the optimum solution will be built. The scenario will be built based on the subjective prespective of the researcher.

### 3.8.4 Simulation Running

The simulation is started by generating random number for demand and making the function for each cell. The function is needed to simulate the Total Material Arrived, Inventory in PT. Rakabu Sejahtera, Supply Quantity and Number of Truck Delivered for Supplier A, Supplier B, and UD. Trenggalek Lestari, Shortage Cost of PT. Rakabu Sejahtera, Holding Cost of PT. Rakabu Sejahtera, Production Cost for Supplier A,

Supplier B, and UD. Trenggalek Lestari, Delivery Cost for Supplier A, Supplier B, and UD. Trenggalek Lestari, and Total Supply Chain Cost.

### 3.8.5 Scenario Selection

The scenario selection will be done after the simulation is finished. In scenario selection, there will be some variable to be considered and analyzed. The variable are Shortage Frequency, Shortage Quantity, Average Inventory Level of PT. Rakabu Sejahtera, Average Inventory Cost of PT. Ralabu Sejahtera, Average Expenses of Suppliers, and Average Supply Chain Cost.

## 3.9 Result and Discussion

After conducting the data processing, there are several expected results as follows:

1. The implementation of vendor managed inventory in the collaborative supply chain between PT. Rakabu Sejahtera with its supplier.
2. Optimum material quantity arrival needed for the raw material in order to get optimum supply chain cost based on the application of Spreadsheet Simulation which feasible to be applied in PT. Rakabu Sejahtera and its suppliers.

Then, the result will be discussed including the collaborative supply chain should be applied for the company and suppliers, the simulation will be conducted in Microsoft Excel and the scenario will be built which gives the optimum material quantity needed arrival of raw material.

## 3.10 Conclusion and Recommendation

In this part, there will be answers on the problems which have been formulated from some literature review in the beginning of the research. Besides, there also will be some recommendations that could be used and beneficial for the company and future research.

# CHAPTER IV

# DATA COLLECTING AND PROCESSING

## 4.1 Data Collection

### 4.1.1 Company Profile

This research was conducted at PT. Rakabu Sejahtera which is located in Solo, Central Java that produces bare core as the semi-finished product and furniture. The raw material for the bare core is Balken wood with varieties of size which will be made to specified size. Both of company's products, bare core and furniture, are being exported to several countries. The production in this company runs for 24 hours in 7 days a week, except national holiday, thus the company divides the employees to some work shifts. However, in this research, the production process of the bare core also being analyzed where the raw material is the Balken wood.

Since the collaboration concept is used as the focus of this research, hence, the research also conducted in PT. Rakabu Sejahtera's suppliers which are Supplier A, Supplier B, and UD. Trenggalek Lestari that located in East Java and Central Java. To be exact, supplier A is located in Kediri, East Java. Supplier B is located in Karanganyar, Central Java, while UD. Trenggalek Lestari is located in Trenggalek, East Java. However, UD Trenggalek Lestari also buys and supplies some of materials from others area such Kampak, Gandusari, and Malang. The distance from Supplier A to PT. Rakabu Sejahtera is approximately 230 km, the delivery time will take 6.5-7.5 hours. The distance from Supplier B to PT. Rakabu Sejahtera is approximately 65 km, thus the delivery time will take 1-2 hour. The distance from UD. Rakabu Sejahtera to PT. Rakabu Sejahtera is approximately 170 km, thus the delivery time will take 5-6 hour.

In current system, the suppliers supply Balken Wood almost every day for PT. Rakabu Sejahtera. However, these suppliers do not have their own warehouse. The supplier will cut down the trees after receiving order from the customer or manufacturer. Thus, after the wood is being cut down by the workers, then they will be sent directly to the customer of manufacturer. There is also a supplier that has a tier-supplier. When the supplier receive order from the manufacturer, then the supplier will order to their supplier which will deliver the Balken wood to the manufacturer directly.

### 4.1.2 Ordering System

The current ordering system in the supply chain of PT. Rakabu Sejahtera and its suppliers will start from the demand that arrived from PT. Rakabu Sejahtera's customers. When the demand from customer arrived, PT. Rakabu Sejahtera will conduct production planning in order to know the amount of material needed. After identifying the amount of material needed based on the expert's recommendation, PT. Rakabu Sejahtera will initiate a purchase order and deliver to its suppliers. While all of the suppliers conduct planning for the production amount, the suppliers receives the exact amount of order from PT. Rakabu Sejahtera. After identifying the amount of order, the suppliers will prepare the order of the wood. Instantly, the supplier will deliver the order to PT. Rakabu Sejahtera. The illustration of the current ordering system among PT. Rakabu Sejahtera and its suppliers can be seen in Figure 4.1 below:

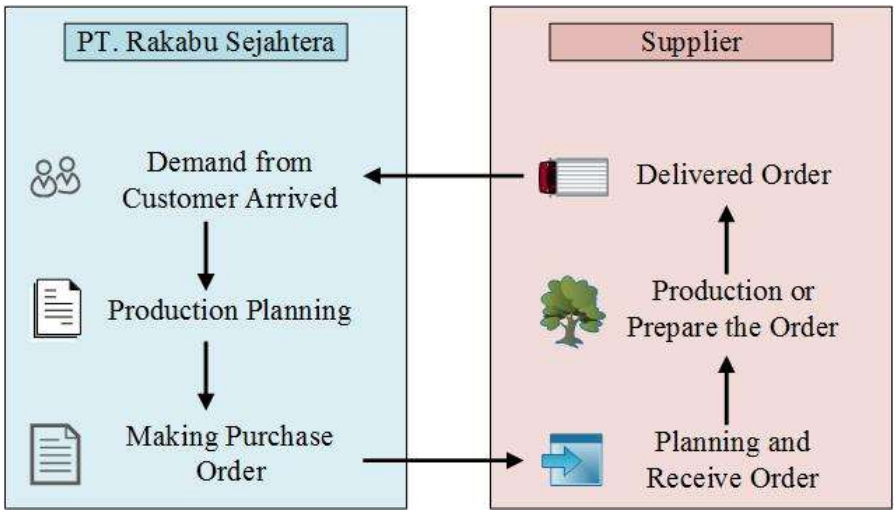



Figure 4.1 Current Ordering System of PT. Rakabu Sejahtera and Its Suppliers

### 4.1.3 Production Process

The products produced in PT. Rakabu Sejahtera are bare core and furniture. However, the raw material needed in the production process should pass the drying process. To make it clear, the production process of whole product in this company is illustrated in the Figure 4.2 below:

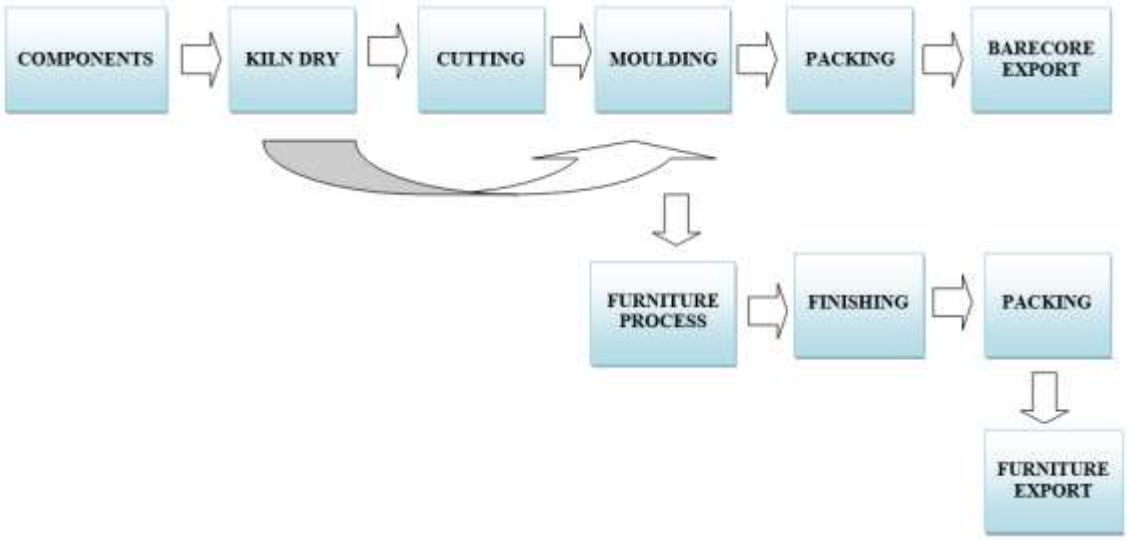



Figure 4.2 Whole Production Process in PT. Rakabu Sejahtera

The production process of bare core and furniture is starting from the arrival of the component or raw material which is Balken wood. Then, the Balken wood is being dried in the Kiln Dry room. After that, the wood is being cut and molded according to the specified size and standard of the company. Some of the bare cores will be packed to some container and being exported, while the other bare cores will be sent to furniture production department to be produced for some specific products such as table and chair. The products have to pass the finishing and packing process before being exported to other countries.

However, the focus of this research is the production of bare core. The production process of bare core can be seen in Figure 4.3 below:

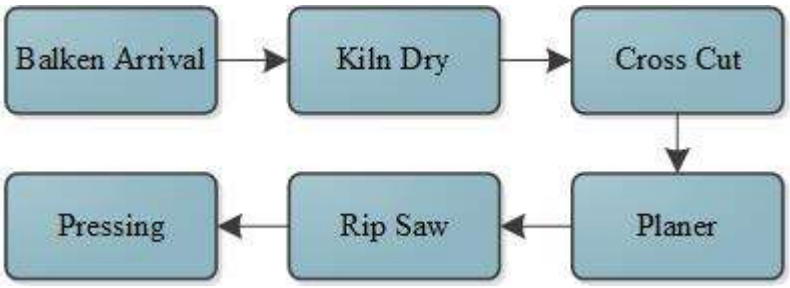



Figure 4.3 Bare core Production Process

### 4.1.4 Historical Data

After observing the condition in PT. Rakabu Sejahtera, there are several data collected in order to support the simulation. From the observation, it can be seen that the Balken wood from the supplier arrives almost every day. The Balken wood sent by the supplier is based on the order from the company. The data used for this research is in the data of November and Desember in 2016 which can be seen in Table 4.1 below:

Table 4.1 Historical Data of Balken Wood Arrival in November and December 2016

| Day | Date | Quantity (pieces) | Volume ($m^3$) |
|---|---|---|---|
| 1 | 11/1/2016 | 7,067 | 46.1665 |
| 2 | 11/2/2016 | 10,606 | 69.0971 |

| Day | Date | Quantity (pieces) | Volume ($m^3$) |
|---|---|---|---|
| 3 | 11/3/2016 | 10,673 | 73.3363 |
| 4 | 11/4/2016 | 35,438 | 217.3393 |
| 5 | 11/5/2016 | 15,644 | 102.4301 |
| 6 | 11/6/2016 | 9,306 | 62.1605 |
| 7 | 11/7/2016 | 21,301 | 137.0585 |
| 8 | 11/8/2016 | 13,068 | 87.1429 |
| 9 | 11/9/2016 | 14,244 | 95.1557 |
| 10 | 11/10/2016 | 6,069 | 37.5103 |
| 11 | 11/11/2016 | 22,096 | 143.3257 |
| 12 | 11/12/2016 | 24,139 | 151.6787 |
| 13 | 11/14/2016 | 17,204 | 115.1848 |
| 14 | 11/15/2016 | 18,090 | 118.5796 |
| 15 | 11/16/2016 | 14,441 | 94.7123 |
| 16 | 11/17/2016 | 14,938 | 101.5253 |
| 17 | 11/18/2016 | 22,884 | 149.3918 |
| 18 | 11/19/2016 | 14,043 | 94.8739 |
| 19 | 11/21/2016 | 23,798 | 160.6267 |
| 20 | 11/22/2016 | 29,126 | 178.5856 |
| 21 | 11/23/2016 | 16,510 | 105.9808 |
| 22 | 11/24/2016 | 17,777 | 120.2786 |
| 23 | 11/25/2016 | 38,812 | 245.3753 |
| 24 | 11/26/2016 | 23,787 | 142.7439 |
| 25 | 11/27/2016 | 13,798 | 87.4330 |
| 26 | 11/28/2016 | 4,986 | 34.1448 |
| 27 | 11/29/2016 | 24,161 | 160.8454 |
| 28 | 11/30/2016 | 40,637 | 279.0734 |
| 29 | 12/1/2016 | 28,524 | 176.9235 |
| 30 | 12/2/2016 | 27,817 | 183.1139 |
| 31 | 12/3/2016 | 28,684 | 181.5442 |
| 32 | 12/5/2016 | 27,702 | 183.4720 |
| 33 | 12/6/2016 | 26,402 | 168.9181 |
| 34 | 12/7/2016 | 22,475 | 151.7762 |
| 35 | 12/8/2016 | 29,528 | 197.6733 |
| 36 | 12/9/2016 | 26,987 | 183.7830 |
| 37 | 12/10/2016 | 33,648 | 214.9978 |
| 38 | 12/13/2016 | 32,223 | 224.9069 |
| 39 | 12/14/2016 | 19,317 | 133.3813 |
| 40 | 12/15/2016 | 33,030 | 219.5833 |
| 41 | 12/16/2016 | 42,067 | 269.4799 |

| Day | Date | Quantity (pieces) | Volume ($m^3$) |
|---|---|---|---|
| 42 | 12/17/2016 | 34,978 | 227.4208 |
| 43 | 12/18/2016 | 5,540 | 38.7812 |
| 44 | 12/19/2016 | 17,582 | 118.1793 |
| 45 | 12/20/2016 | 27,080 | 171.7670 |
| 46 | 12/21/2016 | 45,678 | 297.0852 |
| 47 | 12/22/2016 | 21,178 | 141.8491 |
| 48 | 12/23/2016 | 23,917 | 159.4689 |
| 49 | 12/24/2016 | 26,581 | 177.8134 |
| 50 | 12/25/2016 | 0 | 0 |
| 51 | 12/26/2016 | 1,721 | 13.6941 |
| 52 | 12/27/2016 | 33,293 | 226.3136 |
| 53 | 12/28/2016 | 14,437 | 100.2584 |
| 54 | 12/29/2016 | 43,967 | 287.4369 |
| 55 | 12/30/2016 | 5,666 | 41.5496 |
| 56 | 12/31/2016 | 0 | 0 |

Other than the historical data of Balken wood arrival, the data of demand during November and December in 2016 are also collected. In this research, researcher assumes the raw material that comes into the production process as the demand for the raw material. The historical data of demand in November and December in 2016 can be seen in Table 4.2 below:

Table 4.2 Historical Data of Demand in November and December 2016

| Day | Date | Demand (pieces) |
|---|---|---|
| 1 | 11/1/2016 | 16,158 |
| 2 | 11/2/2016 | 9,022 |
| 3 | 11/3/2016 | 9,501 |
| 4 | 11/4/2016 | 16,539 |
| 5 | 11/5/2016 | 12,902 |
| 6 | 11/6/2016 | 0 |
| 7 | 11/7/2016 | 17,012 |
| 8 | 11/8/2016 | 15,550 |
| 9 | 11/9/2016 | 17,591 |
| 10 | 11/10/2016 | 18,989 |
| 11 | 11/11/2016 | 22,025 |
| 12 | 11/12/2016 | 20,046 |

| Day | Date | Demand (pieces) |
|---|---|---|
| 13 | 11/14/2016 | 18,156 |
| 14 | 11/15/2016 | 26,350 |
| 15 | 11/16/2016 | 27,727 |
| 16 | 11/17/2016 | 21,732 |
| 17 | 11/18/2016 | 22,902 |
| 18 | 11/19/2016 | 16,388 |
| 19 | 11/21/2016 | 22,095 |
| 20 | 11/22/2016 | 27,113 |
| 21 | 11/23/2016 | 22,602 |
| 22 | 11/24/2016 | 22,878 |
| 23 | 11/25/2016 | 19,308 |
| 24 | 11/26/2016 | 26,220 |
| 25 | 11/27/2016 | 0 |
| 26 | 11/28/2016 | 22,484 |
| 27 | 11/29/2016 | 30,582 |
| 28 | 11/30/2016 | 23,702 |
| 29 | 12/1/2016 | 31,054 |
| 30 | 12/2/2016 | 28,465 |
| 31 | 12/3/2016 | 17,386 |
| 32 | 12/5/2016 | 24,829 |
| 33 | 12/6/2016 | 20,894 |
| 34 | 12/7/2016 | 27,325 |
| 35 | 12/8/2016 | 23,521 |
| 36 | 12/9/2016 | 27,954 |
| 37 | 12/10/2016 | 32,205 |
| 38 | 12/13/2016 | 9,374 |
| 39 | 12/14/2016 | 24,673 |
| 40 | 12/15/2016 | 22,127 |
| 41 | 12/16/2016 | 24,886 |
| 42 | 12/17/2016 | 7,028 |
| 43 | 12/18/2016 | 6,765 |
| 44 | 12/19/2016 | 28,666 |
| 45 | 12/20/2016 | 28,397 |
| 46 | 12/21/2016 | 27,283 |
| 47 | 12/22/2016 | 24,390 |
| 48 | 12/23/2016 | 20,919 |
| 49 | 12/24/2016 | 13,757 |
| 50 | 12/25/2016 | 14,891 |
| 51 | 12/26/2016 | 28,804 |

| Day | Date | Demand (pieces) |
|---|---|---|
| 52 | 12/27/2016 | 28,152 |
| 53 | 12/28/2016 | 24,312 |
| 54 | 12/29/2016 | 23,859 |
| 55 | 12/30/2016 | 25,600 |
| 56 | 12/31/2016 | 9,773 |

Meanwhile, the inventory level in November and December 2016 also can be seen in Table 4.3 below:

Table 4.3 Historical Data of Inventory Level in November and December 2016 of PT. Rakabu Sejahtera

| Day | Date | Quantity (pieces) | Volume ($m^3$) |
|---|---|---|---|
| 1 | 11/1/2016 | 386,172 | 2521.837 |
| 2 | 11/2/2016 | 377,081 | 2467.488 |
| 3 | 11/3/2016 | 378,665 | 2485.030 |
| 4 | 11/4/2016 | 379,837 | 2491.395 |
| 5 | 11/5/2016 | 398,736 | 2603.966 |
| 6 | 11/6/2016 | 401,478 | 2622.295 |
| 7 | 11/7/2016 | 410,784 | 2684.456 |
| 8 | 11/8/2016 | 415,073 | 2717.409 |
| 9 | 11/9/2016 | 412,591 | 2716.001 |
| 10 | 11/10/2016 | 409,244 | 2699.164 |
| 11 | 11/11/2016 | 396,324 | 2619.127 |
| 12 | 11/12/2016 | 396,395 | 2622.954 |
| 13 | 11/14/2016 | 400,488 | 2643.180 |
| 14 | 11/15/2016 | 399,536 | 2634.656 |
| 15 | 11/16/2016 | 391,276 | 2604.722 |
| 16 | 11/17/2016 | 377,990 | 2530.902 |
| 17 | 11/18/2016 | 371,196 | 2476.591 |
| 18 | 11/19/2016 | 371,178 | 2477.147 |
| 19 | 11/21/2016 | 368,833 | 2455.286 |
| 20 | 11/22/2016 | 370,536 | 2467.156 |
| 21 | 11/23/2016 | 372,549 | 2478.090 |
| 22 | 11/24/2016 | 366,457 | 2444.552 |
| 23 | 11/25/2016 | 361,356 | 2422.284 |
| 24 | 11/26/2016 | 380,860 | 2543.324 |
| 25 | 11/27/2016 | 378,427 | 2510.922 |
| 26 | 11/28/2016 | 392,225 | 2598.355 |

| Day | Date | Quantity (pieces) | Volume ($m^3$) |
|---|---|---|---|
| 27 | 11/29/2016 | 374,727 | 2486.324 |
| 28 | 11/30/2016 | 368,306 | 2448.659 |
| 29 | 12/1/2016 | 385,241 | 2579.210 |
| 30 | 12/2/2016 | 382,711 | 2555.730 |
| 31 | 12/3/2016 | 382,063 | 2556.345 |
| 32 | 12/5/2016 | 393,361 | 2613.329 |
| 33 | 12/6/2016 | 396,234 | 2638.443 |
| 34 | 12/7/2016 | 401,742 | 2669.965 |
| 35 | 12/8/2016 | 396,892 | 2651.647 |
| 36 | 12/9/2016 | 402,899 | 2694.337 |
| 37 | 12/10/2016 | 401,932 | 2705.527 |
| 38 | 12/13/2016 | 403,375 | 2718.124 |
| 39 | 12/14/2016 | 426,224 | 2884.591 |
| 40 | 12/15/2016 | 420,868 | 2846.694 |
| 41 | 12/16/2016 | 431,771 | 2918.631 |
| 42 | 12/17/2016 | 448,952 | 3038.079 |
| 43 | 12/18/2016 | 476,902 | 3224.293 |
| 44 | 12/19/2016 | 475,677 | 3222.362 |
| 45 | 12/20/2016 | 464,593 | 3142.779 |
| 46 | 12/21/2016 | 463,276 | 3128.208 |
| 47 | 12/22/2016 | 481,671 | 3239.754 |
| 48 | 12/23/2016 | 478,459 | 3222.896 |
| 49 | 12/24/2016 | 481,457 | 3235.950 |
| 50 | 12/25/2016 | 494,281 | 3323.719 |
| 51 | 12/26/2016 | 479,390 | 3222.482 |
| 52 | 12/27/2016 | 452,307 | 3058.267 |
| 53 | 12/28/2016 | 457,448 | 3102.333 |
| 54 | 12/29/2016 | 447,573 | 3044.174 |
| 55 | 12/30/2016 | 467,681 | 3173.112 |
| 56 | 12/31/2016 | 447,747 | 3049.516 |

From the table above, it can be seen that the inventory level in the company is quite high. This condition might give some impacts to the inventory cost of the company. Later, the costs information of manufacturer and suppliers can be seen in Table 4.4 and Table 4.5 below:

Table 4.4 Cost Information of PT. Rakabu Sejahtera

| Costing Activity | Cost | |
|---|---|---|
| Holding Cost /period | Rp | 7,000 |
| Shortage Cost /unit | Rp | 21,154 |

Table 4.5 Information of Suppliers of PT. Rakabu Sejahtera

| Description | Supplier A | Supplier B | UD. Trenggalek Lestari |
|---|---|---|---|
| Capacity per period | 35,000 pcs | 12,000 pcs | 20,000 pcs |
| Capacity per truck | 10,000 pcs | 2,100 pcs | 7,500 pcs |
| Production cost or Worker Salary (per unit) | Rp 900 | Rp 1,050 | Rp 2,000 |
| Delivering Cost (per order) | Rp 2,500,000 | Rp 750,000 | Rp 1,900,000 |
| Delivery Time | 6.5-7.5 hours | 1-2 hour | 5-6 hour |
| Distance | 230 km | 65 km | 170 km |

## 4.2 Vendor Managed Inventory (VMI) Implementation

In vendor managed inventory, suppliers as the vendor are allowed to access the manufacturer inventory condition by performing physical counts or using data. When the inventory level reaches the re-order point, the suppliers will deliver the material to PT. Rakabu Sejahtera. More over, the suppliers are also the one who determines the amount of material will be dispatched to PT. Rakabu Sejahtera to fulfill the customer demand based on the agreement of PT. Rakabu Sejahtera and its suppliers. Thus, information sharing as one of the alternatives in a collaborative supply chain is needed in implementing the vendor managed inventory.

Other than information sharing, the alternatives of a collaborative supply chain are decision synchronization, incentive alignment, resource and skill sharing, and knowledge management. In this research, the implementation of vendor managed inventory by considering information sharing and decision synchronization as two of the alternatives in a collaborative supply chain will be analyzed. The implementation of information sharing and decision synchronization will be simulated using Spreadsheet Simulation by considering the historical data from PT. Rakabu Sejahtera and its suppliers.

For the information sharing, PT. Rakabu Sejahtera could share all the information related to the customer demand and their inventory condition to the suppliers. Hence, the supplier can deliver the material with the quantity based on PT. Rakabu Sejahtera inventory condition. However, this condition might be efficient to be implemented if the PT. Rakabu Sejahtera and its supplier have a long-term relationship, trust, and commitment for each other in order to give benefit or win-win solution for both parties. Moreover, both of PT. Rakabu Sejahtera and its supplier could make policy for the inventory control. This condition leads to the implementation of decision synchronization for both of PT. Rakabu Sejahtera and its supplier. The decision synchronization for both parties could be making the procedures or agreement which give advantages for both parties.

By having a collaborative supply chain, both of manufacturer and suppliers can keep the products' costs to be low. Collaborative supply chain can lower the material purchasing costs, logistic costs, and manufacturing costs of PT. Rakabu Sejahtera and its suppliers. in brief, by having a collaborative supply chain, it could reduce the supply chain costs. By sharing their resources and capabilities, supply chain members can exploit profit-making opportunities that they cannot create alone. Other than that, vendor managed inventory implementation can reduce the lead time.

## 4.3 Data Processing

### 4.3.1 Distribution Fitting

The distribution fitting is used to identify the distribution pattern of demand's historical data. In this research, XLSTAT application is used to acknowledge the distribution of the demand's data. The importance of familiar with data distribution is to support in generating random number for the simulation. The distribution data that exist in Microsoft Excel are:

1. Uniform
2. Normal
3. Bernoulli
4. Binomial
5. Poisson
6. Patterned
7. Discrete

In order to know the distribution of the demand's data, a null hypothesis is used. For this simulation, the significance level (α) used is 0.05 This distribution fitting will be considered as the hypothesis:

H0 = The data follows normal distribution
H1 = The data does not follow normal distribution

For this condition, H0 is accepted if the p-value or $\alpha > 0.05$ and H1 is not accepted if the p-value or $\alpha < 0.05$. The result of distribution fitting using XLSTAT can be seen in Table 4.6 below:

Table 4.6 Distribution Fitting Result

| **Distribution** | **p-value** |
|---|---|
| Beta4 | 0.366 |
| Negative binomial (2) | < 0.0001 |
| Erlang | < 0.0001 |
| Exponential | < 0.0001 |
| Fisher-Tippett (1) | < 0.0001 |
| Fisher-Tippett (2) | 0.110 |
| GEV | 0.054 |
| Gumbel | < 0.0001 |
| Logistic | 0.202 |
| Normal | 0.260 |
| Normal (Standard) | < 0.0001 |
| Poisson | < 0.0001 |
| Student | < 0.0001 |

From the table above, it can be seen that there is some distributions that has p-value greater than 0.05. There are Beta Distribution with value of 0.366, Fisher-Tippett (2) with value of 0.110, Generalized Extreme Value (GEV) Distribution with value of 0.054, Logistic Distribution with value of 0.202, and Normal Distribution with the value of 0.260. The distribution from the highest p-value to the lowest which is greater than 0.05 respectively is Beta Distribution, Normal Distribution, Logistic Distribution, Fisher-Tippett (2) Distribution and GEV Distribution. However, Beta distribution is not available in Microsoft Excel. Thus, the normal distribution that will be choosen is the normal distribution with the value of 0.0260. From the XLSTAT result, the distribution of the data is shown in the Histogram of Figure 4.4 below:

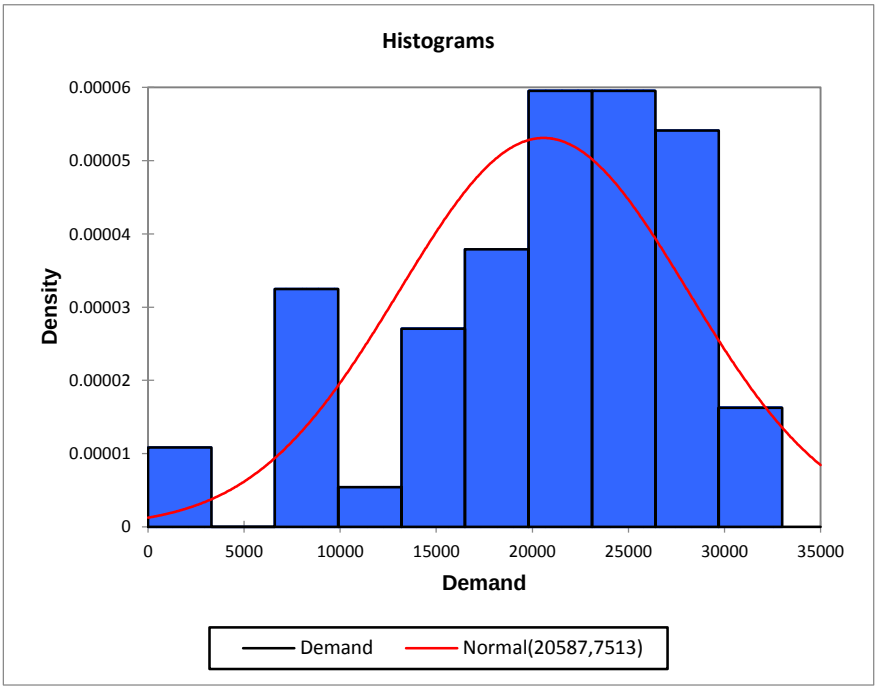



Figure 4.4 Histogram of Historical Data Distribution

The interval used for the histogram above is shown in Table 4.7 below:

Table 4.7 Interval of Data for Histogram

| Lower bound | Upper bound | Frequency | Relative frequency | Density (Data) | Density (Distribution) |
|---|---|---|---|---|---|
| 0 | 3300 | 2 | 0.036 | 0.000 | 0.008 |
| 3300 | 6600 | 0 | 0.000 | 0.000 | 0.021 |
| 6600 | 9900 | 6 | 0.107 | 0.000 | 0.046 |

| Lower bound | Upper bound | Frequency | Relative frequency | Density (Data) | Density (Distribution) |
|---|---|---|---|---|---|
| 9900 | 13200 | 1 | 0.018 | 0.000 | 0.085 |
| 13200 | 16500 | 5 | 0.089 | 0.000 | 0.130 |
| 16500 | 19800 | 7 | 0.125 | 0.000 | 0.165 |
| 19800 | 23100 | 11 | 0.196 | 0.000 | 0.173 |
| 23100 | 26400 | 11 | 0.196 | 0.000 | 0.149 |
| 26400 | 29700 | 10 | 0.179 | 0.000 | 0.107 |
| 29700 | 33000 | 3 | 0.054 | 0.000 | 0.063 |

### 4.3.2 Data Calculation

The first step before conducting simulation, is calculating the data needed as the input of the simulation. In this research, there are some data needed for the simulation for instance average demand, standard deviation, safety stock, reorder point, and costing activities. The average demand and standard deviation, will be derived from the XLSTAT result in Microsoft Excel. The result of XLSTAT for demand and standard deviation is shown in Table 4.8 below:

Table 4.8 Result of XLSTAT for Average Demand and Standard Deviation

| Variable | Obs. | Obs. with missing data | Obs. without missing data | Min | Max | Mean | Std. deviation |
|---|---|---|---|---|---|---|---|
| Demand | 56 | 0 | 56 | 0.000 | 32205 | 20586.839 | 7512.543 |

From the table above, it can be seen that by observing 56 data of demand, the minimum demand is 0 and max demand is 32,205 product. The mean or average demand is 20,586.839 and the standard deviation is 7,512.543.

Other than that, the safety stock and re-order point should be calculated. By using Equation (2.2), the safety stock level using the historical data with standard deviation (σ) is 7,512.543, service level (Z) is 99% which means the stock out probability is 0.01 or 1% with the z value for 99% is 2,33, and lead time after implementing vendor managed inventory become 1 day is:

$Safety\ Stock = Z\ x\ \sigma\ x\ \sqrt{l}$

= 2.33 x 7,512.543 x √1

= 17,505

From the calculation above, can be seen that the safety stock that will be used for the input of the simulation is 17,505 products. Besides, the formula for re-order point is as mentioned in Equation (2.3). To calculate the reorder point, average demand, lead time and safety stock level is already known. With the average demand (D) is 20,586.839, lead time after implementing vendor managed inventory could be reduced until (LT) is 1 day, and safety stock level (SS) is 17,505 products, the re-order point is:

$Reorder\ point = \bar{d}l + Z\sigma\sqrt{l}$

= 20,586.839 x 1 + 17,505

= 38,092

From the calculation above, can be seen that the re-order point is 38,092which mean that when the inventory level is reaching 38,092, the supplier should deliver ,material to the company. Other than that, there are some costs needed such as holding cost and shortage cost. These costs data are derived from the historical data after interviewing the experts from PT. Rakabu Sejahtera. The costs are shown in Table 4.9 below:

Table 4.9 Costing Activities Data for PT Rakabu Sejahtera

| **Costing Activity** | | **Cost** |
|---|---|---|
| Holding Cost | Rp | 7,000 |
| Shortage Cost | Rp | 21,154 |

Other than that, the cost and inventory level from the current system in PT. Ralabu Sejahtera has been calculated. The result of the current system for PT. Ralabu Sejahtera can be seen in Table 4.10 below:

Table 4.10 Current System for PT. Rakabu Sejahtera

| Day | Date | Initial Inventory (pcs) | Raw Material Arrival (pcs) | Demand (pcs) | Ending Inventory (pcs) | Holding Cost (Rp) |
|---|---|---|---|---|---|---|
| 1 | 11/1/2016 | 386,172 | 7,067 | 16,158 | 377,081 | 2,639,567,000 |
| 2 | 11/2/2016 | 377,081 | 10,606 | 9,022 | 378,665 | 2,650,655,000 |
| 3 | 11/3/2016 | 378,665 | 10,673 | 9,501 | 379,837 | 2,658,859,000 |
| 4 | 11/4/2016 | 379,837 | 35,438 | 16,539 | 398,736 | 2,791,152,000 |
| 5 | 11/5/2016 | 398,736 | 15,644 | 12,902 | 401,478 | 2,810,346,000 |
| 6 | 11/6/2016 | 401,478 | 9,306 | 0 | 410,784 | 2,875,488,000 |
| 7 | 11/7/2016 | 410,784 | 21,301 | 17,012 | 415,073 | 2,905,511,000 |
| 8 | 11/8/2016 | 415,073 | 13,068 | 15,550 | 412,591 | 2,888,137,000 |
| 9 | 11/9/2016 | 412,591 | 14,244 | 17,591 | 409,244 | 2,864,708,000 |
| 10 | 11/10/2016 | 409,244 | 6,069 | 18,989 | 396,324 | 2,774,268,000 |
| 11 | 11/11/2016 | 396,324 | 22,096 | 22,025 | 396,395 | 2,774,765,000 |
| 12 | 11/12/2016 | 396,395 | 24,139 | 20,046 | 400,488 | 2,803,416,000 |
| 13 | 11/14/2016 | 400,488 | 17,204 | 18,156 | 399,536 | 2,796,752,000 |
| 14 | 11/15/2016 | 399,536 | 18,090 | 26,350 | 391,276 | 2,738,932,000 |
| 15 | 11/16/2016 | 391,276 | 14,441 | 27,727 | 377,990 | 2,645,930,000 |
| 16 | 11/17/2016 | 377,990 | 14,938 | 21,732 | 371,196 | 2,598,372,000 |
| 17 | 11/18/2016 | 371,196 | 22,884 | 22,902 | 371,178 | 2,598,246,000 |
| 18 | 11/19/2016 | 371,178 | 14,043 | 16,388 | 368,833 | 2,581,831,000 |

| Day | Date | Initial Inventory (pcs) | Raw Material Arrival (pcs) | Demand (pcs) | Ending Inventory (pcs) | Holding Cost (Rp) |
|---|---|---|---|---|---|---|
| 19 | 11/21/2016 | 368,833 | 23,798 | 22,095 | 370,536 | 2,593,752,000 |
| 20 | 11/22/2016 | 370,536 | 29,126 | 27,113 | 372,549 | 2,607,843,000 |
| 21 | 11/23/2016 | 372,549 | 16,510 | 22,602 | 366,457 | 2,565,199,000 |
| 22 | 11/24/2016 | 366,457 | 17,777 | 22,878 | 361,356 | 2,529,492,000 |
| 23 | 11/25/2016 | 361,356 | 38,812 | 19,308 | 380,860 | 2,666,020,000 |
| 24 | 11/26/2016 | 380,860 | 23,787 | 26,220 | 378,427 | 2,648,989,000 |
| 25 | 11/27/2016 | 378,427 | 13,798 | 0 | 392,225 | 2,745,575,000 |
| 26 | 11/28/2016 | 392,225 | 4,986 | 22,484 | 374,727 | 2,623,089,000 |
| 27 | 11/29/2016 | 374,727 | 24,161 | 30,582 | 368,306 | 2,578,142,000 |
| 28 | 11/30/2016 | 368,306 | 40,637 | 23,702 | 385,241 | 2,696,687,000 |
| 29 | 12/1/2016 | 385,241 | 28,524 | 31,054 | 382,711 | 2,678,977,000 |
| 30 | 12/2/2016 | 382,711 | 27,817 | 28,465 | 382,063 | 2,674,441,000 |
| 31 | 12/3/2016 | 382,063 | 28,684 | 17,386 | 393,361 | 2,753,527,000 |
| 32 | 12/5/2016 | 393,361 | 27,702 | 24,829 | 396,234 | 2,773,638,000 |
| 33 | 12/6/2016 | 396,234 | 26,402 | 20,894 | 401,742 | 2,812,194,000 |
| 34 | 12/7/2016 | 401,742 | 22,475 | 27,325 | 396,892 | 2,778,244,000 |
| 35 | 12/8/2016 | 396,892 | 29,528 | 23,521 | 402,899 | 2,820,293,000 |
| 36 | 12/9/2016 | 402,899 | 26,987 | 27,954 | 401,932 | 2,813,524,000 |
| 37 | 12/10/2016 | 401,932 | 33,648 | 32,205 | 403,375 | 2,823,625,000 |
| 38 | 12/13/2016 | 403,375 | 32,223 | 9,374 | 426,224 | 2,983,568,000 |
| 39 | 12/14/2016 | 426,224 | 19,317 | 24,673 | 420,868 | 2,946,076,000 |
| 40 | 12/15/2016 | 420,868 | 33,030 | 22,127 | 431,771 | 3,022,397,000 |
| 41 | 12/16/2016 | 431,771 | 42,067 | 24,886 | 448,952 | 3,142,664,000 |
| 42 | 12/17/2016 | 448,952 | 34,978 | 7,028 | 476,902 | 3,338,314,000 |
| 43 | 12/18/2016 | 476,902 | 5,540 | 6,765 | 475,677 | 3,329,739,000 |

| Day | Date | Initial Inventory (pcs) | Raw Material Arrival (pcs) | Demand (pcs) | Ending Inventory (pcs) | Holding Cost (Rp) |
|---|---|---|---|---|---|---|
| 44 | 12/19/2016 | 475,677 | 17,582 | 28,666 | 464,593 | 3,252,151,000 |
| 45 | 12/20/2016 | 464,593 | 27,080 | 28,397 | 463,276 | 3,242,932,000 |
| 46 | 12/21/2016 | 463,276 | 45,678 | 27,283 | 481,671 | 3,371,697,000 |
| 47 | 12/22/2016 | 481,671 | 21,178 | 24,390 | 478,459 | 3,349,213,000 |
| 48 | 12/23/2016 | 478,459 | 23,917 | 20,919 | 481,457 | 3,370,199,000 |
| 49 | 12/24/2016 | 481,457 | 26,581 | 13,757 | 494,281 | 3,459,967,000 |
| 50 | 12/25/2016 | 494,281 | 0 | 14,891 | 479,390 | 3,355,730,000 |
| 51 | 12/26/2016 | 479,390 | 1,721 | 28,804 | 452,307 | 3,166,149,000 |
| 52 | 12/27/2016 | 452,307 | 33,293 | 28,152 | 457,448 | 3,202,136,000 |
| 53 | 12/28/2016 | 457,448 | 14,437 | 24,312 | 447,573 | 3,133,011,000 |
| 54 | 12/29/2016 | 447,573 | 43,967 | 23,859 | 467,681 | 3,273,767,000 |
| 55 | 12/30/2016 | 467,681 | 5,666 | 25,600 | 447,747 | 3,134,229,000 |
| 56 | 12/31/2016 | 447,747 | 0 | 9,773 | 437,974 | 3,065,818,000 |

From the table above, it can be seen the holding cost of material in warehouse of PT. Rakabu Sejahtera. The holding cost includes the maintenance cost, salary for workers, and building cost. However, there is no shortage happened in this current system. Thus, the average inventory cost of PT. Rakabu Sejahtera has been calculated. For this current system, the average holding cost is Rp 2,887,856,125.

Besides, there are some cost needed for the suppliers such as production cost and delivery cost. These cost data is obtained from the historical data after interviewing the expert from suppliers of PT. Rakabu Sejahtera. The costs is shown in Table 4.11 below:

Table 4.11 Costing Activities Data for suppliers of PT Rakabu Sejahtera

| **Costing Activity** | **Supplier A** | **Supplier B** | **UD. Trenggalek Lestari** |
|---|---|---|---|
| Production/Worker Salary (per unit) | Rp 900 | Rp 1,050 | Rp 2,000 |
| Delivering Cost (per truck) | Rp 2,500,000 | Rp 750,000 | Rp 1,900,000 |

The costing activities, including production cost which is consist of salary for workers, purchasing and delivery cost, from the supplier's current system also have been calculated. The result of the current system can be seen in Table 4.12 below:

Table 4.12 Current System for suppliers of PT. Rakabu Sejahtera

| Date | Material Delivered | | Supplier Name | Number of Truck | Cost | | |
|---|---|---|---|---|---|---|---|
| | Quantity (pcs) | Volume ($m^3$) | | | Production Cost | Delivery Cost | Total Cost |
| 11/1/2016 | 5,363 | 33.2507 | Supplier A | 1 | Rp 4,826,700 | Rp 2,500,000 | Rp 7,326,700 |
| | 1,704 | 12.9158 | Supplier B | 1 | Rp 1,789,200 | Rp 750,000 | Rp 2,539,200 |
| 11/2/2016 | 10,606 | 69.0971 | Supplier A | 2 | Rp 9,545,400 | Rp 5,000,000 | Rp 14,545,400 |
| 11/3/2016 | 5,113 | 34.3419 | Supplier A | 1 | Rp 4,601,700 | Rp 2,500,000 | Rp 7,101,700 |
| | 5,560 | 38.9944 | Supplier B | 3 | Rp 5,838,000 | Rp 2,250,000 | Rp 8,088,000 |
| 11/4/2016 | 20,150 | 125.916165 | Supplier A | 4 | Rp 18,135,000 | Rp 10,000,000 | Rp 28,135,000 |
| | 15,288 | 91.4231 | UD. Trenggalek Lestari | 5 | Rp 30,576,000 | Rp 9,500,000 | Rp 40,076,000 |
| 11/5/2016 | 10,519 | 67.0372 | Supplier A | 2 | Rp 9,467,100 | Rp 5,000,000 | Rp 14,467,100 |
| | 5,125 | 35.3930 | UD. Trenggalek Lestari | 1 | Rp 10,250,000 | Rp 1,900,000 | Rp 12,150,000 |
| 11/6/2016 | 5,361 | 33.6513 | Supplier A | 1 | Rp 4,824,900 | Rp 2,500,000 | Rp 7,324,900 |
| | 3,945 | 28.5092 | UD. Trenggalek Lestari | 1 | Rp 7,890,000 | Rp 1,900,000 | Rp 9,790,000 |
| 11/7/2016 | 16,861 | 108.4186 | Supplier A | 3 | Rp 15,174,900 | Rp 7,500,000 | Rp 22,674,900 |
| | 4,440 | 28.6400 | UD. Trenggalek Lestari | 1 | Rp 8,880,000 | Rp 1,900,000 | Rp 10,780,000 |
| 11/8/2016 | 10,721 | 71.5422 | Supplier A | 2 | Rp 9,648,900 | Rp 5,000,000 | Rp 14,648,900 |
| | 2,347 | 15.6007 | UD. Trenggalek Lestari | 1 | Rp 4,694,000 | Rp 1,900,000 | Rp 6,594,000 |
| 11/9/2016 | 10,377 | 69.0221 | Supplier A | 2 | Rp 9,339,300 | Rp 5,000,000 | Rp 14,339,300 |
| | 1,836 | 13.9238 | Supplier B | 1 | Rp 1,927,800 | Rp 750,000 | Rp 2,677,800 |
| | 2,031 | 12.2098 | UD. Trenggalek Lestari | 1 | Rp 4,062,000 | Rp 1,900,000 | Rp 5,962,000 |
| 11/10/2016 | 6,069 | 37.5103 | Supplier A | 1 | Rp 5,462,100 | Rp 2,500,000 | Rp 7,962,100 |
| 11/11/2016 | 17,078 | 113.9578 | Supplier A | 3 | Rp 15,370,200 | Rp 7,500,000 | Rp 22,870,200 |
| | 5,018 | 29.3679 | UD. Trenggalek Lestari | 2 | Rp 10,036,000 | Rp 3,800,000 | Rp 13,836,000 |
| 11/12/2016 | 11,852 | 77.29438 | Supplier A | 2 | Rp 10,666,800 | Rp 5,000,000 | Rp 15,666,800 |

| Date | Material Delivered | | Supplier Name | Number of Truck | Cost | | |
|---|---|---|---|---|---|---|---|
| | Quantity (pcs) | Volume ($m^3$) | | | Production Cost | Delivery Cost | Total Cost |
| | 2,142 | 15.3261 | Supplier B | 1 | Rp 2,249,100 | Rp 750,000 | Rp 2,999,100 |
| | 10,145 | 59.058195 | UD. Trenggalek Lestari | 2 | Rp 20,290,000 | Rp 3,800,000 | Rp 24,090,000 |
| 11/14/2016 | 11,132 | 72.440765 | Supplier A | 2 | Rp 10,018,800 | Rp 5,000,000 | Rp 15,018,800 |
| | 1,767 | 13.4469 | Supplier B | 1 | Rp 1,855,350 | Rp 750,000 | Rp 2,605,350 |
| | 4,305 | 29.29719 | UD. Trenggalek Lestari | 2 | Rp 8,610,000 | Rp 3,800,000 | Rp 12,410,000 |
| 11/15/2016 | 11,841 | 76.99875 | Supplier A | 2 | Rp 10,656,900 | Rp 5,000,000 | Rp 15,656,900 |
| | 6,249 | 41.5808 | UD. Trenggalek Lestari | 2 | Rp 12,498,000 | Rp 3,800,000 | Rp 16,298,000 |
| 11/16/2016 | 14,441 | 94.7123 | Supplier A | 2 | Rp 12,996,900 | Rp 5,000,000 | Rp 17,996,900 |
| 11/17/2016 | 5,514 | 34.7820 | Supplier A | 1 | Rp 4,962,600 | Rp 2,500,000 | Rp 7,462,600 |
| | 1,956 | 14.7587 | Supplier B | 1 | Rp 2,053,800 | Rp 750,000 | Rp 2,803,800 |
| | 7,468 | 51.98464 | UD. Trenggalek Lestari | 3 | Rp 14,936,000 | Rp 5,700,000 | Rp 20,636,000 |
| 11/18/2016 | 22,884 | 149.3918 | Supplier A | 4 | Rp 20,595,600 | Rp 10,000,000 | Rp 30,595,600 |
| 11/19/2016 | 11,826 | 79.665105 | Supplier A | 2 | Rp 10,643,400 | Rp 5,000,000 | Rp 15,643,400 |
| | 2,217 | 15.2088 | UD. Trenggalek Lestari | 1 | Rp 4,434,000 | Rp 1,900,000 | Rp 6,334,000 |
| 11/21/2016 | 1,958 | 15.0285 | Supplier B | 1 | Rp 2,055,900 | Rp 750,000 | Rp 2,805,900 |
| | 5,985 | 40.4512 | Supplier A | 1 | Rp 5,386,500 | Rp 2,500,000 | Rp 7,886,500 |
| | 15,855 | 105.146985 | UD. Trenggalek Lestari | 4 | Rp 31,710,000 | Rp 7,600,000 | Rp 39,310,000 |
| 11/22/2016 | 11,502 | 76.62506 | Supplier A | 2 | Rp 10,351,800 | Rp 5,000,000 | Rp 15,351,800 |
| | 17,624 | 101.960525 | UD. Trenggalek Lestari | 4 | Rp 35,248,000 | Rp 7,600,000 | Rp 42,848,000 |
| 11/23/2016 | 16,510 | 105.980845 | Supplier A | 3 | Rp 14,859,000 | Rp 7,500,000 | Rp 22,359,000 |
| 11/24/2016 | 15,829 | 105.8727 | Supplier A | 3 | Rp 14,246,100 | Rp 7,500,000 | Rp 21,746,100 |
| | 1,948 | 14.4059 | Supplier B | 1 | Rp 2,045,400 | Rp 750,000 | Rp 2,795,400 |

| Date | Material Delivered | | Supplier Name | Number of Truck | Cost | | |
|---|---|---|---|---|---|---|---|
| | Quantity (pcs) | Volume ($m^3$) | | | Production Cost | Delivery Cost | Total Cost |
| 11/25/2016 | 20,634 | 136.36757 | Supplier A | 4 | Rp 18,570,600 | Rp 10,000,000 | Rp 28,570,600 |
| | 1,865 | 15.0322 | Supplier B | 1 | Rp 1,958,250 | Rp 750,000 | Rp 2,708,250 |
| | 16,313 | 93.975545 | UD. Trenggalek Lestari | 4 | Rp 32,626,000 | Rp 7,600,000 | Rp 40,226,000 |
| 11/26/2016 | 11,837 | 78.2097 | Supplier A | 2 | Rp 10,653,300 | Rp 5,000,000 | Rp 15,653,300 |
| | 11,950 | 64.534225 | UD. Trenggalek Lestari | 2 | Rp 23,900,000 | Rp 3,800,000 | Rp 27,700,000 |
| 11/27/2016 | 11,647 | 73.129195 | Supplier A | 2 | Rp 10,482,300 | Rp 5,000,000 | Rp 15,482,300 |
| | 2,151 | 14.3038 | UD. Trenggalek Lestari | 1 | Rp 4,302,000 | Rp 1,900,000 | Rp 6,202,000 |
| 11/28/2016 | 4,986 | 34.1448 | Supplier A | 1 | Rp 4,487,400 | Rp 2,500,000 | Rp 6,987,400 |
| 11/29/2016 | 15,368 | 101.476755 | Supplier A | 3 | Rp 13,831,200 | Rp 7,500,000 | Rp 21,331,200 |
| | 8,793 | 59.368615 | UD. Trenggalek Lestari | 2 | Rp 17,586,000 | Rp 3,800,000 | Rp 21,386,000 |
| 11/30/2016 | 15,795 | 102.790445 | Supplier A | 3 | Rp 14,215,500 | Rp 7,500,000 | Rp 21,715,500 |
| | 11,507 | 87.29381 | Supplier B | 7 | Rp 12,082,350 | Rp 5,250,000 | Rp 17,332,350 |
| | 13,335 | 88.989185 | UD. Trenggalek Lestari | 4 | Rp 26,670,000 | Rp 7,600,000 | Rp 34,270,000 |
| 12/1/2016 | 15,298 | 102.88981 | Supplier A | 3 | Rp 13,768,200 | Rp 7,500,000 | Rp 21,268,200 |
| | 13,226 | 74.033665 | UD. Trenggalek Lestari | 3 | Rp 26,452,000 | Rp 5,700,000 | Rp 32,152,000 |
| 12/2/2016 | 18,153 | 116.646335 | Supplier A | 3 | Rp 16,337,700 | Rp 7,500,000 | Rp 23,837,700 |
| | 3,237 | 25.21562 | Supplier B | 2 | Rp 3,398,850 | Rp 1,500,000 | Rp 4,898,850 |
| | 6,427 | 41.25192 | UD. Trenggalek Lestari | 3 | Rp 12,854,000 | Rp 5,700,000 | Rp 18,554,000 |
| 12/3/2016 | 16,175 | 104.300925 | Supplier A | 3 | Rp 14,557,500 | Rp 7,500,000 | Rp 22,057,500 |
| | 5,455 | 40.248875 | Supplier B | 3 | Rp 5,727,750 | Rp 2,250,000 | Rp 7,977,750 |
| | 7,054 | 36.9944 | UD. Trenggalek Lestari | 1 | Rp 14,108,000 | Rp 1,900,000 | Rp 16,008,000 |
| 12/5/2016 | 16,259 | 106.11334 | Supplier A | 3 | Rp 14,633,100 | Rp 7,500,000 | Rp 22,133,100 |

| Date | Material Delivered | | Supplier Name | Number of Truck | Cost | | |
|---|---|---|---|---|---|---|---|
| | Quantity (pcs) | Volume ($m^3$) | | | Production Cost | Delivery Cost | Total Cost |
| | 3,423 | 24.351625 | Supplier B | 2 | Rp 3,594,150 | Rp 1,500,000 | Rp 5,094,150 |
| | 8,020 | 53.00703 | UD. Trenggalek Lestari | 3 | Rp 16,040,000 | Rp 5,700,000 | Rp 21,740,000 |
| 12/6/2016 | 17,788 | 115.81851 | Supplier A | 3 | Rp 16,009,200 | Rp 7,500,000 | Rp 23,509,200 |
| | 5,566 | 39.56537 | Supplier B | 3 | Rp 5,844,300 | Rp 2,250,000 | Rp 8,094,300 |
| | 3,048 | 13.5343 | UD. Trenggalek Lestari | 1 | Rp 6,096,000 | Rp 1,900,000 | Rp 7,996,000 |
| 12/7/2016 | 10,821 | 68.98579 | Supplier A | 2 | Rp 9,738,900 | Rp 5,000,000 | Rp 14,738,900 |
| | 7,384 | 53.523275 | Supplier B | 4 | Rp 7,753,200 | Rp 3,000,000 | Rp 10,753,200 |
| | 4,270 | 29.2672 | UD. Trenggalek Lestari | 1 | Rp 8,540,000 | Rp 1,900,000 | Rp 10,440,000 |
| 12/8/2016 | 25,288 | 170.175045 | Supplier A | 4 | Rp 22,759,200 | Rp 10,000,000 | Rp 32,759,200 |
| | 4,240 | 27.498205 | UD. Trenggalek Lestari | 2 | Rp 8,480,000 | Rp 3,800,000 | Rp 12,280,000 |
| 12/9/2016 | 18,028 | 118.164335 | Supplier A | 3 | Rp 16,225,200 | Rp 7,500,000 | Rp 23,725,200 |
| | 6,980 | 52.21595 | Supplier B | 4 | Rp 7,329,000 | Rp 3,000,000 | Rp 10,329,000 |
| | 1,979 | 13.4027 | UD. Trenggalek Lestari | 1 | Rp 3,958,000 | Rp 1,900,000 | Rp 5,858,000 |
| 12/10/2016 | 15,847 | 107.11168 | Supplier A | 3 | Rp 14,262,300 | Rp 7,500,000 | Rp 21,762,300 |
| | 1,754 | 13.4922 | Supplier B | 1 | Rp 1,841,700 | Rp 750,000 | Rp 2,591,700 |
| | 16,047 | 94.39387 | UD. Trenggalek Lestari | 3 | Rp 32,094,000 | Rp 5,700,000 | Rp 37,794,000 |
| 12/13/2016 | 21,478 | 143.33194 | Supplier A | 4 | Rp 19,330,200 | Rp 10,000,000 | Rp 29,330,200 |
| | 10,745 | 81.574925 | Supplier B | 6 | Rp 11,282,250 | Rp 4,500,000 | Rp 15,782,250 |
| 12/14/2016 | 11,869 | 78.556585 | Supplier A | 2 | Rp 10,682,100 | Rp 5,000,000 | Rp 15,682,100 |
| | 7,448 | 54.824665 | Supplier B | 4 | Rp 7,820,400 | Rp 3,000,000 | Rp 10,820,400 |
| 12/15/2016 | 22,635 | 147.787345 | Supplier A | 4 | Rp 20,371,500 | Rp 10,000,000 | Rp 30,371,500 |
| | 5,596 | 41.03251 | Supplier B | 3 | Rp 5,875,800 | Rp 2,250,000 | Rp 8,125,800 |

| Date | Material Delivered | | Supplier Name | Number of Truck | Cost | | |
|---|---|---|---|---|---|---|---|
| | Quantity (pcs) | Volume ($m^3$) | | | Production Cost | Delivery Cost | Total Cost |
| | 4,799 | 30.7634 | UD. Trenggalek Lestari | 1 | Rp 9,598,000 | Rp 1,900,000 | Rp 11,498,000 |
| 12/16/2016 | 28,408 | 184.023635 | Supplier A | 5 | Rp 25,567,200 | Rp 12,500,000 | Rp 38,067,200 |
| | 5,568 | 41.627745 | Supplier B | 3 | Rp 5,846,400 | Rp 2,250,000 | Rp 8,096,400 |
| | 8,091 | 43.82851 | UD. Trenggalek Lestari | 2 | Rp 16,182,000 | Rp 3,800,000 | Rp 19,982,000 |
| 12/17/2016 | 10,293 | 67.800595 | Supplier A | 2 | Rp 9,263,700 | Rp 5,000,000 | Rp 14,263,700 |
| | 5,770 | 40.471325 | Supplier B | 3 | Rp 6,058,500 | Rp 2,250,000 | Rp 8,308,500 |
| | 18,915 | 119.14887 | UD. Trenggalek Lestari | 5 | Rp 37,830,000 | Rp 9,500,000 | Rp 47,330,000 |
| 12/18/2016 | 5,540 | 38.7812 | Supplier A | 1 | Rp 4,986,000 | Rp 2,500,000 | Rp 7,486,000 |
| 12/19/2016 | 5,243 | 33.5861 | Supplier A | 1 | Rp 4,718,700 | Rp 2,500,000 | Rp 7,218,700 |
| | 7,669 | 54.63218 | Supplier B | 4 | Rp 8,052,450 | Rp 3,000,000 | Rp 11,052,450 |
| | 4,670 | 29.9610 | UD. Trenggalek Lestari | 1 | Rp 9,340,000 | Rp 1,900,000 | Rp 11,240,000 |
| 12/20/2016 | 10,311 | 68.159105 | Supplier A | 2 | Rp 9,279,900 | Rp 5,000,000 | Rp 14,279,900 |
| | 3,756 | 27.46348 | Supplier B | 2 | Rp 3,943,800 | Rp 1,500,000 | Rp 5,443,800 |
| | 13,013 | 76.144435 | UD. Trenggalek Lestari | 4 | Rp 26,026,000 | Rp 7,600,000 | Rp 33,626,000 |
| 12/21/2016 | 22,552 | 146.481365 | Supplier A | 3 | Rp 20,296,800 | Rp 7,500,000 | Rp 27,796,800 |
| | 7,355 | 55.734795 | Supplier B | 4 | Rp 7,722,750 | Rp 3,000,000 | Rp 10,722,750 |
| | 15,771 | 94.869045 | UD. Trenggalek Lestari | 3 | Rp 31,542,000 | Rp 5,700,000 | Rp 37,242,000 |
| 12/22/2016 | 17,559 | 114.97634 | Supplier A | 3 | Rp 15,803,100 | Rp 7,500,000 | Rp 23,303,100 |
| | 3,619 | 26.87275 | Supplier B | 2 | Rp 3,799,950 | Rp 1,500,000 | Rp 5,299,950 |
| 12/23/2016 | 17,853 | 115.11071 | Supplier A | 3 | Rp 16,067,700 | Rp 7,500,000 | Rp 23,567,700 |
| | 1,667 | 12.8592 | Supplier B | 1 | Rp 1,750,350 | Rp 750,000 | Rp 2,500,350 |
| | 4,397 | 31.4989 | UD. Trenggalek Lestari | 1 | Rp 8,794,000 | Rp 1,900,000 | Rp 10,694,000 |

| Date | Material Delivered | | Supplier Name | Number of Truck | Cost | | |
|---|---|---|---|---|---|---|---|
| | Quantity (pcs) | Volume ($m^3$) | | | Production Cost | Delivery Cost | Total Cost |
| 12/24/2016 | 16,841 | 107.68981 | Supplier A | 3 | Rp 15,156,900 | Rp 7,500,000 | Rp 22,656,900 |
| | 5,587 | 41.16939 | Supplier B | 3 | Rp 5,866,350 | Rp 2,250,000 | Rp 8,116,350 |
| | 4,153 | 28.95418 | UD. Trenggalek Lestari | 2 | Rp 8,306,000 | Rp 3,800,000 | Rp 12,106,000 |
| 12/26/2016 | 1,721 | 13.6941 | Supplier B | 1 | Rp 1,807,050 | Rp 750,000 | Rp 2,557,050 |
| 12/27/2016 | 20,943 | 140.42405 | Supplier A | 4 | Rp 18,848,700 | Rp 10,000,000 | Rp 28,848,700 |
| | 3,482 | 26.93497 | Supplier B | 2 | Rp 3,656,100 | Rp 1,500,000 | Rp 5,156,100 |
| | 8,868 | 58.95462 | UD. Trenggalek Lestari | 2 | Rp 17,736,000 | Rp 3,800,000 | Rp 21,536,000 |
| 12/28/2016 | 10,876 | 72.730385 | Supplier A | 2 | Rp 9,788,400 | Rp 5,000,000 | Rp 14,788,400 |
| | 3,561 | 27.528025 | Supplier B | 2 | Rp 3,739,050 | Rp 1,500,000 | Rp 5,239,050 |
| 12/29/2016 | 32,388 | 210.4425 | Supplier A | 6 | Rp 29,149,200 | Rp 15,000,000 | Rp 44,149,200 |
| | 5,426 | 41.997345 | Supplier B | 3 | Rp 5,697,300 | Rp 2,250,000 | Rp 7,947,300 |
| | 6,153 | 34.9971 | UD. Trenggalek Lestari | 1 | Rp 12,306,000 | Rp 1,900,000 | Rp 14,206,000 |
| 12/30/2016 | 1,804 | 13.3826 | Supplier B | 1 | Rp 1,894,200 | Rp 750,000 | Rp 2,644,200 |
| | 3,862 | 28.1670 | UD. Trenggalek Lestari | 1 | Rp 7,724,000 | Rp 1,900,000 | Rp 9,624,000 |

From the table above, it can be seen that the total cost is obtained from production cost and delivery cost. The production cost includes the salary for workers for cutting down the tree, loading cost, and materials' purchasing. While delivery cost includes the drivers' fee, unloading cost, and fuel cost. However, the suppliers do not have their own warehouse, thus there is no holding cost of material needed for the suppliers. The average cost for suppliers of PT. Rakabu Sejahtera has been calculated. For this current system, the average cost is Rp 16,143,215.

From Table 4.10 and Table 4.12, the supply chain cost of PT. Rakabu Sejahtera and its suppliers can be calculated. The supply chain cost for this current system can be seen in Table 4.13 below:

Table 4.13 Total Supply Chain Cost for Current System

| Day | Date | PT. Rakabu Sejahtera Costs (Rp) | Supplier Costs (Rp) | Total Supply Chain Cost (Rp) |
|---|---|---|---|---|
| 1 | 11/1/2016 | 2,639,567,000 | 9,865,900 | 2,649,432,900 |
| 2 | 11/2/2016 | 2,650,655,000 | 14,545,400 | 2,665,200,400 |
| 3 | 11/3/2016 | 2,658,859,000 | 15,189,700 | 2,674,048,700 |
| 4 | 11/4/2016 | 2,791,152,000 | 68,211,000 | 2,859,363,000 |
| 5 | 11/5/2016 | 2,810,346,000 | 26,617,100 | 2,836,963,100 |
| 6 | 11/6/2016 | 2,875,488,000 | 17,114,900 | 2,892,602,900 |
| 7 | 11/7/2016 | 2,905,511,000 | 33,454,900 | 2,938,965,900 |
| 8 | 11/8/2016 | 2,888,137,000 | 21,242,900 | 2,909,379,900 |
| 9 | 11/9/2016 | 2,864,708,000 | 22,979,100 | 2,887,687,100 |
| 10 | 11/10/2016 | 2,774,268,000 | 7,962,100 | 2,782,230,100 |
| 11 | 11/11/2016 | 2,774,765,000 | 36,706,200 | 2,811,471,200 |
| 12 | 11/12/2016 | 2,803,416,000 | 42,755,900 | 2,846,171,900 |
| 13 | 11/14/2016 | 2,796,752,000 | 30,034,150 | 2,826,786,150 |
| 14 | 11/15/2016 | 2,738,932,000 | 31,954,900 | 2,770,886,900 |
| 15 | 11/16/2016 | 2,645,930,000 | 17,996,900 | 2,663,926,900 |
| 16 | 11/17/2016 | 2,598,372,000 | 30,902,400 | 2,629,274,400 |
| 17 | 11/18/2016 | 2,598,246,000 | 30,595,600 | 2,628,841,600 |
| 18 | 11/19/2016 | 2,581,831,000 | 21,977,400 | 2,603,808,400 |
| 19 | 11/21/2016 | 2,593,752,000 | 50,002,400 | 2,643,754,400 |
| 20 | 11/22/2016 | 2,607,843,000 | 58,199,800 | 2,666,042,800 |
| 21 | 11/23/2016 | 2,565,199,000 | 22,359,000 | 2,587,558,000 |

| Day | Date | PT. Rakabu Sejahtera Costs (Rp) | Supplier Costs (Rp) | Total Supply Chain Cost (Rp) |
|---|---|---|---|---|
| 22 | 11/24/2016 | 2,529,492,000 | 24,541,500 | 2,554,033,500 |
| 23 | 11/25/2016 | 2,666,020,000 | 71,504,850 | 2,737,524,850 |
| 24 | 11/26/2016 | 2,648,989,000 | 43,353,300 | 2,692,342,300 |
| 25 | 11/27/2016 | 2,745,575,000 | 21,684,300 | 2,767,259,300 |
| 26 | 11/28/2016 | 2,623,089,000 | 6,987,400 | 2,630,076,400 |
| 27 | 11/29/2016 | 2,578,142,000 | 42,717,200 | 2,620,859,200 |
| 28 | 11/30/2016 | 2,696,687,000 | 73,317,850 | 2,770,004,850 |
| 29 | 12/1/2016 | 2,678,977,000 | 53,420,200 | 2,732,397,200 |
| 30 | 12/2/2016 | 2,674,441,000 | 47,290,550 | 2,721,731,550 |
| 31 | 12/3/2016 | 2,753,527,000 | 46,043,250 | 2,799,570,250 |
| 32 | 12/5/2016 | 2,773,638,000 | 48,967,250 | 2,822,605,250 |
| 33 | 12/6/2016 | 2,812,194,000 | 39,599,500 | 2,851,793,500 |
| 34 | 12/7/2016 | 2,778,244,000 | 35,932,100 | 2,814,176,100 |
| 35 | 12/8/2016 | 2,820,293,000 | 45,039,200 | 2,865,332,200 |
| 36 | 12/9/2016 | 2,813,524,000 | 39,912,200 | 2,853,436,200 |
| 37 | 12/10/2016 | 2,823,625,000 | 62,148,000 | 2,885,773,000 |
| 38 | 12/13/2016 | 2,983,568,000 | 45,112,450 | 3,028,680,450 |
| 39 | 12/14/2016 | 2,946,076,000 | 26,502,500 | 2,972,578,500 |
| 40 | 12/15/2016 | 3,022,397,000 | 49,995,300 | 3,072,392,300 |
| 41 | 12/16/2016 | 3,142,664,000 | 66,145,600 | 3,208,809,600 |
| 42 | 12/17/2016 | 3,338,314,000 | 69,902,200 | 3,408,216,200 |
| 43 | 12/18/2016 | 3,329,739,000 | 7,486,000 | 3,337,225,000 |
| 44 | 12/19/2016 | 3,252,151,000 | 29,511,150 | 3,281,662,150 |
| 45 | 12/20/2016 | 3,242,932,000 | 53,349,700 | 3,296,281,700 |
| 46 | 12/21/2016 | 3,371,697,000 | 75,761,550 | 3,447,458,550 |
| 47 | 12/22/2016 | 3,349,213,000 | 28,603,050 | 3,377,816,050 |
| 48 | 12/23/2016 | 3,370,199,000 | 36,762,050 | 3,406,961,050 |
| 49 | 12/24/2016 | 3,459,967,000 | 42,879,250 | 3,502,846,250 |
| 50 | 12/25/2016 | 3,355,730,000 | 0 | 3,355,730,000 |
| 51 | 12/26/2016 | 3,166,149,000 | 2,557,050 | 3,168,706,050 |
| 52 | 12/27/2016 | 3,202,136,000 | 55,540,800 | 3,257,676,800 |
| 53 | 12/28/2016 | 3,133,011,000 | 20,027,450 | 3,153,038,450 |
| 54 | 12/29/2016 | 3,273,767,000 | 66,302,500 | 3,340,069,500 |
| 55 | 12/30/2016 | 3,134,229,000 | 12,268,200 | 3,146,497,200 |
| 56 | 12/31/2016 | 3,065,818,000 | 0 | 3,065,818,000 |

The total supply chain cost is obtained from all costing activies in PT. Rakabu Sejahtera and its Supplier. For this current system, the average supply chain cost is Rp 2,923,603,145.

### 4.3.3 Scenario Building

After calculating the average demand, standard deviation, safety stock and re-order point from the historical data, the scenario to get the optimum solution was built. The scenario was built based on the subjective prespective of the researcher. However, the addressed scenario must be able to be implemented in the company. The scenario used in this research are:

1. The suppliers deliver the raw material to PT. Rakabu Sejahtera everyday as much as the maximum capacity for one truck for each suppliers.
2. The suppliers deliver the raw material to PT. Rakabu Sejahtera once in three days as much as the maximum capacity for three trucks for each suppliers.
3. The suppliers deliver the raw material to PT. Rakabu Sejahtera once in three days as much as the demand of the last three days.
4. The suppliers deliver raw material to PT. Rakabu Sejahtera everyday based on the random number generation result of each suppliers' historical data.
5. The suppliers deliver raw material to the PT. Rakabu Sejahtera only when the inventory level reach the re-order point as much as safety stock amount added by demand on the day it reached the re-order point and half amount of previous day.
6. The suppliers deliver raw material to the PT. Rakabu Sejahtera only when the inventory level reach the re-order point as much as safety stock amount added by demand on the day it reached the re-order point.

### 4.3.4 Simulation Result

The simulation is started by generating random number of demand. As illustrated before that the distribution of the data is Normal Distribution, then the average demand with value 20,586.839 and the standard deviation with value 7,512.543 is used to generate the

random number. The random number generation is performed by Microsoft Excel with 100 random numbers and will be used as the demand for all scenario in simulation. The result of random number generation can be seen in Table 4.14 below:

Table 4.14 Result of Random Number Generation

| Day | Demand (pcs) |
|---|---|
| 1 | 16492 |
| 2 | 19356 |
| 3 | 14211 |
| 4 | 28972 |
| 5 | 30247 |
| 6 | 19006 |
| 7 | 16639 |
| 8 | 6861 |
| 9 | 12995 |
| 10 | 29880 |
| 11 | 23354 |
| 12 | 14516 |
| 13 | 19692 |
| 14 | 14000 |
| 15 | 14548 |
| 16 | 7900 |
| 17 | 21737 |
| 18 | 17287 |
| 19 | 19713 |
| 20 | 13072 |
| 21 | 14434 |
| 22 | 30699 |
| 23 | 25599 |
| 24 | 18796 |
| 25 | 18061 |
| 26 | 28099 |
| 27 | 17205 |
| 28 | 24576 |
| 29 | 33277 |
| 30 | 32269 |
| 31 | 22689 |
| 32 | 23674 |
| 33 | 3008 |
| 34 | 31861 |

| Day | Demand (pcs) |
|---|---|
| 35 | 17382 |
| 36 | 27679 |
| 37 | 11561 |
| 38 | 29658 |
| 39 | 18350 |
| 40 | 27524 |
| 41 | 12111 |
| 42 | 22436 |
| 43 | 25160 |
| 44 | 11693 |
| 45 | 32206 |
| 46 | 36699 |
| 47 | 18661 |
| 48 | 26640 |
| 49 | 17827 |
| 50 | 43137 |
| 51 | 28658 |
| 52 | 35837 |
| 53 | 28170 |
| 54 | 10807 |
| 55 | 25124 |
| 56 | 18175 |
| 57 | 14188 |
| 58 | 26752 |
| 59 | 14995 |
| 60 | 20226 |
| 61 | 28954 |
| 62 | 17609 |
| 63 | 16358 |
| 64 | 33968 |
| 65 | 8601 |
| 66 | 9615 |
| 67 | 23879 |
| 68 | 27947 |
| 69 | 15592 |
| 70 | 18028 |
| 71 | 10271 |
| 72 | 27006 |
| 73 | 18235 |
| 74 | 31145 |
| 75 | 23330 |

| Day | Demand (pcs) |
|---|---|
| 76 | 20498 |
| 77 | 12964 |
| 78 | 13833 |
| 79 | 22099 |
| 80 | 30973 |
| 81 | 31165 |
| 82 | 22788 |
| 83 | 23751 |
| 84 | 28979 |
| 85 | 20041 |
| 86 | 24959 |
| 87 | 13399 |
| 88 | 23031 |
| 89 | 12776 |
| 90 | 19484 |
| 91 | 28455 |
| 92 | 23960 |
| 93 | 26872 |
| 94 | 31015 |
| 95 | 27029 |
| 96 | 25158 |
| 97 | 25731 |
| 98 | 12157 |
| 99 | 22745 |
| 100 | 30688 |

After that, the function for each cells is being made. The function is needed to simulate the Total Material Arrived, Inventory in PT. Rakabu Sejahtera, Supply Quantity and Number of Truck Delivered for Supplier A, Supplier B, and UD. Trenggalek Lestari, Shortage Cost of PT. Rakabu Sejahtera, Holding Cost of PT. Rakabu Sejahtera, Production Cost for Supplier A, Supplier B, and UD. Trenggalek Lestari, Delivery Cost for Supplier A, Supplier B, and UD. Trenggalek Lestari, and Total Supply Chain Cost. Thus, the results for each scenario are:

1. Scenario 1

Scenario 1 is suppliers deliver the raw material to PT. Rakabu Sejahtera everyday as much as the maximum capacity for one truck for each suppliers. As mentioned above, the maximum capacity for one truck in Supplier A is as much as 10,000 pieces, the maximum capacity for one truck in Supplier B is as much as 2,100 pieces, and the maximum capacity for one truck of UD. Trengalek Lestari is 7,500 pieces. Thus, based on this scenario, everyday, the material that arrived will be 19,600 in total from Supplier A, Supplier B, and UD. Trenggalek Lestari. The result of Scenario 1 system can be seen in Table 4.15, while the Scenario 1 costing result can be seen in Table 4.16 below:

Table 4.15 Scenario 1 System Simulation Result

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 1 | 19,600 | 16,492 | 369,680 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 2 | 19,600 | 19,356 | 369,924 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 3 | 19,600 | 14,211 | 375,313 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 4 | 19,600 | 28,972 | 365,941 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 5 | 19,600 | 30,247 | 355,294 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 6 | 19,600 | 19,006 | 355,888 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 7 | 19,600 | 16,639 | 358,849 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 8 | 19,600 | 6,861 | 371,588 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 9 | 19,600 | 12,995 | 378,193 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 10 | 19,600 | 29,880 | 367,913 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 11 | 19,600 | 23,354 | 364,158 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 12 | 19,600 | 14,516 | 369,243 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 13 | 19,600 | 19,692 | 369,151 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 14 | 19,600 | 14,000 | 374,751 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 15 | 19,600 | 14,548 | 379,803 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 16 | 19,600 | 7,900 | 391,503 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 17 | 19,600 | 21,737 | 389,367 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 18 | 19,600 | 17,287 | 391,680 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 19 | 19,600 | 19,713 | 391,567 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 20 | 19,600 | 13,072 | 398,095 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 21 | 19,600 | 14,434 | 403,260 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 22 | 19,600 | 30,699 | 392,161 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 23 | 19,600 | 25,599 | 386,162 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 24 | 19,600 | 18,796 | 386,966 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 25 | 19,600 | 18,061 | 388,504 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 26 | 19,600 | 28,099 | 380,005 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 27 | 19,600 | 17,205 | 382,400 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 28 | 19,600 | 24,576 | 377,425 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 29 | 19,600 | 33,277 | 363,748 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 30 | 19,600 | 32,269 | 351,079 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 31 | 19,600 | 22,689 | 347,990 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 32 | 19,600 | 23,674 | 343,916 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 33 | 19,600 | 3,008 | 360,507 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 34 | 19,600 | 31,861 | 348,246 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 35 | 19,600 | 17,382 | 350,464 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 36 | 19,600 | 27,679 | 342,385 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 37 | 19,600 | 11,561 | 350,424 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 38 | 19,600 | 29,658 | 340,366 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 39 | 19,600 | 18,350 | 341,616 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 40 | 19,600 | 27,524 | 333,692 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 41 | 19,600 | 12,111 | 341,181 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 42 | 19,600 | 22,436 | 338,345 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 43 | 19,600 | 25,160 | 332,785 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 44 | 19,600 | 11,693 | 340,692 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 45 | 19,600 | 32,206 | 328,086 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 46 | 19,600 | 36,699 | 310,988 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 47 | 19,600 | 18,661 | 311,927 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 48 | 19,600 | 26,640 | 304,887 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 49 | 19,600 | 17,827 | 306,660 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 50 | 19,600 | 43,137 | 283,123 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 51 | 19,600 | 28,658 | 274,065 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 52 | 19,600 | 35,837 | 257,828 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 53 | 19,600 | 28,170 | 249,258 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 54 | 19,600 | 10,807 | 258,051 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 55 | 19,600 | 25,124 | 252,526 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 56 | 19,600 | 18,175 | 253,951 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 57 | 19,600 | 14,188 | 259,363 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 58 | 19,600 | 26,752 | 252,211 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 59 | 19,600 | 14,995 | 256,816 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 60 | 19,600 | 20,226 | 256,190 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 61 | 19,600 | 28,954 | 246,835 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 62 | 19,600 | 17,609 | 248,826 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 63 | 19,600 | 16,358 | 252,068 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 64 | 19,600 | 33,968 | 237,701 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 65 | 19,600 | 8,601 | 248,700 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 66 | 19,600 | 9,615 | 258,685 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 67 | 19,600 | 23,879 | 254,405 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 68 | 19,600 | 27,947 | 246,058 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 69 | 19,600 | 15,592 | 250,066 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 70 | 19,600 | 18,028 | 251,638 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 71 | 19,600 | 10,271 | 260,968 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 72 | 19,600 | 27,006 | 253,562 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 73 | 19,600 | 18,235 | 254,927 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 74 | 19,600 | 31,145 | 243,382 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 75 | 19,600 | 23,330 | 239,653 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 76 | 19,600 | 20,498 | 238,754 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 77 | 19,600 | 12,964 | 245,390 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 78 | 19,600 | 13,833 | 251,157 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 79 | 19,600 | 22,099 | 248,658 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 80 | 19,600 | 30,973 | 237,285 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 81 | 19,600 | 31,165 | 225,720 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 82 | 19,600 | 22,788 | 222,531 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 83 | 19,600 | 23,751 | 218,381 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 84 | 19,600 | 28,979 | 209,002 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 85 | 19,600 | 20,041 | 208,561 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 86 | 19,600 | 24,959 | 203,202 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 87 | 19,600 | 13,399 | 209,403 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 88 | 19,600 | 23,031 | 205,972 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 89 | 19,600 | 12,776 | 212,796 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 90 | 19,600 | 19,484 | 212,912 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 91 | 19,600 | 28,455 | 204,057 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 92 | 19,600 | 23,960 | 199,697 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 93 | 19,600 | 26,872 | 192,425 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 94 | 19,600 | 31,015 | 181,010 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 95 | 19,600 | 27,029 | 173,582 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 96 | 19,600 | 25,158 | 168,023 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 97 | 19,600 | 25,731 | 161,892 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 98 | 19,600 | 12,157 | 169,335 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 99 | 19,600 | 22,745 | 166,190 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |
| 100 | 19,600 | 30,688 | 155,102 | 0 | 10,000 | 1 | 2,100 | 1 | 7,500 | 1 |

Table 4.16 Scenario 1 Costing Simulation Result

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 1 | 0 | 2,587,758,576 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,619,113,576 |
| 2 | 0 | 2,589,466,805 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,620,821,805 |
| 3 | 0 | 2,627,192,874 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,658,547,874 |
| 4 | 0 | 2,561,587,158 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,592,942,158 |
| 5 | 0 | 2,487,057,633 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,518,412,633 |
| 6 | 0 | 2,491,214,254 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,522,569,254 |
| 7 | 0 | 2,511,942,793 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,543,297,793 |
| 8 | 0 | 2,601,115,161 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,632,470,161 |
| 9 | 0 | 2,647,351,802 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,678,706,802 |
| 10 | 0 | 2,575,389,343 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,606,744,343 |
| 11 | 0 | 2,549,109,273 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,580,464,273 |
| 12 | 0 | 2,584,697,774 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,616,052,774 |
| 13 | 0 | 2,584,057,154 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,615,412,154 |
| 14 | 0 | 2,623,254,063 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,654,609,063 |
| 15 | 0 | 2,658,619,803 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,689,974,803 |
| 16 | 0 | 2,740,523,222 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,771,878,222 |
| 17 | 0 | 2,725,567,346 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,756,922,346 |
| 18 | 0 | 2,741,757,454 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,773,112,454 |
| 19 | 0 | 2,740,966,953 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,772,321,953 |
| 20 | 0 | 2,786,663,372 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,818,018,372 |
| 21 | 0 | 2,822,823,182 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,854,178,182 |
| 22 | 0 | 2,745,128,738 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,776,483,738 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 23 | 0 | 2,703,133,954 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,734,488,954 |
| 24 | 0 | 2,708,759,323 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,740,114,323 |
| 25 | 0 | 2,719,530,542 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,750,885,542 |
| 26 | 0 | 2,660,035,971 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,691,390,971 |
| 27 | 0 | 2,676,803,428 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,708,158,428 |
| 28 | 0 | 2,641,974,762 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,673,329,762 |
| 29 | 0 | 2,546,236,603 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,577,591,603 |
| 30 | 0 | 2,457,551,687 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,488,906,687 |
| 31 | 0 | 2,435,928,302 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,467,283,302 |
| 32 | 0 | 2,407,408,551 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,438,763,551 |
| 33 | 0 | 2,523,550,356 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,554,905,356 |
| 34 | 0 | 2,437,721,509 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,469,076,509 |
| 35 | 0 | 2,453,248,896 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,484,603,896 |
| 36 | 0 | 2,396,696,485 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,428,051,485 |
| 37 | 0 | 2,452,971,334 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,484,326,334 |
| 38 | 0 | 2,382,562,698 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,413,917,698 |
| 39 | 0 | 2,391,311,855 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,422,666,855 |
| 40 | 0 | 2,335,841,919 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,367,196,919 |
| 41 | 0 | 2,388,263,957 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,419,618,957 |
| 42 | 0 | 2,368,414,645 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,399,769,645 |
| 43 | 0 | 2,329,496,896 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,360,851,896 |
| 44 | 0 | 2,384,846,029 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,416,201,029 |
| 45 | 0 | 2,296,603,047 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,327,958,047 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 46 | 0 | 2,176,913,418 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,208,268,418 |
| 47 | 0 | 2,183,488,658 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,214,843,658 |
| 48 | 0 | 2,134,210,337 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,165,565,337 |
| 49 | 0 | 2,146,620,753 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,177,975,753 |
| 50 | 0 | 1,981,862,971 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 2,013,217,971 |
| 51 | 0 | 1,918,455,804 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,949,810,804 |
| 52 | 0 | 1,804,795,414 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,836,150,414 |
| 53 | 0 | 1,744,807,733 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,776,162,733 |
| 54 | 0 | 1,806,355,417 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,837,710,417 |
| 55 | 0 | 1,767,684,223 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,799,039,223 |
| 56 | 0 | 1,777,657,187 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,809,012,187 |
| 57 | 0 | 1,815,539,176 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,846,894,176 |
| 58 | 0 | 1,765,476,949 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,796,831,949 |
| 59 | 0 | 1,797,710,412 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,829,065,412 |
| 60 | 0 | 1,793,326,748 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,824,681,748 |
| 61 | 0 | 1,727,848,375 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,759,203,375 |
| 62 | 0 | 1,741,782,003 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,773,137,003 |
| 63 | 0 | 1,764,479,335 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,795,834,335 |
| 64 | 0 | 1,663,905,014 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,695,260,014 |
| 65 | 0 | 1,740,900,291 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,772,255,291 |
| 66 | 0 | 1,810,792,582 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,842,147,582 |
| 67 | 0 | 1,780,837,623 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,812,192,623 |
| 68 | 0 | 1,722,406,754 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,753,761,754 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 69 | 0 | 1,750,463,011 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,781,818,011 |
| 70 | 0 | 1,761,468,589 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,792,823,589 |
| 71 | 0 | 1,826,774,383 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,858,129,383 |
| 72 | 0 | 1,774,935,453 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,806,290,453 |
| 73 | 0 | 1,784,489,680 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,815,844,680 |
| 74 | 0 | 1,703,676,351 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,735,031,351 |
| 75 | 0 | 1,677,568,343 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,708,923,343 |
| 76 | 0 | 1,671,280,872 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,702,635,872 |
| 77 | 0 | 1,717,732,501 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,749,087,501 |
| 78 | 0 | 1,758,098,812 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,789,453,812 |
| 79 | 0 | 1,740,604,925 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,771,959,925 |
| 80 | 0 | 1,660,992,565 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,692,347,565 |
| 81 | 0 | 1,580,038,619 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,611,393,619 |
| 82 | 0 | 1,557,719,452 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,589,074,452 |
| 83 | 0 | 1,528,664,502 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,560,019,502 |
| 84 | 0 | 1,463,013,828 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,494,368,828 |
| 85 | 0 | 1,459,927,925 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,491,282,925 |
| 86 | 0 | 1,422,417,406 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,453,772,406 |
| 87 | 0 | 1,465,821,653 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,497,176,653 |
| 88 | 0 | 1,441,806,015 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,473,161,015 |
| 89 | 0 | 1,489,573,521 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,520,928,521 |
| 90 | 0 | 1,490,385,926 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,521,740,926 |
| 91 | 0 | 1,428,398,303 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,459,753,303 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 92 | 0 | 1,397,879,627 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,429,234,627 |
| 93 | 0 | 1,346,978,252 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,378,333,252 |
| 94 | 0 | 1,267,071,867 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,298,426,867 |
| 95 | 0 | 1,215,070,560 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,246,425,560 |
| 96 | 0 | 1,176,162,496 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,207,517,496 |
| 97 | 0 | 1,133,242,593 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,164,597,593 |
| 98 | 0 | 1,185,346,334 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,216,701,334 |
| 99 | 0 | 1,163,329,263 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,194,684,263 |
| 100 | 0 | 1,085,714,452 | 9,000,000 | 2,500,000 | 2,205,000 | 750,000 | 15,000,000 | 1,900,000 | 1,117,069,452 |

From the table, it can be seen that the supply chain cost for PT. Rakabu Sejahtera and its suppliers is obtained from the holding cost in PT. Rakabu Sejahtera, production cost in Supplier A, Supplier B, and UD. Trenggalek Lestari, and delivery cost in Supplier A, Supplier B, and UD. Trenggalek Lestari. For this scenario, there is no shortage happens for the system, so the shortage cost will be Rp 0. The holding cost includes the maintenance cost, salary for workers, and building cost. The production cost includes the salary for workers for cutting down the tree, loading cost, and materials' purchasing. The delivery cost includes the drivers fee, unloading cost, and fuel cost. Thus, the average supply chain cost of the scenario can be calculated. For scenario 1, the average supply chain cost is Rp 2,089,121,427.

2. Scenario 2

Scenario 2 is suppliers deliver the raw material to PT. Rakabu Sejahtera once in three days as much as the maximum capacity for three trucks for each suppliers. As mentioned above, the safety stock based on the calculation is as much as 17,505 pieces, the maximum capacity for one truck in Supplier A is as much as 10,000 pieces, the maximum capacity for one truck in Supplier B is as much as 2,100 pieces, and the maximum capacity for one truck of UD. Trengalek Lestari is 7,500 pieces. For this system, the number of material delivered will be total of three maximum capacity of truck for each supplier added by the safety stock amount. However, because of Supplier A has the highest capacity fuilfillment amount, the safety stock amount will be added to Supplier A. So in total, supplier A will deliver 27,505 pieces, Supplier B will deliver 6300 pieces, and UD. Trengalek Lestari will deliver 20,000 pieces for three trucks for once in three days. Thus, in this scenario, the material that arrived will be 53,805 in total from Supplier A, Supplier B, and UD. Trenggalek Lestari for once in three days. The result of Scenario 2 system can be seen in Table 4.17 while Scenario 2 costing result can be seen in Table 4.18 below:

Table 4.17 Scenario 2 System Simulation Result

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 1 | 0 | 16,492 | 369,680 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 19,356 | 350,324 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 53,805 | 14,211 | 389,918 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 4 | - | 28,972 | 360,946 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | - | 30,247 | 330,699 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 53,805 | 19,006 | 365,498 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 7 | - | 16,639 | 348,859 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | - | 6,861 | 341,998 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 53,805 | 12,995 | 382,808 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 10 | - | 29,880 | 352,928 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | - | 23,354 | 329,573 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 53,805 | 14,516 | 368,863 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 13 | - | 19,692 | 349,171 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | - | 14,000 | 335,171 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 53,805 | 14,548 | 374,428 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 16 | - | 7,900 | 366,528 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | - | 21,737 | 344,792 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 53,805 | 17,287 | 381,310 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 19 | - | 19,713 | 361,597 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | - | 13,072 | 348,525 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 53,805 | 14,434 | 387,895 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 22 | - | 30,699 | 357,196 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | - | 25,599 | 331,597 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 53,805 | 18,796 | 366,606 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 25 | - | 18,061 | 348,544 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | - | 28,099 | 320,445 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 53,805 | 17,205 | 357,045 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 28 | - | 24,576 | 332,470 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | - | 33,277 | 299,193 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 53,805 | 32,269 | 320,729 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 31 | - | 22,689 | 298,040 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 32 | - | 23,674 | 274,366 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 33 | 53,805 | 3,008 | 325,162 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 34 | - | 31,861 | 293,301 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 35 | - | 17,382 | 275,919 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 36 | 53,805 | 27,679 | 302,045 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 37 | - | 11,561 | 290,484 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 38 | - | 29,658 | 260,826 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 39 | 53,805 | 18,350 | 296,281 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 40 | - | 27,524 | 268,757 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41 | - | 12,111 | 256,646 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 42 | 53,805 | 22,436 | 288,015 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 43 | - | 25,160 | 262,855 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 44 | - | 11,693 | 251,162 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 45 | 53,805 | 32,206 | 272,761 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 46 | - | 36,699 | 236,063 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 47 | - | 18,661 | 217,402 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 48 | 53,805 | 26,640 | 244,567 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 49 | - | 17,827 | 226,740 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 50 | - | 43,137 | 183,603 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 51 | 53,805 | 28,658 | 208,750 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 52 | - | 35,837 | 172,913 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 53 | - | 28,170 | 144,743 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 54 | 53,805 | 10,807 | 187,741 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 55 | - | 25,124 | 162,616 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 56 | - | 18,175 | 144,441 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 57 | 53,805 | 14,188 | 184,058 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 58 | - | 26,752 | 157,306 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 59 | - | 14,995 | 142,311 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 60 | 53,805 | 20,226 | 175,890 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 61 | - | 28,954 | 146,935 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 62 | - | 17,609 | 129,326 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 63 | 53,805 | 16,358 | 166,773 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 64 | - | 33,968 | 132,806 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 65 | - | 8,601 | 124,205 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 66 | 53,805 | 9,615 | 168,395 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 67 | - | 23,879 | 144,515 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 68 | - | 27,947 | 116,568 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 69 | 53,805 | 15,592 | 154,781 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 70 | - | 18,028 | 136,753 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 71 | - | 10,271 | 126,483 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 72 | 53,805 | 27,006 | 153,282 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 73 | - | 18,235 | 135,047 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 74 | - | 31,145 | 103,902 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 75 | 53,805 | 23,330 | 134,378 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 76 | - | 20,498 | 113,879 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 77 | - | 12,964 | 100,915 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 78 | 53,805 | 13,833 | 140,887 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 79 | - | 22,099 | 118,788 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80 | - | 30,973 | 87,815 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 81 | 53,805 | 31,165 | 110,455 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 82 | - | 22,788 | 87,666 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 83 | - | 23,751 | 63,916 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 84 | 53,805 | 28,979 | 88,742 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 85 | - | 20,041 | 68,701 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 86 | - | 24,959 | 43,742 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 87 | 53,805 | 13,399 | 84,148 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 88 | - | 23,031 | 61,117 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 89 | - | 12,776 | 48,341 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 90 | 53,805 | 19,484 | 82,662 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 91 | - | 28,455 | 54,207 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 92 | - | 23,960 | 30,247 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 93 | 53,805 | 26,872 | 57,180 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 94 | - | 31,015 | 26,165 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 95 | - | 27,029 | 0 | 863 | 0 | 0 | 0 | 0 | 0 | 0 |
| 96 | 53,805 | 25,158 | 28,647 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 97 | - | 25,731 | 2,915 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 98 | - | 12,157 | 0 | 9,241 | 0 | 0 | 0 | 0 | 0 | 0 |
| 99 | 53,805 | 22,745 | 31,060 | 0 | 27,505 | 3 | 6,300 | 3 | 20,000 | 3 |
| 100 | - | 30,688 | 372 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 4.18 Scenario 2 Costing Simulation Result

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 1 | 0 | 2,587,758,576 | 0 | 0 | 0 | 0 | 0 | 0 | 2,587,758,576 |
| 2 | 0 | 2,452,266,805 | 0 | 0 | 0 | 0 | 0 | 0 | 2,452,266,805 |
| 3 | 0 | 2,729,427,874 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 2,816,247,374 |
| 4 | 0 | 2,526,622,158 | 0 | 0 | 0 | 0 | 0 | 0 | 2,526,622,158 |
| 5 | 0 | 2,314,892,633 | 0 | 0 | 0 | 0 | 0 | 0 | 2,314,892,633 |
| 6 | 0 | 2,558,484,254 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 2,645,303,754 |
| 7 | 0 | 2,442,012,793 | 0 | 0 | 0 | 0 | 0 | 0 | 2,442,012,793 |
| 8 | 0 | 2,393,985,161 | 0 | 0 | 0 | 0 | 0 | 0 | 2,393,985,161 |
| 9 | 0 | 2,679,656,802 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 2,766,476,302 |
| 10 | 0 | 2,470,494,343 | 0 | 0 | 0 | 0 | 0 | 0 | 2,470,494,343 |
| 11 | 0 | 2,307,014,273 | 0 | 0 | 0 | 0 | 0 | 0 | 2,307,014,273 |
| 12 | 0 | 2,582,037,774 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 2,668,857,274 |
| 13 | 0 | 2,444,197,154 | 0 | 0 | 0 | 0 | 0 | 0 | 2,444,197,154 |
| 14 | 0 | 2,346,194,063 | 0 | 0 | 0 | 0 | 0 | 0 | 2,346,194,063 |
| 15 | 0 | 2,620,994,803 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 2,707,814,303 |
| 16 | 0 | 2,565,698,222 | 0 | 0 | 0 | 0 | 0 | 0 | 2,565,698,222 |
| 17 | 0 | 2,413,542,346 | 0 | 0 | 0 | 0 | 0 | 0 | 2,413,542,346 |
| 18 | 0 | 2,669,167,454 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 2,755,986,954 |
| 19 | 0 | 2,531,176,953 | 0 | 0 | 0 | 0 | 0 | 0 | 2,531,176,953 |
| 20 | 0 | 2,439,673,372 | 0 | 0 | 0 | 0 | 0 | 0 | 2,439,673,372 |
| 21 | 0 | 2,715,268,182 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 2,802,087,682 |
| 22 | 0 | 2,500,373,738 | 0 | 0 | 0 | 0 | 0 | 0 | 2,500,373,738 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 23 | 0 | 2,321,178,954 | 0 | 0 | 0 | 0 | 0 | 0 | 2,321,178,954 |
| 24 | 0 | 2,566,239,323 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 2,653,058,823 |
| 25 | 0 | 2,439,810,542 | 0 | 0 | 0 | 0 | 0 | 0 | 2,439,810,542 |
| 26 | 0 | 2,243,115,971 | 0 | 0 | 0 | 0 | 0 | 0 | 2,243,115,971 |
| 27 | 0 | 2,499,318,428 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 2,586,137,928 |
| 28 | 0 | 2,327,289,762 | 0 | 0 | 0 | 0 | 0 | 0 | 2,327,289,762 |
| 29 | 0 | 2,094,351,603 | 0 | 0 | 0 | 0 | 0 | 0 | 2,094,351,603 |
| 30 | 0 | 2,245,101,687 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 2,331,921,187 |
| 31 | 0 | 2,086,278,302 | 0 | 0 | 0 | 0 | 0 | 0 | 2,086,278,302 |
| 32 | 0 | 1,920,558,551 | 0 | 0 | 0 | 0 | 0 | 0 | 1,920,558,551 |
| 33 | 0 | 2,276,135,356 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 2,362,954,856 |
| 34 | 0 | 2,053,106,509 | 0 | 0 | 0 | 0 | 0 | 0 | 2,053,106,509 |
| 35 | 0 | 1,931,433,896 | 0 | 0 | 0 | 0 | 0 | 0 | 1,931,433,896 |
| 36 | 0 | 2,114,316,485 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 2,201,135,985 |
| 37 | 0 | 2,033,391,334 | 0 | 0 | 0 | 0 | 0 | 0 | 2,033,391,334 |
| 38 | 0 | 1,825,782,698 | 0 | 0 | 0 | 0 | 0 | 0 | 1,825,782,698 |
| 39 | 0 | 2,073,966,855 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 2,160,786,355 |
| 40 | 0 | 1,881,296,919 | 0 | 0 | 0 | 0 | 0 | 0 | 1,881,296,919 |
| 41 | 0 | 1,796,518,957 | 0 | 0 | 0 | 0 | 0 | 0 | 1,796,518,957 |
| 42 | 0 | 2,016,104,645 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 2,102,924,145 |
| 43 | 0 | 1,839,986,896 | 0 | 0 | 0 | 0 | 0 | 0 | 1,839,986,896 |
| 44 | 0 | 1,758,136,029 | 0 | 0 | 0 | 0 | 0 | 0 | 1,758,136,029 |
| 45 | 0 | 1,909,328,047 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 1,996,147,547 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 46 | 0 | 1,652,438,418 | 0 | 0 | 0 | 0 | 0 | 0 | 1,652,438,418 |
| 47 | 0 | 1,521,813,658 | 0 | 0 | 0 | 0 | 0 | 0 | 1,521,813,658 |
| 48 | 0 | 1,711,970,337 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 1,798,789,837 |
| 49 | 0 | 1,587,180,753 | 0 | 0 | 0 | 0 | 0 | 0 | 1,587,180,753 |
| 50 | 0 | 1,285,222,971 | 0 | 0 | 0 | 0 | 0 | 0 | 1,285,222,971 |
| 51 | 0 | 1,461,250,804 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 1,548,070,304 |
| 52 | 0 | 1,210,390,414 | 0 | 0 | 0 | 0 | 0 | 0 | 1,210,390,414 |
| 53 | 0 | 1,013,202,733 | 0 | 0 | 0 | 0 | 0 | 0 | 1,013,202,733 |
| 54 | 0 | 1,314,185,417 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 1,401,004,917 |
| 55 | 0 | 1,138,314,223 | 0 | 0 | 0 | 0 | 0 | 0 | 1,138,314,223 |
| 56 | 0 | 1,011,087,187 | 0 | 0 | 0 | 0 | 0 | 0 | 1,011,087,187 |
| 57 | 0 | 1,288,404,176 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 1,375,223,676 |
| 58 | 0 | 1,101,141,949 | 0 | 0 | 0 | 0 | 0 | 0 | 1,101,141,949 |
| 59 | 0 | 996,175,412 | 0 | 0 | 0 | 0 | 0 | 0 | 996,175,412 |
| 60 | 0 | 1,231,226,748 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 1,318,046,248 |
| 61 | 0 | 1,028,548,375 | 0 | 0 | 0 | 0 | 0 | 0 | 1,028,548,375 |
| 62 | 0 | 905,282,003 | 0 | 0 | 0 | 0 | 0 | 0 | 905,282,003 |
| 63 | 0 | 1,167,414,335 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 1,254,233,835 |
| 64 | 0 | 929,640,014 | 0 | 0 | 0 | 0 | 0 | 0 | 929,640,014 |
| 65 | 0 | 869,435,291 | 0 | 0 | 0 | 0 | 0 | 0 | 869,435,291 |
| 66 | 0 | 1,178,762,582 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 1,265,582,082 |
| 67 | 0 | 1,011,607,623 | 0 | 0 | 0 | 0 | 0 | 0 | 1,011,607,623 |
| 68 | 0 | 815,976,754 | 0 | 0 | 0 | 0 | 0 | 0 | 815,976,754 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 69 | 0 | 1,083,468,011 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 1,170,287,511 |
| 70 | 0 | 957,273,589 | 0 | 0 | 0 | 0 | 0 | 0 | 957,273,589 |
| 71 | 0 | 885,379,383 | 0 | 0 | 0 | 0 | 0 | 0 | 885,379,383 |
| 72 | 0 | 1,072,975,453 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 1,159,794,953 |
| 73 | 0 | 945,329,680 | 0 | 0 | 0 | 0 | 0 | 0 | 945,329,680 |
| 74 | 0 | 727,316,351 | 0 | 0 | 0 | 0 | 0 | 0 | 727,316,351 |
| 75 | 0 | 940,643,343 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 1,027,462,843 |
| 76 | 0 | 797,155,872 | 0 | 0 | 0 | 0 | 0 | 0 | 797,155,872 |
| 77 | 0 | 706,407,501 | 0 | 0 | 0 | 0 | 0 | 0 | 706,407,501 |
| 78 | 0 | 986,208,812 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 1,073,028,312 |
| 79 | 0 | 831,514,925 | 0 | 0 | 0 | 0 | 0 | 0 | 831,514,925 |
| 80 | 0 | 614,702,565 | 0 | 0 | 0 | 0 | 0 | 0 | 614,702,565 |
| 81 | 0 | 773,183,619 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 860,003,119 |
| 82 | 0 | 613,664,452 | 0 | 0 | 0 | 0 | 0 | 0 | 613,664,452 |
| 83 | 0 | 447,409,502 | 0 | 0 | 0 | 0 | 0 | 0 | 447,409,502 |
| 84 | 0 | 621,193,828 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 708,013,328 |
| 85 | 0 | 480,907,925 | 0 | 0 | 0 | 0 | 0 | 0 | 480,907,925 |
| 86 | 0 | 306,197,406 | 0 | 0 | 0 | 0 | 0 | 0 | 306,197,406 |
| 87 | 0 | 589,036,653 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 675,856,153 |
| 88 | 0 | 427,821,015 | 0 | 0 | 0 | 0 | 0 | 0 | 427,821,015 |
| 89 | 0 | 338,388,521 | 0 | 0 | 0 | 0 | 0 | 0 | 338,388,521 |
| 90 | 0 | 578,635,926 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 665,455,426 |
| 91 | 0 | 379,448,303 | 0 | 0 | 0 | 0 | 0 | 0 | 379,448,303 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 92 | 0 | 211,729,627 | 0 | 0 | 0 | 0 | 0 | 0 | 211,729,627 |
| 93 | 0 | 400,263,252 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 487,082,752 |
| 94 | 0 | 183,156,867 | 0 | 0 | 0 | 0 | 0 | 0 | 183,156,867 |
| 95 | 18,266,298 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18,266,298 |
| 96 | 0 | 200,526,937 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 287,346,437 |
| 97 | 0 | 20,407,033 | 0 | 0 | 0 | 0 | 0 | 0 | 20,407,033 |
| 98 | 195,490,840 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 195,490,840 |
| 99 | 0 | 217,417,928 | 24,754,500 | 7,500,000 | 6,615,000 | 2,250,000 | 40,000,000 | 5,700,000 | 304,237,428 |
| 100 | 0 | 2,603,118 | 0 | 0 | 0 | 0 | 0 | 0 | 2,603,118 |

From the table, it can be seen that the supply chain cost for PT. Rakabu Sejahtera and its suppliers is obtained from the holding cost and shortage cost in PT. Rakabu Sejahtera, production cost in Supplier A, Supplier B, and UD. Trenggalek Lestari, and delivery cost in Supplier A, Supplier B, and UD. Trenggalek Lestari. In this scenario, there is shortage happens with the total of material shortage is 10,105 pieces. The shortage cost is a cost that occurs when the demand cannot be fulfilled because of running out of material. The holding cost includes the maintenance cost, salary for workers, and building cost. The production cost includes the salary for workers for cutting down the tree, loading cost, and materials' purchasing. The delivery cost includes the drivers fee, unloading cost, and fuel cost. Thus, the average supply chain cost of the scenario can be calculated. For scenario 2, the average supply chain cost is Rp 1,513,935,277.

3. Scenario 3

Scenario 3 is suppliers deliver the raw material to PT. Rakabu Sejahtera once in three days as much as the demand of the last three days. As mentioned above, the maximum fulfillment capacity for Supplier A is as much as 35,000 pieces, the maximum fulfillment capacity for Supplier B is as much as 12,000 pieces, and the maximum fulfillment capacity for UD. Trengalek Lestari is 20,000 pieces. For this system, the number of material delivered will be as much as of the total demand from the lastest three days. However, Supplier A will deliver the material based on the lastest three days demand until it reached the maximum fuilfillment capacity of Supplier A. If Supplier A cannot fulfill the total amount, Supplier B will deliver the material as much as the total amount that Supplier A cannot fulfill until it reached the maximum fulfillment capacity of Supplier B. If Supplier B cannot fulfill the rest of material needed by Supplier A, or it still has remaining amount of material that should be delivered, the rest will be delivered by UD. Trenggalek Lestari until it reached the maximum fulfillment capacity of UD. Trenggalek Lestari. The result of Scenario 3 system can be seen in Table 4.19 while Scenario 3 costing result can be seen in Table 4.20 below:

Table 4.19 Scenario 3 System Simulation Result

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 1 | 0 | 16,492 | 369,680 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 19,356 | 350,324 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 50,059 | 14,211 | 386,172 | 0 | 35,000 | 4 | 12,000 | 6 | 3,059 | 1 |
| 4 | 0 | 28,972 | 357,200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 30,247 | 326,953 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 67,000 | 19,006 | 374,946 | 0 | 35,000 | 4 | 12,000 | 6 | 20,000 | 3 |
| 7 | 0 | 16,639 | 358,308 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 6,861 | 351,447 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 36,495 | 12,995 | 374,946 | 0 | 35,000 | 4 | 1,495 | 1 | 0 | 0 |
| 10 | 0 | 29,880 | 345,066 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 23,354 | 321,712 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 67,000 | 14,516 | 374,196 | 0 | 35,000 | 4 | 12,000 | 6 | 20,000 | 3 |
| 13 | 0 | 19,692 | 354,504 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 0 | 14,000 | 340,504 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 48,240 | 14,548 | 374,196 | 0 | 35,000 | 4 | 12,000 | 6 | 1,240 | 1 |
| 16 | 0 | 7,900 | 366,296 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 21,737 | 344,560 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 46,923 | 17,287 | 374,196 | 0 | 35,000 | 4 | 11,923 | 6 | 0 | 0 |
| 19 | 0 | 19,713 | 354,483 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 13,072 | 341,411 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 47,219 | 14,434 | 374,196 | 0 | 35,000 | 4 | 12,000 | 6 | 219 | 1 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 22 | 0 | 30,699 | 343,497 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 25,599 | 317,897 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 67,000 | 18,796 | 366,101 | 0 | 35,000 | 4 | 12,000 | 6 | 20,000 | 3 |
| 25 | 0 | 18,061 | 348,040 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 28,099 | 319,941 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 63,365 | 17,205 | 366,101 | 0 | 35,000 | 4 | 12,000 | 6 | 16,365 | 3 |
| 28 | 0 | 24,576 | 341,526 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 0 | 33,277 | 308,249 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 67,000 | 32,269 | 342,979 | 0 | 35,000 | 4 | 12,000 | 6 | 20,000 | 3 |
| 31 | 0 | 22,689 | 320,290 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 32 | 0 | 23,674 | 296,616 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 33 | 49,372 | 3,008 | 342,979 | 0 | 35,000 | 4 | 12,000 | 6 | 2,372 | 1 |
| 34 | 0 | 31,861 | 311,118 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 35 | 0 | 17,382 | 293,736 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 36 | 67,000 | 27,679 | 333,057 | 0 | 35,000 | 4 | 12,000 | 6 | 20,000 | 3 |
| 37 | 0 | 11,561 | 321,497 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 38 | 0 | 29,658 | 291,838 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 39 | 59,569 | 18,350 | 333,057 | 0 | 35,000 | 4 | 12,000 | 6 | 12,569 | 2 |
| 40 | 0 | 27,524 | 305,533 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41 | 0 | 12,111 | 293,422 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 42 | 62,071 | 22,436 | 333,057 | 0 | 35,000 | 4 | 12,000 | 6 | 15,071 | 3 |
| 43 | 0 | 25,160 | 307,898 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 44 | 0 | 11,693 | 296,205 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 45 | 67,000 | 32,206 | 330,999 | 0 | 35,000 | 4 | 12,000 | 6 | 20,000 | 3 |
| 46 | 0 | 36,699 | 294,300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 47 | 0 | 18,661 | 275,639 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 48 | 67,000 | 26,640 | 316,000 | 0 | 35,000 | 4 | 12,000 | 6 | 20,000 | 3 |
| 49 | 0 | 17,827 | 298,173 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 50 | 0 | 43,137 | 255,036 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 51 | 67,000 | 28,658 | 293,378 | 0 | 35,000 | 4 | 12,000 | 6 | 20,000 | 3 |
| 52 | 0 | 35,837 | 257,540 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 53 | 0 | 28,170 | 229,371 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 54 | 67,000 | 10,807 | 285,563 | 0 | 35,000 | 4 | 12,000 | 6 | 20,000 | 3 |
| 55 | 0 | 25,124 | 260,439 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 56 | 0 | 18,175 | 242,263 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 57 | 57,488 | 14,188 | 285,563 | 0 | 35,000 | 4 | 12,000 | 6 | 10,488 | 2 |
| 58 | 0 | 26,752 | 258,811 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 59 | 0 | 14,995 | 243,816 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 60 | 61,973 | 20,226 | 285,563 | 0 | 35,000 | 4 | 12,000 | 6 | 14,973 | 2 |
| 61 | 0 | 28,954 | 256,609 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 62 | 0 | 17,609 | 239,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 63 | 62,921 | 16,358 | 285,563 | 0 | 35,000 | 4 | 12,000 | 6 | 15,921 | 3 |
| 64 | 0 | 33,968 | 251,595 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 65 | 0 | 8,601 | 242,995 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 66 | 52,184 | 9,615 | 285,563 | 0 | 35,000 | 4 | 12,000 | 6 | 5,184 | 1 |
| 67 | 0 | 23,879 | 261,684 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 68 | 0 | 27,947 | 233,737 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 69 | 67,000 | 15,592 | 285,145 | 0 | 35,000 | 4 | 12,000 | 6 | 20,000 | 3 |
| 70 | 0 | 18,028 | 267,117 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 71 | 0 | 10,271 | 256,846 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 72 | 55,304 | 27,006 | 285,145 | 0 | 35,000 | 4 | 12,000 | 6 | 8,304 | 2 |
| 73 | 0 | 18,235 | 266,910 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 74 | 0 | 31,145 | 235,765 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 75 | 67,000 | 23,330 | 279,435 | 0 | 35,000 | 4 | 12,000 | 6 | 20,000 | 3 |
| 76 | 0 | 20,498 | 258,937 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 77 | 0 | 12,964 | 245,973 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 78 | 47,296 | 13,833 | 279,435 | 0 | 35,000 | 4 | 12,000 | 6 | 296 | 1 |
| 79 | 0 | 22,099 | 257,336 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80 | 0 | 30,973 | 226,363 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 81 | 67,000 | 31,165 | 262,198 | 0 | 35,000 | 4 | 12,000 | 6 | 20,000 | 3 |
| 82 | 0 | 22,788 | 239,410 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 83 | 0 | 23,751 | 215,659 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 84 | 67,000 | 28,979 | 253,680 | 0 | 35,000 | 4 | 12,000 | 6 | 20,000 | 3 |
| 85 | 0 | 20,041 | 233,639 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 86 | 0 | 24,959 | 208,681 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 87 | 58,399 | 13,399 | 253,680 | 0 | 35,000 | 4 | 12,000 | 6 | 11,399 | 2 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 88 | 0 | 23,031 | 230,649 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 89 | 0 | 12,776 | 217,873 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 90 | 55,291 | 19,484 | 253,680 | 0 | 35,000 | 4 | 12,000 | 6 | 8,291 | 2 |
| 91 | 0 | 28,455 | 225,225 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 92 | 0 | 23,960 | 201,265 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 93 | 67,000 | 26,872 | 241,393 | 0 | 35,000 | 4 | 12,000 | 6 | 20,000 | 3 |
| 94 | 0 | 31,015 | 210,378 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 95 | 0 | 27,029 | 183,349 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 96 | 67,000 | 25,158 | 225,191 | 0 | 35,000 | 4 | 12,000 | 6 | 20,000 | 3 |
| 97 | 0 | 25,731 | 199,460 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 98 | 0 | 12,157 | 187,303 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 99 | 60,633 | 22,745 | 225,191 | 0 | 35,000 | 4 | 12,000 | 6 | 13,633 | 2 |
| 100 | 0 | 30,688 | 194,503 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 4.20 Scenario 3 Costing Simulation Result

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 1 | 0 | 2,587,758,576 | 0 | 0 | 0 | 0 | 0 | 0 | 2,587,758,576 |
| 2 | 0 | 2,452,266,805 | 0 | 0 | 0 | 0 | 0 | 0 | 2,452,266,805 |
| 3 | 0 | 2,703,204,000 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 6,117,465 | 1,900,000 | 2,769,821,465 |
| 4 | 0 | 2,500,398,284 | 0 | 0 | 0 | 0 | 0 | 0 | 2,500,398,284 |
| 5 | 0 | 2,288,668,759 | 0 | 0 | 0 | 0 | 0 | 0 | 2,288,668,759 |
| 6 | 0 | 2,624,625,381 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 40,000,000 | 5,700,000 | 2,728,925,381 |
| 7 | 0 | 2,508,153,919 | 0 | 0 | 0 | 0 | 0 | 0 | 2,508,153,919 |
| 8 | 0 | 2,460,126,288 | 0 | 0 | 0 | 0 | 0 | 0 | 2,460,126,288 |
| 9 | 0 | 2,624,625,381 | 31,500,000 | 10,000,000 | 1,569,368 | 750,000 | 0 | 0 | 2,668,444,749 |
| 10 | 0 | 2,415,462,922 | 0 | 0 | 0 | 0 | 0 | 0 | 2,415,462,922 |
| 11 | 0 | 2,251,982,852 | 0 | 0 | 0 | 0 | 0 | 0 | 2,251,982,852 |
| 12 | 0 | 2,619,371,352 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 40,000,000 | 5,700,000 | 2,723,671,352 |
| 13 | 0 | 2,481,530,733 | 0 | 0 | 0 | 0 | 0 | 0 | 2,481,530,733 |
| 14 | 0 | 2,383,527,642 | 0 | 0 | 0 | 0 | 0 | 0 | 2,383,527,642 |
| 15 | 0 | 2,619,371,352 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 2,479,420 | 1,900,000 | 2,682,350,773 |
| 16 | 0 | 2,564,074,772 | 0 | 0 | 0 | 0 | 0 | 0 | 2,564,074,772 |
| 17 | 0 | 2,411,918,895 | 0 | 0 | 0 | 0 | 0 | 0 | 2,411,918,895 |
| 18 | 0 | 2,619,371,352 | 31,500,000 | 10,000,000 | 12,519,352 | 4,500,000 | 0 | 0 | 2,677,890,705 |
| 19 | 0 | 2,481,380,851 | 0 | 0 | 0 | 0 | 0 | 0 | 2,481,380,851 |
| 20 | 0 | 2,389,877,271 | 0 | 0 | 0 | 0 | 0 | 0 | 2,389,877,271 |
| 21 | 0 | 2,619,371,352 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 438,363 | 1,900,000 | 2,680,309,716 |
| 22 | 0 | 2,404,476,908 | 0 | 0 | 0 | 0 | 0 | 0 | 2,404,476,908 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 23 | 0 | 2,225,282,124 | 0 | 0 | 0 | 0 | 0 | 0 | 2,225,282,124 |
| 24 | 0 | 2,562,707,493 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 40,000,000 | 5,700,000 | 2,667,007,493 |
| 25 | 0 | 2,436,278,712 | 0 | 0 | 0 | 0 | 0 | 0 | 2,436,278,712 |
| 26 | 0 | 2,239,584,141 | 0 | 0 | 0 | 0 | 0 | 0 | 2,239,584,141 |
| 27 | 0 | 2,562,707,493 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 32,730,256 | 5,700,000 | 2,659,737,749 |
| 28 | 0 | 2,390,678,827 | 0 | 0 | 0 | 0 | 0 | 0 | 2,390,678,827 |
| 29 | 0 | 2,157,740,668 | 0 | 0 | 0 | 0 | 0 | 0 | 2,157,740,668 |
| 30 | 0 | 2,400,855,752 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 40,000,000 | 5,700,000 | 2,505,155,752 |
| 31 | 0 | 2,242,032,367 | 0 | 0 | 0 | 0 | 0 | 0 | 2,242,032,367 |
| 32 | 0 | 2,076,312,616 | 0 | 0 | 0 | 0 | 0 | 0 | 2,076,312,616 |
| 33 | 0 | 2,400,855,752 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 4,743,237 | 1,900,000 | 2,466,098,989 |
| 34 | 0 | 2,177,826,905 | 0 | 0 | 0 | 0 | 0 | 0 | 2,177,826,905 |
| 35 | 0 | 2,056,154,292 | 0 | 0 | 0 | 0 | 0 | 0 | 2,056,154,292 |
| 36 | 0 | 2,331,401,881 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 40,000,000 | 5,700,000 | 2,435,701,881 |
| 37 | 0 | 2,250,476,731 | 0 | 0 | 0 | 0 | 0 | 0 | 2,250,476,731 |
| 38 | 0 | 2,042,868,094 | 0 | 0 | 0 | 0 | 0 | 0 | 2,042,868,094 |
| 39 | 0 | 2,331,401,881 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 25,138,466 | 3,800,000 | 2,418,940,346 |
| 40 | 0 | 2,138,731,944 | 0 | 0 | 0 | 0 | 0 | 0 | 2,138,731,944 |
| 41 | 0 | 2,053,953,983 | 0 | 0 | 0 | 0 | 0 | 0 | 2,053,953,983 |
| 42 | 0 | 2,331,401,881 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 30,142,060 | 5,700,000 | 2,425,843,941 |
| 43 | 0 | 2,155,284,132 | 0 | 0 | 0 | 0 | 0 | 0 | 2,155,284,132 |
| 44 | 0 | 2,073,433,265 | 0 | 0 | 0 | 0 | 0 | 0 | 2,073,433,265 |
| 45 | 0 | 2,316,990,282 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 40,000,000 | 5,700,000 | 2,421,290,282 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 46 | 0 | 2,060,100,654 | 0 | 0 | 0 | 0 | 0 | 0 | 2,060,100,654 |
| 47 | 0 | 1,929,475,894 | 0 | 0 | 0 | 0 | 0 | 0 | 1,929,475,894 |
| 48 | 0 | 2,211,997,573 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 40,000,000 | 5,700,000 | 2,316,297,573 |
| 49 | 0 | 2,087,207,989 | 0 | 0 | 0 | 0 | 0 | 0 | 2,087,207,989 |
| 50 | 0 | 1,785,250,207 | 0 | 0 | 0 | 0 | 0 | 0 | 1,785,250,207 |
| 51 | 0 | 2,053,643,039 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 40,000,000 | 5,700,000 | 2,157,943,039 |
| 52 | 0 | 1,802,782,650 | 0 | 0 | 0 | 0 | 0 | 0 | 1,802,782,650 |
| 53 | 0 | 1,605,594,969 | 0 | 0 | 0 | 0 | 0 | 0 | 1,605,594,969 |
| 54 | 0 | 1,998,942,652 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 40,000,000 | 5,700,000 | 2,103,242,652 |
| 55 | 0 | 1,823,071,459 | 0 | 0 | 0 | 0 | 0 | 0 | 1,823,071,459 |
| 56 | 0 | 1,695,844,423 | 0 | 0 | 0 | 0 | 0 | 0 | 1,695,844,423 |
| 57 | 0 | 1,998,942,652 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 20,976,069 | 3,800,000 | 2,082,318,721 |
| 58 | 0 | 1,811,680,425 | 0 | 0 | 0 | 0 | 0 | 0 | 1,811,680,425 |
| 59 | 0 | 1,706,713,889 | 0 | 0 | 0 | 0 | 0 | 0 | 1,706,713,889 |
| 60 | 0 | 1,998,942,652 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 29,946,408 | 3,800,000 | 2,091,289,060 |
| 61 | 0 | 1,796,264,280 | 0 | 0 | 0 | 0 | 0 | 0 | 1,796,264,280 |
| 62 | 0 | 1,672,997,908 | 0 | 0 | 0 | 0 | 0 | 0 | 1,672,997,908 |
| 63 | 0 | 1,998,942,652 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 31,842,118 | 5,700,000 | 2,095,084,770 |
| 64 | 0 | 1,761,168,332 | 0 | 0 | 0 | 0 | 0 | 0 | 1,761,168,332 |
| 65 | 0 | 1,700,963,608 | 0 | 0 | 0 | 0 | 0 | 0 | 1,700,963,608 |
| 66 | 0 | 1,998,942,652 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 10,367,644 | 1,900,000 | 2,069,810,296 |
| 67 | 0 | 1,831,787,693 | 0 | 0 | 0 | 0 | 0 | 0 | 1,831,787,693 |
| 68 | 0 | 1,636,156,824 | 0 | 0 | 0 | 0 | 0 | 0 | 1,636,156,824 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 69 | 0 | 1,996,013,081 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 40,000,000 | 5,700,000 | 2,100,313,081 |
| 70 | 0 | 1,869,818,659 | 0 | 0 | 0 | 0 | 0 | 0 | 1,869,818,659 |
| 71 | 0 | 1,797,924,453 | 0 | 0 | 0 | 0 | 0 | 0 | 1,797,924,453 |
| 72 | 0 | 1,996,013,081 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 16,607,874 | 3,800,000 | 2,075,020,954 |
| 73 | 0 | 1,868,367,308 | 0 | 0 | 0 | 0 | 0 | 0 | 1,868,367,308 |
| 74 | 0 | 1,650,353,978 | 0 | 0 | 0 | 0 | 0 | 0 | 1,650,353,978 |
| 75 | 0 | 1,956,045,971 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 40,000,000 | 5,700,000 | 2,060,345,971 |
| 76 | 0 | 1,812,558,500 | 0 | 0 | 0 | 0 | 0 | 0 | 1,812,558,500 |
| 77 | 0 | 1,721,810,129 | 0 | 0 | 0 | 0 | 0 | 0 | 1,721,810,129 |
| 78 | 0 | 1,956,045,971 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 591,294 | 1,900,000 | 2,017,137,265 |
| 79 | 0 | 1,801,352,084 | 0 | 0 | 0 | 0 | 0 | 0 | 1,801,352,084 |
| 80 | 0 | 1,584,539,723 | 0 | 0 | 0 | 0 | 0 | 0 | 1,584,539,723 |
| 81 | 0 | 1,835,385,778 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 40,000,000 | 5,700,000 | 1,939,685,778 |
| 82 | 0 | 1,675,866,611 | 0 | 0 | 0 | 0 | 0 | 0 | 1,675,866,611 |
| 83 | 0 | 1,509,611,661 | 0 | 0 | 0 | 0 | 0 | 0 | 1,509,611,661 |
| 84 | 0 | 1,775,760,986 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 40,000,000 | 5,700,000 | 1,880,060,986 |
| 85 | 0 | 1,635,475,084 | 0 | 0 | 0 | 0 | 0 | 0 | 1,635,475,084 |
| 86 | 0 | 1,460,764,564 | 0 | 0 | 0 | 0 | 0 | 0 | 1,460,764,564 |
| 87 | 0 | 1,775,760,986 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 22,797,764 | 3,800,000 | 1,860,958,751 |
| 88 | 0 | 1,614,545,348 | 0 | 0 | 0 | 0 | 0 | 0 | 1,614,545,348 |
| 89 | 0 | 1,525,112,854 | 0 | 0 | 0 | 0 | 0 | 0 | 1,525,112,854 |
| 90 | 0 | 1,775,760,986 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 16,581,636 | 3,800,000 | 1,854,742,623 |
| 91 | 0 | 1,576,573,364 | 0 | 0 | 0 | 0 | 0 | 0 | 1,576,573,364 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 92 | 0 | 1,408,854,688 | 0 | 0 | 0 | 0 | 0 | 0 | 1,408,854,688 |
| 93 | 0 | 1,689,753,313 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 40,000,000 | 5,700,000 | 1,794,053,313 |
| 94 | 0 | 1,472,646,927 | 0 | 0 | 0 | 0 | 0 | 0 | 1,472,646,927 |
| 95 | 0 | 1,283,445,620 | 0 | 0 | 0 | 0 | 0 | 0 | 1,283,445,620 |
| 96 | 0 | 1,576,337,557 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 40,000,000 | 5,700,000 | 1,680,637,557 |
| 97 | 0 | 1,396,217,653 | 0 | 0 | 0 | 0 | 0 | 0 | 1,396,217,653 |
| 98 | 0 | 1,311,121,395 | 0 | 0 | 0 | 0 | 0 | 0 | 1,311,121,395 |
| 99 | 0 | 1,576,337,557 | 31,500,000 | 10,000,000 | 12,600,000 | 4,500,000 | 27,266,638 | 3,800,000 | 1,666,004,195 |
| 100 | 0 | 1,361,522,746 | 0 | 0 | 0 | 0 | 0 | 0 | 1,361,522,746 |

From the table, it can be seen that the supply chain cost for PT. Rakabu Sejahtera and its suppliers is obtained from the holding cost in PT. Rakabu Sejahtera, production cost in Supplier A, Supplier B, and UD. Trenggalek Lestari, and delivery cost in Supplier A, Supplier B, and UD. Trenggalek Lestari. For this scenario, there is no shortage happens for the system, so the shortage cost will be Rp 0. The holding cost includes the maintenance cost, salary for workers, and building cost. The production cost includes the salary for workers for cutting down the tree, loading cost, and materials' purchasing. The delivery cost includes the drivers fee, unloading cost, and fuel cost. Thus, the average supply chain cost of the scenario can be calculated. For scenario 3, the average supply chain cost is Rp 2,061,199,260.

4. Scenario 4

Scenario 4 is suppliers deliver raw material to PT. Rakabu Sejahtera everyday based on the random number generation result of each suppliers' historical data. According to the pattern of historical data, by using Microsoft Excel, it will be generated the random number of supply quantity for Supplier A, Supplier B, and UD. Trenggalek Lestari. The result of Scenario 4 system can be seen in Table 4.21 while Scenario 4 costing result can be seen in Table 4.22 below:

Table 4.21 Scenario 4 System Simulation Result

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 1 | 22,020 | 16,492 | 369,680 | 0 | 20,187 | 3 | 1,833 | 1 | 0 | 0 |
| 2 | 10,963 | 19,356 | 361,287 | 0 | 7,471 | 1 | 2,520 | 2 | 972 | 1 |
| 3 | 25,769 | 14,211 | 372,846 | 0 | 15,789 | 2 | 4,492 | 3 | 5,488 | 1 |
| 4 | 16,484 | 28,972 | 360,358 | 0 | 14,341 | 2 | 0 | 0 | 2,143 | 1 |
| 5 | 17,591 | 30,247 | 347,702 | 0 | 4,125 | 1 | 3,164 | 2 | 10,302 | 2 |
| 6 | 18,595 | 19,006 | 347,291 | 0 | 7,926 | 1 | 0 | 0 | 10,669 | 2 |
| 7 | 18,938 | 16,639 | 349,590 | 0 | 5,118 | 1 | 2,496 | 2 | 11,323 | 2 |
| 8 | 21,756 | 6,861 | 364,485 | 0 | 13,770 | 2 | 5,407 | 3 | 2,579 | 1 |
| 9 | 25,689 | 12,995 | 377,179 | 0 | 17,116 | 2 | 3,381 | 2 | 5,193 | 1 |
| 10 | 22,457 | 29,880 | 369,756 | 0 | 12,527 | 2 | 4,617 | 3 | 5,314 | 1 |
| 11 | 18,874 | 23,354 | 365,276 | 0 | 14,029 | 2 | 4,845 | 3 | 0 | 0 |
| 12 | 10,058 | 14,516 | 360,818 | 0 | 6,412 | 1 | 0 | 0 | 3,646 | 1 |
| 13 | 13,713 | 19,692 | 354,840 | 0 | 12,601 | 2 | 583 | 1 | 529 | 1 |
| 14 | 10,899 | 14,000 | 351,738 | 0 | 5,821 | 1 | 733 | 1 | 4,345 | 1 |
| 15 | 25,832 | 14,548 | 363,022 | 0 | 15,804 | 2 | 3,678 | 2 | 6,350 | 1 |
| 16 | 18,006 | 7,900 | 373,128 | 0 | 8,538 | 1 | 3,852 | 2 | 5,616 | 1 |
| 17 | 21,990 | 21,737 | 373,382 | 0 | 12,351 | 2 | 3,541 | 2 | 6,098 | 1 |
| 18 | 21,100 | 17,287 | 377,195 | 0 | 10,719 | 2 | 7,470 | 4 | 2,911 | 1 |
| 19 | 27,682 | 19,713 | 385,163 | 0 | 19,687 | 2 | 5,972 | 3 | 2,022 | 1 |
| 20 | 11,061 | 13,072 | 383,152 | 0 | 9,777 | 1 | 0 | 0 | 1,284 | 1 |
| 21 | 16,428 | 14,434 | 385,145 | 0 | 11,316 | 2 | 443 | 1 | 4,668 | 1 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 22 | 25,675 | 30,699 | 380,121 | 0 | 12,788 | 2 | 6,267 | 3 | 6,620 | 1 |
| 23 | 22,808 | 25,599 | 377,329 | 0 | 18,157 | 2 | 3,549 | 2 | 1,102 | 1 |
| 24 | 17,348 | 18,796 | 375,881 | 0 | 10,753 | 2 | 872 | 1 | 5,723 | 1 |
| 25 | 20,696 | 18,061 | 378,515 | 0 | 14,892 | 2 | 2,874 | 2 | 2,929 | 1 |
| 26 | 2,834 | 28,099 | 353,250 | 0 | 219 | 1 | 942 | 1 | 1,673 | 1 |
| 27 | 34,964 | 17,205 | 371,009 | 0 | 26,856 | 3 | 1,310 | 1 | 6,797 | 1 |
| 28 | 20,774 | 24,576 | 367,208 | 0 | 19,877 | 2 | 542 | 1 | 356 | 1 |
| 29 | 15,459 | 33,277 | 349,391 | 0 | 9,428 | 1 | 6,031 | 3 | 0 | 0 |
| 30 | 22,833 | 32,269 | 339,954 | 0 | 8,480 | 1 | 5,761 | 3 | 8,592 | 2 |
| 31 | 37,317 | 22,689 | 354,582 | 0 | 13,521 | 2 | 5,521 | 3 | 18,274 | 3 |
| 32 | 14,449 | 23,674 | 345,357 | 0 | 6,080 | 1 | 0 | 0 | 8,369 | 2 |
| 33 | 25,422 | 3,008 | 367,770 | 0 | 24,506 | 3 | 916 | 1 | 0 | 0 |
| 34 | 23,445 | 31,861 | 359,354 | 0 | 21,474 | 3 | 1,971 | 1 | 0 | 0 |
| 35 | 13,649 | 17,382 | 355,621 | 0 | 10,337 | 2 | 3,312 | 2 | 0 | 0 |
| 36 | 21,046 | 27,679 | 348,987 | 0 | 7,664 | 1 | 39 | 1 | 13,342 | 2 |
| 37 | 12,167 | 11,561 | 349,594 | 0 | 6,885 | 1 | 0 | 0 | 5,283 | 1 |
| 38 | 31,463 | 29,658 | 351,398 | 0 | 20,112 | 3 | 3,087 | 2 | 8,263 | 2 |
| 39 | 23,922 | 18,350 | 356,970 | 0 | 16,493 | 2 | 5,420 | 3 | 2,009 | 1 |
| 40 | 36,469 | 27,524 | 365,915 | 0 | 22,837 | 3 | 464 | 1 | 13,168 | 2 |
| 41 | 5,308 | 12,111 | 359,112 | 0 | 454 | 1 | 1,274 | 1 | 3,581 | 1 |
| 42 | 19,794 | 22,436 | 356,471 | 0 | 8,916 | 1 | 3,776 | 2 | 7,102 | 1 |
| 43 | 28,469 | 25,160 | 359,780 | 0 | 21,913 | 3 | 4,588 | 3 | 1,967 | 1 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 44 | 8,657 | 11,693 | 356,744 | 0 | 6,369 | 1 | 1,736 | 1 | 552 | 1 |
| 45 | 12,936 | 32,206 | 337,474 | 0 | 6,559 | 1 | 6,376 | 4 | 0 | 0 |
| 46 | 17,715 | 36,699 | 318,490 | 0 | 11,698 | 2 | 6,017 | 3 | 0 | 0 |
| 47 | 20,054 | 18,661 | 319,883 | 0 | 4,513 | 1 | 1,488 | 1 | 14,053 | 2 |
| 48 | 23,967 | 26,640 | 317,211 | 0 | 16,834 | 2 | 730 | 1 | 6,403 | 1 |
| 49 | 23,985 | 17,827 | 323,369 | 0 | 16,078 | 2 | 1,224 | 1 | 6,683 | 1 |
| 50 | 28,698 | 43,137 | 308,930 | 0 | 24,011 | 3 | 4,687 | 3 | 0 | 0 |
| 51 | 16,815 | 28,658 | 297,087 | 0 | 7,480 | 1 | 104 | 1 | 9,231 | 2 |
| 52 | 18,916 | 35,837 | 280,166 | 0 | 16,325 | 2 | 2,592 | 2 | 0 | 0 |
| 53 | 5,954 | 28,170 | 257,951 | 0 | 3,098 | 1 | 2,856 | 2 | 0 | 0 |
| 54 | 11,192 | 10,807 | 258,335 | 0 | 6,594 | 1 | 4,598 | 3 | 0 | 0 |
| 55 | 26,977 | 25,124 | 260,188 | 0 | 9,981 | 1 | 3,423 | 2 | 13,573 | 2 |
| 56 | 22,381 | 18,175 | 264,393 | 0 | 18,891 | 2 | 3,490 | 2 | 0 | 0 |
| 57 | 19,554 | 14,188 | 269,759 | 0 | 13,581 | 2 | 0 | 0 | 5,973 | 1 |
| 58 | 28,944 | 26,752 | 271,951 | 0 | 22,862 | 3 | 1,401 | 1 | 4,681 | 1 |
| 59 | 22,584 | 14,995 | 279,540 | 0 | 14,455 | 2 | 2,367 | 2 | 5,762 | 1 |
| 60 | 18,361 | 20,226 | 277,675 | 0 | 18,361 | 2 | 0 | 0 | 0 | 0 |
| 61 | 8,285 | 28,954 | 257,005 | 0 | 6,332 | 1 | 0 | 0 | 1,953 | 1 |
| 62 | 12,766 | 17,609 | 252,162 | 0 | 3,700 | 1 | 1,808 | 1 | 7,257 | 1 |
| 63 | 15,265 | 16,358 | 251,069 | 0 | 3,661 | 1 | 2,809 | 2 | 8,795 | 2 |
| 64 | 27,686 | 33,968 | 244,787 | 0 | 18,782 | 2 | 2,979 | 2 | 5,925 | 1 |
| 65 | 9,344 | 8,601 | 245,531 | 0 | 3,691 | 1 | 1,016 | 1 | 4,637 | 1 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 66 | 14,220 | 9,615 | 250,136 | 0 | 5,733 | 1 | 6,484 | 4 | 2,003 | 1 |
| 67 | 27,952 | 23,879 | 254,208 | 0 | 5,286 | 1 | 8,013 | 4 | 14,652 | 2 |
| 68 | 27,216 | 27,947 | 253,477 | 0 | 24,455 | 3 | 0 | 0 | 2,761 | 1 |
| 69 | 9,498 | 15,592 | 247,383 | 0 | 0 | 0 | 2,257 | 2 | 7,241 | 1 |
| 70 | 10,029 | 18,028 | 239,384 | 0 | 10,029 | 2 | 0 | 0 | 0 | 0 |
| 71 | 9,036 | 10,271 | 238,150 | 0 | 8,234 | 1 | 802 | 1 | 0 | 0 |
| 72 | 26,716 | 27,006 | 237,860 | 0 | 8,531 | 1 | 5,322 | 3 | 12,863 | 2 |
| 73 | 16,556 | 18,235 | 236,180 | 0 | 13,257 | 2 | 0 | 0 | 3,299 | 1 |
| 74 | 30,357 | 31,145 | 235,392 | 0 | 17,202 | 2 | 2,543 | 2 | 10,612 | 2 |
| 75 | 9,532 | 23,330 | 221,595 | 0 | 9,532 | 1 | 0 | 0 | 0 | 0 |
| 76 | 8,402 | 20,498 | 209,498 | 0 | 5,445 | 1 | 870 | 1 | 2,087 | 1 |
| 77 | 17,150 | 12,964 | 213,685 | 0 | 13,186 | 2 | 0 | 0 | 3,964 | 1 |
| 78 | 16,109 | 13,833 | 215,960 | 0 | 8,846 | 1 | 0 | 0 | 7,263 | 1 |
| 79 | 32,913 | 22,099 | 226,774 | 0 | 13,945 | 2 | 5,356 | 3 | 13,612 | 2 |
| 80 | 10,457 | 30,973 | 206,258 | 0 | 2,984 | 1 | 6,548 | 4 | 926 | 1 |
| 81 | 22,079 | 31,165 | 197,172 | 0 | 14,799 | 2 | 0 | 0 | 7,279 | 1 |
| 82 | 29,604 | 22,788 | 203,988 | 0 | 16,329 | 2 | 7,317 | 4 | 5,958 | 1 |
| 83 | 10,380 | 23,751 | 190,617 | 0 | 5,863 | 1 | 4,163 | 2 | 354 | 1 |
| 84 | 12,445 | 28,979 | 174,083 | 0 | 10,312 | 2 | 2,133 | 2 | 0 | 0 |
| 85 | 36,826 | 20,041 | 190,868 | 0 | 22,374 | 3 | 3,180 | 2 | 11,272 | 2 |
| 86 | 15,866 | 24,959 | 181,776 | 0 | 7,254 | 1 | 5,070 | 3 | 3,543 | 1 |
| 87 | 21,797 | 13,399 | 190,174 | 0 | 17,201 | 2 | 3,608 | 2 | 989 | 1 |

| Day | Total Material Arrived (pcs) | Demand (pcs) | Inventory in PT. Rakabu Sejahtera (pcs) | Shortage (pcs) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 88 | 19,468 | 23,031 | 186,611 | 0 | 10,962 | 2 | 6,635 | 4 | 1,871 | 1 |
| 89 | 10,723 | 12,776 | 184,558 | 0 | 3,237 | 1 | 1,169 | 1 | 6,316 | 1 |
| 90 | 20,291 | 19,484 | 185,366 | 0 | 13,726 | 2 | 6,466 | 4 | 99 | 1 |
| 91 | 14,166 | 28,455 | 171,076 | 0 | 0 | 0 | 2,481 | 2 | 11,685 | 2 |
| 92 | 26,845 | 23,960 | 173,961 | 0 | 21,380 | 3 | 0 | 0 | 5,465 | 1 |
| 93 | 23,388 | 26,872 | 170,478 | 0 | 6,499 | 1 | 3,378 | 2 | 13,511 | 2 |
| 94 | 26,092 | 31,015 | 165,554 | 0 | 14,596 | 2 | 1,869 | 1 | 9,627 | 2 |
| 95 | 17,454 | 27,029 | 155,979 | 0 | 14,862 | 2 | 2,592 | 2 | 0 | 0 |
| 96 | 9,202 | 25,158 | 140,023 | 0 | 3,044 | 1 | 0 | 0 | 6,158 | 1 |
| 97 | 24,705 | 25,731 | 138,996 | 0 | 22,663 | 3 | 2,042 | 1 | 0 | 0 |
| 98 | 18,461 | 12,157 | 145,301 | 0 | 10,483 | 2 | 434 | 1 | 7,544 | 2 |
| 99 | 10,169 | 22,745 | 132,725 | 0 | 8,599 | 1 | 1,339 | 1 | 231 | 1 |
| 100 | 14,123 | 30,688 | 116,161 | 0 | 8,970 | 1 | 3,265 | 2 | 1,889 | 1 |

Table 4.22 Scenario 4 Costing Simulation Result

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delievry Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 1 | 0 | 2,587,758,576 | 18,168,480 | 7,500,000 | 1,924,384 | 750,000 | 0 | 0 | 2,616,101,440 |
| 2 | 0 | 2,529,010,982 | 6,723,960 | 2,500,000 | 2,646,004 | 1,500,000 | 1,944,766 | 1,900,000 | 2,546,225,712 |
| 3 | 0 | 2,609,921,535 | 14,210,024 | 5,000,000 | 4,716,915 | 2,250,000 | 10,975,993 | 1,900,000 | 2,648,974,467 |
| 4 | 0 | 2,522,506,765 | 12,906,867 | 5,000,000 | 0 | 0 | 4,286,915 | 1,900,000 | 2,546,600,547 |
| 5 | 0 | 2,433,917,482 | 3,712,918 | 2,500,000 | 3,322,029 | 1,500,000 | 20,604,324 | 3,800,000 | 2,469,356,753 |
| 6 | 0 | 2,431,037,188 | 7,133,466 | 2,500,000 | 0 | 0 | 21,337,305 | 3,800,000 | 2,465,807,959 |
| 7 | 0 | 2,447,128,279 | 4,606,097 | 2,500,000 | 2,621,126 | 1,500,000 | 22,646,623 | 3,800,000 | 2,484,802,125 |
| 8 | 0 | 2,551,394,813 | 12,393,438 | 5,000,000 | 5,677,561 | 2,250,000 | 5,157,244 | 1,900,000 | 2,583,773,055 |
| 9 | 0 | 2,640,254,191 | 15,403,957 | 5,000,000 | 3,549,719 | 1,500,000 | 10,385,539 | 1,900,000 | 2,677,993,407 |
| 10 | 0 | 2,588,292,620 | 11,274,230 | 5,000,000 | 4,847,628 | 2,250,000 | 10,627,117 | 1,900,000 | 2,624,191,595 |
| 11 | 0 | 2,556,933,725 | 12,626,292 | 5,000,000 | 5,087,502 | 2,250,000 | 0 | 0 | 2,581,897,519 |
| 12 | 0 | 2,525,729,172 | 5,771,079 | 2,500,000 | 0 | 0 | 7,291,651 | 1,900,000 | 2,543,191,902 |
| 13 | 0 | 2,483,877,251 | 11,341,063 | 5,000,000 | 612,008 | 750,000 | 1,057,250 | 1,900,000 | 2,504,537,573 |
| 14 | 0 | 2,462,165,016 | 5,239,046 | 2,500,000 | 769,228 | 750,000 | 8,689,866 | 1,900,000 | 2,482,013,157 |
| 15 | 0 | 2,541,151,513 | 14,223,523 | 5,000,000 | 3,861,797 | 1,500,000 | 12,699,441 | 1,900,000 | 2,580,336,274 |
| 16 | 0 | 2,611,894,234 | 7,684,168 | 2,500,000 | 4,044,444 | 1,500,000 | 11,231,599 | 1,900,000 | 2,640,754,444 |
| 17 | 0 | 2,613,671,124 | 11,116,153 | 5,000,000 | 3,718,094 | 1,500,000 | 12,196,145 | 1,900,000 | 2,649,101,516 |
| 18 | 0 | 2,640,361,659 | 9,647,330 | 5,000,000 | 7,843,306 | 3,000,000 | 5,821,980 | 1,900,000 | 2,673,574,275 |
| 19 | 0 | 2,696,143,236 | 17,718,296 | 5,000,000 | 6,271,108 | 2,250,000 | 4,044,493 | 1,900,000 | 2,733,327,133 |
| 20 | 0 | 2,682,065,881 | 8,799,243 | 2,500,000 | 0 | 0 | 2,567,904 | 1,900,000 | 2,697,833,028 |
| 21 | 0 | 2,696,018,450 | 10,184,758 | 5,000,000 | 465,319 | 750,000 | 9,335,957 | 1,900,000 | 2,723,654,483 |
| 22 | 0 | 2,660,846,112 | 11,508,827 | 5,000,000 | 6,580,600 | 2,250,000 | 13,239,526 | 1,900,000 | 2,701,325,065 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delievry Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 23 | 0 | 2,641,305,328 | 16,341,067 | 5,000,000 | 3,726,884 | 1,500,000 | 2,203,121 | 1,900,000 | 2,671,976,400 |
| 24 | 0 | 2,631,167,584 | 9,677,617 | 5,000,000 | 915,459 | 750,000 | 11,446,707 | 1,900,000 | 2,660,857,366 |
| 25 | 0 | 2,649,607,320 | 13,402,746 | 5,000,000 | 3,017,867 | 1,500,000 | 5,858,807 | 1,900,000 | 2,680,286,740 |
| 26 | 0 | 2,472,752,282 | 196,898 | 2,500,000 | 989,190 | 750,000 | 3,346,715 | 1,900,000 | 2,482,435,086 |
| 27 | 0 | 2,597,065,938 | 24,170,393 | 7,500,000 | 1,375,790 | 750,000 | 13,594,949 | 1,900,000 | 2,646,357,070 |
| 28 | 0 | 2,570,456,984 | 17,889,008 | 5,000,000 | 568,879 | 750,000 | 711,558 | 1,900,000 | 2,597,276,429 |
| 29 | 0 | 2,445,735,242 | 8,485,237 | 2,500,000 | 6,333,019 | 2,250,000 | 0 | 0 | 2,465,303,499 |
| 30 | 0 | 2,379,678,593 | 7,631,879 | 2,500,000 | 6,048,733 | 2,250,000 | 17,184,090 | 3,800,000 | 2,419,093,296 |
| 31 | 0 | 2,482,071,030 | 12,168,927 | 5,000,000 | 5,797,505 | 2,250,000 | 36,548,165 | 5,700,000 | 2,549,535,627 |
| 32 | 0 | 2,417,496,538 | 5,472,133 | 2,500,000 | 0 | 0 | 16,738,350 | 3,800,000 | 2,446,007,022 |
| 33 | 0 | 2,574,391,300 | 22,055,100 | 7,500,000 | 961,994 | 750,000 | 0 | 0 | 2,605,658,393 |
| 34 | 0 | 2,515,474,841 | 19,326,317 | 7,500,000 | 2,069,488 | 750,000 | 0 | 0 | 2,545,120,646 |
| 35 | 0 | 2,489,345,128 | 9,302,979 | 5,000,000 | 3,477,959 | 1,500,000 | 0 | 0 | 2,508,626,067 |
| 36 | 0 | 2,442,911,291 | 6,897,809 | 2,500,000 | 40,981 | 750,000 | 26,684,497 | 3,800,000 | 2,483,584,579 |
| 37 | 0 | 2,447,157,152 | 6,196,299 | 2,500,000 | 0 | 0 | 10,565,022 | 1,900,000 | 2,468,318,473 |
| 38 | 0 | 2,459,788,079 | 18,100,994 | 7,500,000 | 3,241,527 | 1,500,000 | 16,526,823 | 3,800,000 | 2,510,457,422 |
| 39 | 0 | 2,498,792,421 | 14,843,497 | 5,000,000 | 5,691,450 | 2,250,000 | 4,017,934 | 1,900,000 | 2,532,495,301 |
| 40 | 0 | 2,561,403,824 | 20,553,195 | 7,500,000 | 487,145 | 750,000 | 26,335,864 | 3,800,000 | 2,620,830,028 |
| 41 | 0 | 2,513,784,251 | 408,230 | 2,500,000 | 1,337,460 | 750,000 | 7,161,962 | 1,900,000 | 2,527,841,902 |
| 42 | 0 | 2,495,293,767 | 8,024,147 | 2,500,000 | 3,965,007 | 1,500,000 | 14,204,405 | 1,900,000 | 2,527,387,326 |
| 43 | 0 | 2,518,457,177 | 19,721,853 | 7,500,000 | 4,817,560 | 2,250,000 | 3,934,829 | 1,900,000 | 2,558,581,420 |
| 44 | 0 | 2,497,207,976 | 5,732,493 | 2,500,000 | 1,822,648 | 750,000 | 1,104,179 | 1,900,000 | 2,511,017,296 |
| 45 | 0 | 2,362,314,632 | 5,903,249 | 2,500,000 | 6,695,322 | 3,000,000 | 0 | 0 | 2,380,413,203 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delievry Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 46 | 0 | 2,229,430,571 | 10,528,637 | 5,000,000 | 6,317,426 | 2,250,000 | 0 | 0 | 2,253,526,633 |
| 47 | 0 | 2,239,181,465 | 4,061,618 | 2,500,000 | 1,562,420 | 750,000 | 28,105,474 | 3,800,000 | 2,279,960,977 |
| 48 | 0 | 2,220,474,583 | 15,150,220 | 5,000,000 | 766,787 | 750,000 | 12,806,995 | 1,900,000 | 2,256,848,585 |
| 49 | 0 | 2,263,581,799 | 14,470,362 | 5,000,000 | 1,285,621 | 750,000 | 13,365,353 | 1,900,000 | 2,300,353,135 |
| 50 | 0 | 2,162,512,670 | 21,610,246 | 7,500,000 | 4,921,345 | 2,250,000 | 0 | 0 | 2,198,794,260 |
| 51 | 0 | 2,079,609,888 | 6,732,194 | 2,500,000 | 109,350 | 750,000 | 18,461,108 | 3,800,000 | 2,111,962,540 |
| 52 | 0 | 1,961,164,725 | 14,692,078 | 5,000,000 | 2,721,527 | 1,500,000 | 0 | 0 | 1,985,078,329 |
| 53 | 0 | 1,805,656,238 | 2,788,472 | 2,500,000 | 2,998,662 | 1,500,000 | 0 | 0 | 1,815,443,372 |
| 54 | 0 | 1,808,346,067 | 5,934,733 | 2,500,000 | 4,827,466 | 2,250,000 | 0 | 0 | 1,823,858,266 |
| 55 | 0 | 1,821,313,948 | 8,982,881 | 2,500,000 | 3,594,672 | 1,500,000 | 27,145,070 | 3,800,000 | 1,868,836,571 |
| 56 | 0 | 1,850,751,834 | 17,001,856 | 5,000,000 | 3,664,239 | 1,500,000 | 0 | 0 | 1,877,917,929 |
| 57 | 0 | 1,888,314,349 | 12,223,190 | 5,000,000 | 0 | 0 | 11,946,077 | 1,900,000 | 1,919,383,616 |
| 58 | 0 | 1,903,657,017 | 20,576,039 | 7,500,000 | 1,470,672 | 750,000 | 9,361,302 | 1,900,000 | 1,945,215,029 |
| 59 | 0 | 1,956,778,480 | 13,009,171 | 5,000,000 | 2,485,650 | 1,500,000 | 11,524,160 | 1,900,000 | 1,992,197,460 |
| 60 | 0 | 1,943,724,359 | 16,525,227 | 5,000,000 | 0 | 0 | 0 | 0 | 1,965,249,586 |
| 61 | 0 | 1,799,038,009 | 5,698,437 | 2,500,000 | 0 | 0 | 3,905,955 | 1,900,000 | 1,813,042,401 |
| 62 | 0 | 1,765,131,678 | 3,330,249 | 2,500,000 | 1,898,860 | 750,000 | 14,514,011 | 1,900,000 | 1,790,024,798 |
| 63 | 0 | 1,757,485,392 | 3,294,567 | 2,500,000 | 2,949,563 | 1,500,000 | 17,590,919 | 3,800,000 | 1,789,120,441 |
| 64 | 0 | 1,713,511,742 | 16,904,105 | 5,000,000 | 3,127,613 | 1,500,000 | 11,849,584 | 1,900,000 | 1,753,793,044 |
| 65 | 0 | 1,718,717,546 | 3,321,652 | 2,500,000 | 1,067,078 | 750,000 | 9,274,744 | 1,900,000 | 1,737,531,020 |
| 66 | 0 | 1,750,950,431 | 5,159,899 | 2,500,000 | 6,808,492 | 3,000,000 | 4,005,172 | 1,900,000 | 1,774,323,994 |
| 67 | 0 | 1,779,457,866 | 4,757,566 | 2,500,000 | 8,413,915 | 3,000,000 | 29,304,667 | 3,800,000 | 1,831,234,014 |
| 68 | 0 | 1,774,341,387 | 22,009,731 | 7,500,000 | 0 | 0 | 5,522,169 | 1,900,000 | 1,811,273,287 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delievry Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 69 | 0 | 1,731,681,369 | 0 | 0 | 2,369,627 | 1,500,000 | 14,481,774 | 1,900,000 | 1,751,932,770 |
| 70 | 0 | 1,675,688,703 | 9,025,940 | 5,000,000 | 0 | 0 | 0 | 0 | 1,689,714,643 |
| 71 | 0 | 1,667,046,816 | 7,410,861 | 2,500,000 | 841,843 | 750,000 | 0 | 0 | 1,678,549,521 |
| 72 | 0 | 1,665,016,758 | 7,678,032 | 2,500,000 | 5,587,713 | 2,250,000 | 25,725,551 | 3,800,000 | 1,712,558,053 |
| 73 | 0 | 1,653,260,919 | 11,931,447 | 5,000,000 | 0 | 0 | 6,597,082 | 1,900,000 | 1,678,689,448 |
| 74 | 0 | 1,647,743,660 | 15,481,406 | 5,000,000 | 2,670,138 | 1,500,000 | 21,224,061 | 3,800,000 | 1,697,419,266 |
| 75 | 0 | 1,551,162,523 | 8,579,169 | 2,500,000 | 0 | 0 | 0 | 0 | 1,562,241,692 |
| 76 | 0 | 1,466,486,854 | 4,900,541 | 2,500,000 | 913,390 | 750,000 | 4,173,491 | 1,900,000 | 1,481,624,276 |
| 77 | 0 | 1,495,791,589 | 11,867,432 | 5,000,000 | 0 | 0 | 7,928,816 | 1,900,000 | 1,522,487,837 |
| 78 | 0 | 1,511,722,273 | 7,961,729 | 2,500,000 | 0 | 0 | 14,525,660 | 1,900,000 | 1,538,609,663 |
| 79 | 0 | 1,587,420,879 | 12,550,230 | 5,000,000 | 5,624,302 | 2,250,000 | 27,224,070 | 3,800,000 | 1,643,869,481 |
| 80 | 0 | 1,443,807,129 | 2,685,159 | 2,500,000 | 6,874,911 | 3,000,000 | 1,851,802 | 1,900,000 | 1,462,619,001 |
| 81 | 0 | 1,380,203,260 | 13,319,256 | 5,000,000 | 0 | 0 | 14,558,818 | 1,900,000 | 1,414,981,334 |
| 82 | 0 | 1,427,913,822 | 14,696,347 | 5,000,000 | 7,682,417 | 3,000,000 | 11,916,768 | 1,900,000 | 1,472,109,355 |
| 83 | 0 | 1,334,319,269 | 5,276,529 | 2,500,000 | 4,371,649 | 1,500,000 | 707,543 | 1,900,000 | 1,350,574,990 |
| 84 | 0 | 1,218,580,307 | 9,280,534 | 5,000,000 | 2,239,467 | 1,500,000 | 0 | 0 | 1,236,600,308 |
| 85 | 0 | 1,336,076,219 | 20,136,268 | 7,500,000 | 3,339,190 | 1,500,000 | 22,544,325 | 3,800,000 | 1,394,896,001 |
| 86 | 0 | 1,272,430,478 | 6,528,530 | 2,500,000 | 5,323,274 | 2,250,000 | 7,085,378 | 1,900,000 | 1,298,017,661 |
| 87 | 0 | 1,331,216,802 | 15,480,840 | 5,000,000 | 3,788,077 | 1,500,000 | 1,977,629 | 1,900,000 | 1,360,863,347 |
| 88 | 0 | 1,306,280,043 | 9,866,046 | 5,000,000 | 6,967,178 | 3,000,000 | 3,741,459 | 1,900,000 | 1,336,754,727 |
| 89 | 0 | 1,291,909,100 | 2,913,685 | 2,500,000 | 1,227,757 | 750,000 | 12,632,717 | 1,900,000 | 1,313,833,260 |
| 90 | 0 | 1,297,559,045 | 12,353,791 | 5,000,000 | 6,788,941 | 3,000,000 | 197,969 | 1,900,000 | 1,326,799,745 |
| 91 | 0 | 1,197,534,061 | 0 | 0 | 2,605,508 | 1,500,000 | 23,369,311 | 3,800,000 | 1,228,808,879 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delievry Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 92 | 0 | 1,217,728,287 | 19,241,956 | 7,500,000 | 0 | 0 | 10,929,499 | 1,900,000 | 1,257,299,742 |
| 93 | 0 | 1,193,342,838 | 5,849,152 | 2,500,000 | 3,547,242 | 1,500,000 | 27,021,212 | 3,800,000 | 1,237,560,444 |
| 94 | 0 | 1,158,880,204 | 13,136,555 | 5,000,000 | 1,962,555 | 750,000 | 19,253,384 | 3,800,000 | 1,202,782,698 |
| 95 | 0 | 1,091,855,840 | 13,375,727 | 5,000,000 | 2,721,527 | 1,500,000 | 0 | 0 | 1,114,453,093 |
| 96 | 0 | 980,161,717 | 2,739,908 | 2,500,000 | 0 | 0 | 12,315,298 | 1,900,000 | 999,616,923 |
| 97 | 0 | 972,974,390 | 20,396,264 | 7,500,000 | 2,144,245 | 750,000 | 0 | 0 | 1,003,764,899 |
| 98 | 0 | 1,017,107,940 | 9,434,829 | 5,000,000 | 455,503 | 750,000 | 15,088,890 | 3,800,000 | 1,051,637,163 |
| 99 | 0 | 929,076,104 | 7,739,215 | 2,500,000 | 1,406,298 | 750,000 | 461,720 | 1,900,000 | 943,833,337 |
| 100 | 0 | 813,124,216 | 8,072,638 | 2,500,000 | 3,428,391 | 1,500,000 | 3,777,085 | 1,900,000 | 834,302,330 |

From the table, it can be seen that the supply chain cost for PT. Rakabu Sejahtera and its suppliers is obtained from the holding cost in PT. Rakabu Sejahtera, production cost in Supplier A, Supplier B, and UD. Trenggalek Lestari, and delivery cost in Supplier A, Supplier B, and UD. Trenggalek Lestari. For this scenario, there is no shortage happens for the system, so the shortage cost will be Rp 0. The holding cost includes the maintenance cost, salary for workers, and building cost. The production cost includes the salary for workers for cutting down the tree, loading cost, and materials' purchasing. The delivery cost includes the drivers fee, unloading cost, and fuel cost. Thus, the average supply chain cost of the scenario can be calculated. For scenario 1, the average supply chain cost is Rp Rp 2,042,696,092.

5. Scenario 5

Scenario 5 is suppliers deliver raw material to the PT. Rakabu Sejahtera only when the inventory level reach the re-order point as much as safety stock amount added by demand on the day it reached the re-order point. As mentioned above, the re-order point for the system is as much as 38,092 pieces and the safety stock is 17,505 pieces. When the inventory level is reached the re-order point, the suppliers will deliver the material as much as the safety stock amount added by the demand on the day inventory level reached the re-order point and half of the demand in previous day. More over, as mentioned before that maximum fulfillment capacity for Supplier A is 35,000 pieces, for Supplier B is 12,000 pieces, and for UD. Trenggalek Lestari is 20,000 pieces. According to the maximum fulfillment capacity, the allocation of material that should be delivered for each supplier has been assumed. Supplier A will deliver 52.3%, Supplier B will deliver 17.8%, and UD. Trenggalek Lestari will deliver 29.9% from total amount of material should be delivered. Besides, the lead time is one, which is reduced from the current system because of the vendor managed inventory implementation. The result of Scenario 5 system can be seen in Table 4.23 while result of Scenario 5 costing result can be seen in Table 4.24 below:

Table 4.23 Scenario 5 System Simulation Result

| Day | Material Arrived (pcs) | Demand (pcs) | Ending Inventory (pcs) | Shortage (pcs) | Lead Time (day) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 1 | 0 | 16,492 | 369,680 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 19,356 | 350,324 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 14,211 | 336,113 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 28,972 | 307,141 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 30,247 | 276,894 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 19,006 | 257,888 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 16,639 | 241,249 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 6,861 | 234,388 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0 | 12,995 | 221,393 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 29,880 | 191,513 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 23,354 | 168,158 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 14,516 | 153,643 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 19,692 | 133,951 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 0 | 14,000 | 119,951 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 14,548 | 105,403 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 7,900 | 97,503 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 21,737 | 75,767 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 17,287 | 58,480 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 19,713 | 38,767 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 13,072 | 25,695 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 14,434 | 11,260 | 0 | 1 | 20,123 | 3 | 6,849 | 4 | 11,504 | 2 |

| Day | Material Arrived (pcs) | Demand (pcs) | Ending Inventory (pcs) | Shortage (pcs) | Lead Time (day) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 22 | 38,475 | 30,699 | 19,037 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 25,599 | 0 | 6,563 | 1 | 30,571 | 4 | 10,405 | 5 | 17,478 | 3 |
| 24 | 58,454 | 18,796 | 39,657 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 0 | 18,061 | 21,596 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 28,099 | 0 | 6,503 | 1 | 28,574 | 3 | 9,725 | 5 | 16,336 | 3 |
| 27 | 54,635 | 17,205 | 37,430 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0 | 24,576 | 12,855 | 0 | 1 | 26,507 | 3 | 9,022 | 5 | 15,154 | 3 |
| 29 | 50,683 | 33,277 | 30,261 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 32,269 | 0 | 2,009 | 1 | 34,734 | 4 | 11,821 | 6 | 19,857 | 3 |
| 31 | 66,413 | 22,689 | 43,724 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 32 | 0 | 23,674 | 20,049 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 33 | 0 | 3,008 | 17,041 | 0 | 1 | 16,919 | 2 | 5,758 | 3 | 9,673 | 2 |
| 34 | 32,350 | 31,861 | 17,530 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 35 | 0 | 17,382 | 148 | 0 | 1 | 26,578 | 3 | 9,046 | 5 | 15,194 | 3 |
| 36 | 50,817 | 27,679 | 23,287 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 37 | 0 | 11,561 | 11,726 | 0 | 1 | 22,439 | 3 | 7,637 | 4 | 12,829 | 2 |
| 38 | 42,905 | 29,658 | 24,973 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 39 | 0 | 18,350 | 6,623 | 0 | 1 | 26,508 | 3 | 9,022 | 5 | 15,155 | 3 |
| 40 | 50,684 | 27,524 | 29,783 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 41 | 0 | 12,111 | 17,672 | 0 | 1 | 22,687 | 3 | 7,721 | 4 | 12,970 | 2 |
| 42 | 43,378 | 22,436 | 38,615 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 43 | 0 | 25,160 | 13,455 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Day | Material Arrived (pcs) | Demand (pcs) | Ending Inventory (pcs) | Shortage (pcs) | Lead Time (day) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 44 | 0 | 11,693 | 1,762 | 0 | 1 | 21,850 | 3 | 7,436 | 4 | 12,492 | 2 |
| 45 | 41,778 | 32,206 | 11,334 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 46 | 0 | 36,699 | 0 | 25,365 | 1 | 36,770 | 4 | 12,515 | 6 | 21,022 | 3 |
| 47 | 70,307 | 18,661 | 51,646 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 48 | 0 | 26,640 | 25,006 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 49 | 0 | 17,827 | 7,179 | 0 | 1 | 25,445 | 3 | 8,660 | 5 | 14,547 | 2 |
| 50 | 48,652 | 43,137 | 12,694 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 51 | 0 | 28,658 | 0 | 15,964 | 1 | 35,424 | 4 | 12,056 | 6 | 20,252 | 3 |
| 52 | 67,732 | 35,837 | 31,894 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 53 | 0 | 28,170 | 3,725 | 0 | 1 | 33,259 | 4 | 11,320 | 6 | 19,014 | 3 |
| 54 | 63,593 | 10,807 | 56,511 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 55 | 0 | 25,124 | 31,386 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 56 | 0 | 18,175 | 13,211 | 0 | 1 | 25,231 | 3 | 8,587 | 5 | 14,425 | 2 |
| 57 | 48,243 | 14,188 | 47,265 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 58 | 0 | 26,752 | 20,513 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 59 | 0 | 14,995 | 5,518 | 0 | 1 | 23,993 | 3 | 8,166 | 4 | 13,717 | 2 |
| 60 | 45,876 | 20,226 | 31,168 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 61 | 0 | 28,954 | 2,214 | 0 | 1 | 29,587 | 3 | 10,070 | 5 | 16,915 | 3 |
| 62 | 56,572 | 17,609 | 41,177 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 63 | 0 | 16,358 | 24,819 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 64 | 0 | 33,968 | 0 | 9,149 | 1 | 31,198 | 4 | 10,618 | 6 | 17,836 | 3 |
| 65 | 59,652 | 8,601 | 51,051 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Day | Material Arrived (pcs) | Demand (pcs) | Ending Inventory (pcs) | Shortage (pcs) | Lead Time (day) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 66 | 0 | 9,615 | 41,435 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 67 | 0 | 23,879 | 17,556 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 68 | 0 | 27,947 | 0 | 10,391 | 1 | 30,016 | 4 | 10,216 | 5 | 17,160 | 3 |
| 69 | 57,392 | 15,592 | 41,800 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 70 | 0 | 18,028 | 23,772 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 71 | 0 | 10,271 | 13,502 | 0 | 1 | 19,241 | 2 | 6,549 | 4 | 11,000 | 2 |
| 72 | 36,789 | 27,006 | 23,285 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 73 | 0 | 18,235 | 5,050 | 0 | 1 | 25,754 | 3 | 8,765 | 5 | 14,724 | 2 |
| 74 | 49,243 | 31,145 | 23,149 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 75 | 0 | 23,330 | 0 | 181 | 1 | 29,501 | 3 | 10,040 | 5 | 16,866 | 3 |
| 76 | 56,407 | 20,498 | 35,909 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 77 | 0 | 12,964 | 22,945 | 0 | 1 | 21,296 | 3 | 7,248 | 4 | 12,175 | 2 |
| 78 | 40,718 | 13,833 | 49,830 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 79 | 0 | 22,099 | 27,730 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80 | 0 | 30,973 | 0 | 3,243 | 1 | 31,133 | 4 | 10,596 | 6 | 17,799 | 3 |
| 81 | 59,528 | 31,165 | 28,363 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 82 | 0 | 22,788 | 5,574 | 0 | 1 | 29,223 | 3 | 9,946 | 5 | 16,707 | 3 |
| 83 | 55,876 | 23,751 | 37,700 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 84 | 0 | 28,979 | 8,721 | 0 | 1 | 30,522 | 4 | 10,388 | 5 | 17,449 | 3 |
| 85 | 58,359 | 20,041 | 47,039 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 86 | 0 | 24,959 | 22,080 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 87 | 0 | 13,399 | 8,681 | 0 | 1 | 22,690 | 3 | 7,722 | 4 | 12,972 | 2 |

| Day | Material Arrived (pcs) | Demand (pcs) | Ending Inventory (pcs) | Shortage (pcs) | Lead Time (day) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck | Supply Quantity (pcs) | Number of Truck |
| 88 | 43,384 | 23,031 | 29,034 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 89 | 0 | 12,776 | 16,258 | 0 | 1 | 21,860 | 3 | 7,440 | 4 | 12,497 | 2 |
| 90 | 41,796 | 19,484 | 38,570 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 91 | 0 | 28,455 | 10,115 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 92 | 0 | 23,960 | 0 | 13,845 | 1 | 29,127 | 3 | 9,913 | 5 | 16,652 | 3 |
| 93 | 55,692 | 26,872 | 28,821 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 94 | 0 | 31,015 | 0 | 2,194 | 1 | 32,403 | 4 | 11,028 | 6 | 18,525 | 3 |
| 95 | 61,956 | 27,029 | 34,927 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 96 | 0 | 25,158 | 9,769 | 0 | 1 | 29,381 | 3 | 10,000 | 5 | 16,797 | 3 |
| 97 | 56,178 | 25,731 | 40,215 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 98 | 0 | 12,157 | 28,059 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 99 | 0 | 22,745 | 5,313 | 0 | 1 | 24,230 | 3 | 8,246 | 4 | 13,852 | 2 |
| 100 | 46,329 | 30,688 | 20,954 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 4.24 Scenario 5 Costing Simulation Result

| PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply |
|---|---|---|---|---|---|---|---|---|
| Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Chain Cost (Rp) |
| 0 | 2,587,758,576 | 0 | 0 | 0 | 0 | 0 | 0 | 2,587,758,576 |
| 0 | 2,452,266,805 | 0 | 0 | 0 | 0 | 0 | 0 | 2,452,266,805 |
| 0 | 2,352,792,874 | 0 | 0 | 0 | 0 | 0 | 0 | 2,352,792,874 |
| 0 | 2,149,987,158 | 0 | 0 | 0 | 0 | 0 | 0 | 2,149,987,158 |
| 0 | 1,938,257,633 | 0 | 0 | 0 | 0 | 0 | 0 | 1,938,257,633 |
| 0 | 1,805,214,254 | 0 | 0 | 0 | 0 | 0 | 0 | 1,805,214,254 |
| 0 | 1,688,742,793 | 0 | 0 | 0 | 0 | 0 | 0 | 1,688,742,793 |
| 0 | 1,640,715,161 | 0 | 0 | 0 | 0 | 0 | 0 | 1,640,715,161 |
| 0 | 1,549,751,802 | 0 | 0 | 0 | 0 | 0 | 0 | 1,549,751,802 |
| 0 | 1,340,589,343 | 0 | 0 | 0 | 0 | 0 | 0 | 1,340,589,343 |
| 0 | 1,177,109,273 | 0 | 0 | 0 | 0 | 0 | 0 | 1,177,109,273 |
| 0 | 1,075,497,774 | 0 | 0 | 0 | 0 | 0 | 0 | 1,075,497,774 |
| 0 | 937,657,154 | 0 | 0 | 0 | 0 | 0 | 0 | 937,657,154 |
| 0 | 839,654,063 | 0 | 0 | 0 | 0 | 0 | 0 | 839,654,063 |
| 0 | 737,819,803 | 0 | 0 | 0 | 0 | 0 | 0 | 737,819,803 |
| 0 | 682,523,222 | 0 | 0 | 0 | 0 | 0 | 0 | 682,523,222 |
| 0 | 530,367,346 | 0 | 0 | 0 | 0 | 0 | 0 | 530,367,346 |
| 0 | 409,357,454 | 0 | 0 | 0 | 0 | 0 | 0 | 409,357,454 |
| 0 | 271,366,953 | 0 | 0 | 0 | 0 | 0 | 0 | 271,366,953 |
| 0 | 179,863,372 | 0 | 0 | 0 | 0 | 0 | 0 | 179,863,372 |
| 0 | 78,823,182 | 18,110,316 | 7,500,000 | 7,191,030 | 3,000,000 | 23,008,219 | 3,800,000 | 141,432,748 |
| 0 | 133,255,718 | 0 | 0 | 0 | 0 | 0 | 0 | 133,255,718 |
| 138,827,859 | 0 | 27,514,231 | 10,000,000 | 10,925,026 | 3,750,000 | 34,955,407 | 5,700,000 | 231,672,523 |

| PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|
| Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 0 | 277,602,376 | 0 | 0 | 0 | 0 | 0 | 0 | 277,602,376 |
| 0 | 151,173,595 | 0 | 0 | 0 | 0 | 0 | 0 | 151,173,595 |
| 137,564,389 | - | 25,716,625 | 7,500,000 | 10,211,254 | 3,750,000 | 32,671,641 | 5,700,000 | 223,113,908 |
| 0 | 262,011,418 | 0 | 0 | 0 | 0 | 0 | 0 | 262,011,418 |
| 0 | 89,982,752 | 23,856,417 | 7,500,000 | 9,472,624 | 3,750,000 | 30,308,343 | 5,700,000 | 170,570,136 |
| 0 | 211,824,530 | 0 | 0 | 0 | 0 | 0 | 0 | 211,824,530 |
| 42,490,485 | 0 | 31,260,464 | 10,000,000 | 12,412,536 | 4,500,000 | 39,714,803 | 5,700,000 | 146,078,288 |
| 0 | 306,065,611 | 0 | 0 | 0 | 0 | 0 | 0 | 306,065,611 |
| 0 | 140,345,860 | 0 | 0 | 0 | 0 | 0 | 0 | 140,345,860 |
| 0 | 119,287,665 | 15,227,351 | 5,000,000 | 6,046,297 | 2,250,000 | 19,345,562 | 3,800,000 | 170,956,876 |
| 0 | 122,711,888 | 0 | 0 | 0 | 0 | 0 | 0 | 122,711,888 |
| 0 | 1,039,275 | 23,919,766 | 7,500,000 | 9,497,778 | 3,750,000 | 30,388,825 | 5,700,000 | 81,795,645 |
| 0 | 163,008,900 | 0 | 0 | 0 | 0 | 0 | 0 | 163,008,900 |
| 0 | 82,083,750 | 20,195,475 | 7,500,000 | 8,018,981 | 3,000,000 | 25,657,306 | 3,800,000 | 150,255,511 |
| 0 | 174,811,470 | 0 | 0 | 0 | 0 | 0 | 0 | 174,811,470 |
| 0 | 46,360,627 | 23,857,104 | 7,500,000 | 9,472,897 | 3,750,000 | 30,309,217 | 5,700,000 | 126,949,845 |
| 0 | 208,480,851 | 0 | 0 | 0 | 0 | 0 | 0 | 208,480,851 |
| 0 | 123,702,890 | 20,418,154 | 7,500,000 | 8,107,400 | 3,000,000 | 25,940,209 | 3,800,000 | 192,468,653 |
| 0 | 270,301,507 | 0 | 0 | 0 | 0 | 0 | 0 | 270,301,507 |
| 0 | 94,183,758 | 0 | 0 | 0 | 0 | 0 | 0 | 94,183,758 |
| 0 | 12,332,891 | 19,664,820 | 7,500,000 | 7,808,275 | 3,000,000 | 24,983,137 | 3,800,000 | 79,089,122 |
| 0 | 79,334,651 | 0 | 0 | 0 | 0 | 0 | 0 | 79,334,651 |
| 536,571,143 | 0 | 33,093,311 | 10,000,000 | 13,140,301 | 4,500,000 | 42,043,340 | 5,700,000 | 645,048,096 |
| 0 | 361,521,360 | 0 | 0 | 0 | 0 | 0 | 0 | 361,521,360 |
| 0 | 175,043,039 | 0 | 0 | 0 | 0 | 0 | 0 | 175,043,039 |

| PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|
| Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 0 | 50,253,454 | 22,900,479 | 7,500,000 | 9,093,052 | 3,750,000 | 29,093,874 | 3,800,000 | 126,390,860 |
| 0 | 88,859,417 | 0 | 0 | 0 | 0 | 0 | 0 | 88,859,417 |
| 337,701,701 | 0 | 31,881,255 | 10,000,000 | 12,659,032 | 4,500,000 | 40,503,485 | 5,700,000 | 442,945,472 |
| 0 | 223,260,669 | 0 | 0 | 0 | 0 | 0 | 0 | 223,260,669 |
| 0 | 26,072,988 | 29,933,351 | 10,000,000 | 11,885,582 | 4,500,000 | 38,028,774 | 5,700,000 | 126,120,695 |
| 0 | 395,573,547 | 0 | 0 | 0 | 0 | 0 | 0 | 395,573,547 |
| 0 | 219,702,353 | 0 | 0 | 0 | 0 | 0 | 0 | 219,702,353 |
| 0 | 92,475,318 | 22,707,754 | 7,500,000 | 9,016,527 | 3,750,000 | 28,849,026 | 3,800,000 | 168,098,624 |
| 0 | 330,854,939 | 0 | 0 | 0 | 0 | 0 | 0 | 330,854,939 |
| 0 | 143,592,712 | 0 | 0 | 0 | 0 | 0 | 0 | 143,592,712 |
| 0 | 38,626,175 | 21,593,877 | 7,500,000 | 8,574,242 | 3,000,000 | 27,433,904 | 3,800,000 | 110,528,197 |
| 0 | 218,175,161 | 0 | 0 | 0 | 0 | 0 | 0 | 218,175,161 |
| 0 | 15,496,788 | 26,628,521 | 7,500,000 | 10,573,339 | 3,750,000 | 33,830,159 | 5,700,000 | 103,478,807 |
| 0 | 288,235,621 | 0 | 0 | 0 | 0 | 0 | 0 | 288,235,621 |
| 0 | 173,732,953 | 0 | 0 | 0 | 0 | 0 | 0 | 173,732,953 |
| 193,533,013 | 0 | 28,077,971 | 10,000,000 | 11,148,869 | 4,500,000 | 35,671,610 | 5,700,000 | 288,631,464 |
| 0 | 357,355,931 | 0 | 0 | 0 | 0 | 0 | 0 | 357,355,931 |
| 0 | 290,048,223 | 0 | 0 | 0 | 0 | 0 | 0 | 290,048,223 |
| 0 | 122,893,263 | 0 | 0 | 0 | 0 | 0 | 0 | 122,893,263 |
| 219,813,045 | 0 | 27,014,371 | 10,000,000 | 10,726,547 | 3,750,000 | 34,320,360 | 5,700,000 | 311,324,323 |
| 0 | 292,599,605 | 0 | 0 | 0 | 0 | 0 | 0 | 292,599,605 |
| 0 | 166,405,183 | 0 | 0 | 0 | 0 | 0 | 0 | 166,405,183 |
| 0 | 94,510,978 | 17,316,812 | 5,000,000 | 6,875,955 | 3,000,000 | 22,000,114 | 3,800,000 | 152,503,859 |
| 0 | 162,998,465 | 0 | 0 | 0 | 0 | 0 | 0 | 162,998,465 |
| 0 | 35,352,692 | 23,178,629 | 7,500,000 | 9,203,496 | 3,750,000 | 29,447,249 | 3,800,000 | 112,232,066 |

| PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|
| Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 0 | 162,039,599 | 0 | 0 | 0 | 0 | 0 | 0 | 162,039,599 |
| 3,833,129 | 0 | 26,550,820 | 7,500,000 | 10,542,486 | 3,750,000 | 33,731,443 | 5,700,000 | 91,607,879 |
| 0 | 251,362,202 | 0 | 0 | 0 | 0 | 0 | 0 | 251,362,202 |
| 0 | 160,613,831 | 19,166,037 | 7,500,000 | 7,610,224 | 3,000,000 | 24,349,459 | 3,800,000 | 226,039,550 |
| 0 | 348,807,249 | 0 | 0 | 0 | 0 | 0 | 0 | 348,807,249 |
| 0 | 194,113,362 | 0 | 0 | 0 | 0 | 0 | 0 | 194,113,362 |
| 68,596,375 | - | 28,019,716 | 10,000,000 | 11,125,738 | 4,500,000 | 35,597,599 | 5,700,000 | 163,539,428 |
| 0 | 198,540,359 | 0 | 0 | 0 | 0 | 0 | 0 | 198,540,359 |
| 0 | 39,021,192 | 26,300,775 | 7,500,000 | 10,443,201 | 3,750,000 | 33,413,775 | 5,700,000 | 126,128,943 |
| 0 | 263,897,382 | 0 | 0 | 0 | 0 | 0 | 0 | 263,897,382 |
| 0 | 61,046,707 | 27,469,591 | 10,000,000 | 10,907,301 | 3,750,000 | 34,898,695 | 5,700,000 | 153,772,294 |
| 0 | 329,273,954 | 0 | 0 | 0 | 0 | 0 | 0 | 329,273,954 |
| 0 | 154,563,434 | 0 | 0 | 0 | 0 | 0 | 0 | 154,563,434 |
| 0 | 60,767,681 | 20,420,715 | 7,500,000 | 8,108,417 | 3,000,000 | 25,943,462 | 3,800,000 | 129,540,275 |
| 0 | 203,238,056 | 0 | 0 | 0 | 0 | 0 | 0 | 203,238,056 |
| 0 | 113,805,562 | 19,673,600 | 7,500,000 | 7,811,761 | 3,000,000 | 24,994,291 | 3,800,000 | 180,585,214 |
| 0 | 269,993,280 | 0 | 0 | 0 | 0 | 0 | 0 | 269,993,280 |
| 0 | 70,805,658 | 0 | 0 | 0 | 0 | 0 | 0 | 70,805,658 |
| 292,871,141 | 0 | 26,214,459 | 7,500,000 | 10,408,928 | 3,750,000 | 33,304,114 | 5,700,000 | 379,748,642 |
| 0 | 201,746,112 | 0 | 0 | 0 | 0 | 0 | 0 | 201,746,112 |
| 46,418,745 | 0 | 29,162,694 | 10,000,000 | 11,579,578 | 4,500,000 | 37,049,694 | 5,700,000 | 144,410,712 |
| 0 | 244,490,766 | 0 | 0 | 0 | 0 | 0 | 0 | 244,490,766 |
| 0 | 68,382,702 | 26,442,831 | 7,500,000 | 10,499,607 | 3,750,000 | 33,594,249 | 5,700,000 | 155,869,390 |
| 0 | 281,506,516 | 0 | 0 | 0 | 0 | 0 | 0 | 281,506,516 |
| 0 | 196,410,257 | 0 | 0 | 0 | 0 | 0 | 0 | 196,410,257 |

| PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost (Rp) |
|---|---|---|---|---|---|---|---|---|
| Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 0 | 37,193,186 | 21,806,872 | 7,500,000 | 8,658,815 | 3,000,000 | 27,704,503 | 3,800,000 | 109,663,376 |
| 0 | 146,678,576 | 0 | 0 | 0 | 0 | 0 | 0 | 146,678,576 |

From the table, it can be seen that the supply chain cost for PT. Rakabu Sejahtera and its suppliers is obtained from the holding cost and shortage cost in PT. Rakabu Sejahtera, production cost in Supplier A, Supplier B, and UD. Trenggalek Lestari, and delivery cost in Supplier A, Supplier B, and UD. Trenggalek Lestari. In this scenario, there is shortage happens with the total of material shortage is 95,406 pieces. The shortage cost is a cost that occurs when the demand cannot be fulfilled because of running out of material. The holding cost includes the maintenance cost, salary for workers, and building cost. The production cost includes the salary for workers for cutting down the tree, loading cost, and materials' purchasing. The delivery cost includes the drivers fee, unloading cost, and fuel cost. Thus, the average supply chain cost of the scenario can be calculated. For scenario 5, the average supply chain cost is Rp 426,333,156.

6. Scenario 6

Scenario 6 is suppliers deliver raw material to the PT. Rakabu Sejahtera only when the inventory level reach the re-order point as much as safety stock amount added by demand on the day it reached the re-order point. For this scenario. The reorder point used is as much as reorder point calculation result which is 38,092 added by the amount of safety stock which is 17,505 pieces. So, the supplier will deliver material when PT Rakabu Sejatera inventory level reach as much as 55,597 pieces. More over, as mentioned before that maximum fulfillment capacity for Supplier A is 35,000 pieces, for Supplier B is 12,000 pieces, and for UD. Trenggalek Lestari is 20,000 pieces. According to the maximum fulfillment capacity, the allocation of material that should be delivered for each supplier has been assumed. Supplier A will deliver 52.3%, Supplier B will deliver 17.8%, and UD. Trenggalek Lestari will deliver 29.9% from total amount of material should be delivered. Besides, the lead time is one, which is reduced from the current system because of the vendor managed inventory implementation. The result of Scenario 6 system can be seen in Table 4.25 while Scenario 6 costing result can be seen in Table 4.26 below:

Table 4.25 Scenario 6 System Simulation Result

| Day | Material Needed (pcs) | Demand (pcs) | Ending Inventory (pcs) | Shortage (pcs) | Lead Time (day) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Quantity (pcs) | Number of Truck | Quantity (pcs) | Number of Truck | Quantity (pcs) | Number of Truck |
| 1 | 0 | 16,492 | 369,680 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 19,356 | 350,324 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 14,211 | 336,113 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 28,972 | 307,141 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 30,247 | 276,894 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 19,006 | 257,888 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 16,639 | 241,249 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 6,861 | 234,388 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0 | 12,995 | 221,393 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 29,880 | 191,513 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 23,354 | 168,158 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 14,516 | 153,643 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 19,692 | 133,951 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 0 | 14,000 | 119,951 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 14,548 | 105,403 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 7,900 | 97,503 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 21,737 | 75,767 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 17,287 | 58,480 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 19,713 | 38,767 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 13,072 | 25,695 | 0 | 1 | 15,992 | 2 | 5,443 | 3 | 9,143 | 2 |
| 21 | 30,577 | 14,434 | 41,837 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 30,699 | 11,138 | 0 | 1 | 25,211 | 3 | 8,580 | 5 | 14,413 | 2 |
| 23 | 48,204 | 25,599 | 33,743 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Day | Material Needed (pcs) | Demand (pcs) | Ending Inventory (pcs) | Shortage (pcs) | Lead Time (day) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Quantity (pcs) | Number of Truck | Quantity (pcs) | Number of Truck | Quantity (pcs) | Number of Truck |
| 24 | 0 | 18,796 | 14,947 | 0 | 1 | 18,986 | 2 | 6,462 | 4 | 10,854 | 2 |
| 25 | 36,301 | 18,061 | 33,187 | 0 | 1 | 18,601 | 2 | 6,331 | 4 | 10,634 | 2 |
| 26 | 35,566 | 28,099 | 40,654 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 17,205 | 23,449 | 0 | 1 | 18,153 | 2 | 6,178 | 3 | 10,378 | 2 |
| 28 | 34,710 | 24,576 | 33,583 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 0 | 33,277 | 307 | 0 | 1 | 26,559 | 3 | 9,039 | 5 | 15,184 | 3 |
| 30 | 50,782 | 32,269 | 18,819 | 0 | 1 | 26,032 | 3 | 8,860 | 5 | 14,883 | 2 |
| 31 | 49,774 | 22,689 | 45,904 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 32 | 0 | 23,674 | 22,230 | 0 | 1 | 21,537 | 3 | 7,330 | 4 | 12,313 | 2 |
| 33 | 41,179 | 3,008 | 60,401 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 34 | 0 | 31,861 | 28,540 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 35 | 0 | 17,382 | 11,158 | 0 | 1 | 18,246 | 2 | 6,210 | 3 | 10,431 | 2 |
| 36 | 34,887 | 27,679 | 18,366 | 0 | 1 | 23,631 | 3 | 8,043 | 4 | 13,510 | 2 |
| 37 | 45,184 | 11,561 | 51,989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 38 | 0 | 29,658 | 22,331 | 0 | 1 | 24,666 | 3 | 8,395 | 4 | 14,102 | 2 |
| 39 | 47,163 | 18,350 | 51,144 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 0 | 27,524 | 23,620 | 0 | 1 | 23,550 | 3 | 8,015 | 4 | 13,464 | 2 |
| 41 | 45,029 | 12,111 | 56,538 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 42 | 0 | 22,436 | 34,102 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 43 | 0 | 25,160 | 8,942 | 0 | 1 | 22,314 | 3 | 7,594 | 4 | 12,757 | 2 |
| 44 | 42,665 | 11,693 | 39,914 | 0 | 1 | 15,271 | 2 | 5,197 | 3 | 8,730 | 2 |
| 45 | 29,198 | 32,206 | 36,906 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 46 | 0 | 36,699 | 207 | 0 | 1 | 28,348 | 3 | 9,648 | 5 | 16,207 | 3 |
| 47 | 54,204 | 18,661 | 35,750 | 0 | 1 | 18,915 | 2 | 6,437 | 4 | 10,814 | 2 |

| Day | Material Needed (pcs) | Demand (pcs) | Ending Inventory (pcs) | Shortage (pcs) | Lead Time (day) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Quantity (pcs) | Number of Truck | Quantity (pcs) | Number of Truck | Quantity (pcs) | Number of Truck |
| 48 | 36,166 | 26,640 | 45,276 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 49 | 0 | 17,827 | 27,449 | 0 | 1 | 18,479 | 2 | 6,289 | 3 | 10,564 | 2 |
| 50 | 35,332 | 43,137 | 19,644 | 0 | 1 | 31,716 | 4 | 10,794 | 6 | 18,132 | 3 |
| 51 | 60,642 | 28,658 | 51,628 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 52 | 0 | 35,837 | 15,791 | 0 | 1 | 27,898 | 3 | 9,495 | 5 | 15,949 | 3 |
| 53 | 53,342 | 28,170 | 40,963 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 54 | 0 | 10,807 | 30,156 | 0 | 1 | 14,807 | 2 | 5,040 | 3 | 8,465 | 2 |
| 55 | 28,312 | 25,124 | 33,344 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 56 | 0 | 18,175 | 15,169 | 0 | 1 | 18,661 | 2 | 6,351 | 4 | 10,668 | 2 |
| 57 | 35,680 | 14,188 | 36,661 | 0 | 1 | 16,576 | 2 | 5,641 | 3 | 9,476 | 2 |
| 58 | 31,693 | 26,752 | 41,602 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 59 | 0 | 14,995 | 26,607 | 0 | 1 | 16,998 | 2 | 5,785 | 3 | 9,718 | 2 |
| 60 | 32,500 | 20,226 | 38,881 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 61 | 0 | 28,954 | 9,927 | 0 | 1 | 24,298 | 3 | 8,270 | 4 | 13,891 | 2 |
| 62 | 46,459 | 17,609 | 38,776 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 63 | 0 | 16,358 | 22,419 | 0 | 1 | 17,710 | 2 | 6,028 | 3 | 10,125 | 2 |
| 64 | 33,863 | 33,968 | 22,314 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 65 | 0 | 8,601 | 13,713 | 0 | 1 | 13,653 | 2 | 4,647 | 3 | 7,806 | 2 |
| 66 | 26,106 | 9,615 | 30,203 | 0 | 1 | 14,184 | 2 | 4,827 | 3 | 8,109 | 2 |
| 67 | 27,120 | 23,879 | 33,444 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 68 | 0 | 27,947 | 5,497 | 0 | 1 | 23,772 | 3 | 8,091 | 4 | 13,590 | 2 |
| 69 | 45,452 | 15,592 | 35,357 | 0 | 1 | 17,310 | 2 | 5,891 | 3 | 9,896 | 2 |
| 70 | 33,097 | 18,028 | 50,427 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 71 | 0 | 10,271 | 40,156 | 0 | 1 | 14,527 | 2 | 4,944 | 3 | 8,305 | 2 |

| Day | Material Needed (pcs) | Demand (pcs) | Ending Inventory (pcs) | Shortage (pcs) | Lead Time (day) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Quantity (pcs) | Number of Truck | Quantity (pcs) | Number of Truck | Quantity (pcs) | Number of Truck |
| 72 | 27,776 | 27,006 | 40,926 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 73 | 0 | 18,235 | 22,691 | 0 | 1 | 18,692 | 2 | 6,362 | 4 | 10,686 | 2 |
| 74 | 35,740 | 31,145 | 27,286 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 75 | 0 | 23,330 | 3,957 | 0 | 1 | 21,357 | 3 | 7,269 | 4 | 12,210 | 2 |
| 76 | 40,835 | 20,498 | 24,293 | 0 | 1 | 19,876 | 2 | 6,765 | 4 | 11,363 | 2 |
| 77 | 38,003 | 12,964 | 49,332 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 78 | 0 | 13,833 | 35,499 | 0 | 1 | 16,390 | 2 | 5,578 | 3 | 9,370 | 2 |
| 79 | 31,338 | 22,099 | 44,738 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 80 | 0 | 30,973 | 13,765 | 0 | 1 | 25,354 | 3 | 8,629 | 5 | 14,495 | 2 |
| 81 | 48,478 | 31,165 | 31,078 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 82 | 0 | 22,788 | 8,290 | 0 | 1 | 21,073 | 3 | 7,172 | 4 | 12,048 | 2 |
| 83 | 40,293 | 23,751 | 24,833 | 0 | 1 | 21,577 | 3 | 7,344 | 4 | 12,335 | 2 |
| 84 | 41,256 | 28,979 | 37,110 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 85 | 0 | 20,041 | 17,069 | 0 | 1 | 19,636 | 2 | 6,683 | 4 | 11,226 | 2 |
| 86 | 37,546 | 24,959 | 29,656 | 0 | 1 | 22,208 | 3 | 7,559 | 4 | 12,697 | 2 |
| 87 | 42,464 | 13,399 | 58,720 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 88 | 0 | 23,031 | 35,689 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 89 | 0 | 12,776 | 22,913 | 0 | 1 | 15,837 | 2 | 5,390 | 3 | 9,054 | 2 |
| 90 | 30,281 | 19,484 | 33,711 | 0 | 1 | 19,345 | 2 | 6,584 | 4 | 11,060 | 2 |
| 91 | 36,989 | 28,455 | 42,244 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 92 | 0 | 23,960 | 18,284 | 0 | 1 | 21,686 | 3 | 7,381 | 4 | 12,398 | 2 |
| 93 | 41,465 | 26,872 | 32,877 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 94 | 0 | 31,015 | 1,862 | 0 | 1 | 25,376 | 3 | 8,637 | 5 | 14,508 | 2 |
| 95 | 48,520 | 27,029 | 23,354 | 0 | 1 | 23,291 | 3 | 7,927 | 4 | 13,316 | 2 |

| Day | Material Needed (pcs) | Demand (pcs) | Ending Inventory (pcs) | Shortage (pcs) | Lead Time (day) | Supplier A | | Supplier B | | UD. Trenggalek Lestari | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Quantity (pcs) | Number of Truck | Quantity (pcs) | Number of Truck | Quantity (pcs) | Number of Truck |
| 96 | 44,534 | 25,158 | 42,729 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 97 | 0 | 25,731 | 16,998 | 0 | 1 | 22,613 | 3 | 7,696 | 4 | 12,928 | 2 |
| 98 | 43,236 | 12,157 | 48,078 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 99 | 0 | 22,745 | 25,332 | 0 | 1 | 21,051 | 3 | 7,165 | 4 | 12,035 | 2 |
| 100 | 40,250 | 30,688 | 34,895 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Table 4.26 Scenario 6 Cost Simulation Result

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delievry Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 1 | 0 | 2,587,758,576 | 0 | 0 | 0 | 0 | 0 | 0 | 2,587,758,576 |
| 2 | 0 | 2,452,266,805 | 0 | 0 | 0 | 0 | 0 | 0 | 2,452,266,805 |
| 3 | 0 | 2,352,792,874 | 0 | 0 | 0 | 0 | 0 | 0 | 2,352,792,874 |
| 4 | 0 | 2,149,987,158 | 0 | 0 | 0 | 0 | 0 | 0 | 2,149,987,158 |
| 5 | 0 | 1,938,257,633 | 0 | 0 | 0 | 0 | 0 | 0 | 1,938,257,633 |
| 6 | 0 | 1,805,214,254 | 0 | 0 | 0 | 0 | 0 | 0 | 1,805,214,254 |
| 7 | 0 | 1,688,742,793 | 0 | 0 | 0 | 0 | 0 | 0 | 1,688,742,793 |
| 8 | 0 | 1,640,715,161 | 0 | 0 | 0 | 0 | 0 | 0 | 1,640,715,161 |
| 9 | 0 | 1,549,751,802 | 0 | 0 | 0 | 0 | 0 | 0 | 1,549,751,802 |
| 10 | 0 | 1,340,589,343 | 0 | 0 | 0 | 0 | 0 | 0 | 1,340,589,343 |
| 11 | 0 | 1,177,109,273 | 0 | 0 | 0 | 0 | 0 | 0 | 1,177,109,273 |
| 12 | 0 | 1,075,497,774 | 0 | 0 | 0 | 0 | 0 | 0 | 1,075,497,774 |
| 13 | 0 | 937,657,154 | 0 | 0 | 0 | 0 | 0 | 0 | 937,657,154 |
| 14 | 0 | 839,654,063 | 0 | 0 | 0 | 0 | 0 | 0 | 839,654,063 |
| 15 | 0 | 737,819,803 | 0 | 0 | 0 | 0 | 0 | 0 | 737,819,803 |
| 16 | 0 | 682,523,222 | 0 | 0 | 0 | 0 | 0 | 0 | 682,523,222 |
| 17 | 0 | 530,367,346 | 0 | 0 | 0 | 0 | 0 | 0 | 530,367,346 |
| 18 | 0 | 409,357,454 | 0 | 0 | 0 | 0 | 0 | 0 | 409,357,454 |
| 19 | 0 | 271,366,953 | 0 | 0 | 0 | 0 | 0 | 0 | 271,366,953 |
| 20 | 0 | 179,863,372 | 14,392,566 | 5,000,000 | 5,714,830 | 2,250,000 | 18,285,010 | 3,800,000 | 229,305,778 |
| 21 | 0 | 292,861,763 | 0 | 0 | 0 | 0 | 0 | 0 | 292,861,763 |
| 22 | 0 | 77,967,318 | 22,689,720 | 7,500,000 | 9,009,366 | 3,750,000 | 28,826,115 | 3,800,000 | 153,542,520 |
| 23 | 0 | 236,201,979 | 0 | 0 | 0 | 0 | 0 | 0 | 236,201,979 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delievry Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 24 | 0 | 104,627,348 | 17,087,058 | 5,000,000 | 6,784,727 | 3,000,000 | 21,708,223 | 3,800,000 | 162,007,356 |
| 25 | 0 | 232,308,198 | 16,741,036 | 5,000,000 | 6,647,333 | 3,000,000 | 21,268,620 | 3,800,000 | 288,765,187 |
| 26 | 0 | 284,577,408 | 0 | 0 | 0 | 0 | 0 | 0 | 284,577,408 |
| 27 | 0 | 164,144,864 | 16,337,832 | 5,000,000 | 6,487,233 | 2,250,000 | 20,756,370 | 3,800,000 | 218,776,300 |
| 28 | 0 | 235,083,742 | 0 | 0 | 0 | 0 | 0 | 0 | 235,083,742 |
| 29 | 0 | 2,145,583 | 23,903,031 | 7,500,000 | 9,491,133 | 3,750,000 | 30,367,564 | 5,700,000 | 82,857,311 |
| 30 | 0 | 131,733,826 | 23,428,751 | 7,500,000 | 9,302,812 | 3,750,000 | 29,765,016 | 3,800,000 | 209,280,404 |
| 31 | 0 | 321,330,357 | 0 | 0 | 0 | 0 | 0 | 0 | 321,330,357 |
| 32 | 0 | 155,610,606 | 19,383,073 | 7,500,000 | 7,696,402 | 3,000,000 | 24,625,192 | 3,800,000 | 221,615,273 |
| 33 | 0 | 422,807,162 | 0 | 0 | 0 | 0 | 0 | 0 | 422,807,162 |
| 34 | 0 | 199,778,315 | 0 | 0 | 0 | 0 | 0 | 0 | 199,778,315 |
| 35 | 0 | 78,105,702 | 16,421,218 | 5,000,000 | 6,520,343 | 2,250,000 | 20,862,307 | 3,800,000 | 132,959,571 |
| 36 | 0 | 128,560,903 | 21,268,069 | 7,500,000 | 8,444,874 | 3,000,000 | 27,019,982 | 3,800,000 | 199,593,828 |
| 37 | 0 | 363,923,165 | 0 | 0 | 0 | 0 | 0 | 0 | 363,923,165 |
| 38 | 0 | 156,314,528 | 22,199,801 | 7,500,000 | 8,814,835 | 3,000,000 | 28,203,699 | 3,800,000 | 229,832,864 |
| 39 | 0 | 358,007,322 | 0 | 0 | 0 | 0 | 0 | 0 | 358,007,322 |
| 40 | 0 | 165,337,385 | 21,195,281 | 7,500,000 | 8,415,972 | 3,000,000 | 26,927,507 | 3,800,000 | 236,176,145 |
| 41 | 0 | 395,764,360 | 0 | 0 | 0 | 0 | 0 | 0 | 395,764,360 |
| 42 | 0 | 238,715,048 | 0 | 0 | 0 | 0 | 0 | 0 | 238,715,048 |
| 43 | 0 | 62,597,299 | 20,082,264 | 7,500,000 | 7,974,028 | 3,000,000 | 25,513,478 | 3,800,000 | 130,467,070 |
| 44 | 0 | 279,399,181 | 13,743,490 | 5,000,000 | 5,457,103 | 2,250,000 | 17,460,393 | 3,800,000 | 327,110,166 |
| 45 | 0 | 258,342,066 | 0 | 0 | 0 | 0 | 0 | 0 | 258,342,066 |
| 46 | 0 | 1,452,437 | 25,513,596 | 7,500,000 | 10,130,638 | 3,750,000 | 32,413,704 | 5,700,000 | 86,460,375 |
| 47 | 0 | 250,252,306 | 17,023,186 | 5,000,000 | 6,759,366 | 3,000,000 | 21,627,077 | 3,800,000 | 307,461,934 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delievry Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 48 | 0 | 316,933,745 | 0 | 0 | 0 | 0 | 0 | 0 | 316,933,745 |
| 49 | 0 | 192,144,161 | 16,630,812 | 5,000,000 | 6,603,566 | 2,250,000 | 21,128,586 | 3,800,000 | 247,557,125 |
| 50 | 0 | 137,510,963 | 28,544,108 | 10,000,000 | 11,333,957 | 4,500,000 | 36,263,812 | 5,700,000 | 233,852,840 |
| 51 | 0 | 361,396,578 | 0 | 0 | 0 | 0 | 0 | 0 | 361,396,578 |
| 52 | 0 | 110,536,188 | 25,108,173 | 7,500,000 | 9,969,657 | 3,750,000 | 31,898,635 | 5,700,000 | 194,462,653 |
| 53 | 0 | 286,743,897 | 0 | 0 | 0 | 0 | 0 | 0 | 286,743,897 |
| 54 | 0 | 211,091,581 | 13,326,681 | 5,000,000 | 5,291,601 | 2,250,000 | 16,930,859 | 3,800,000 | 257,690,723 |
| 55 | 0 | 233,407,703 | 0 | 0 | 0 | 0 | 0 | 0 | 233,407,703 |
| 56 | 0 | 106,180,668 | 16,794,713 | 5,000,000 | 6,668,646 | 3,000,000 | 21,336,814 | 3,800,000 | 162,780,841 |
| 57 | 0 | 256,624,692 | 14,918,030 | 5,000,000 | 5,923,475 | 2,250,000 | 18,952,586 | 3,800,000 | 307,468,784 |
| 58 | 0 | 291,215,476 | 0 | 0 | 0 | 0 | 0 | 0 | 291,215,476 |
| 59 | 0 | 186,248,940 | 15,297,853 | 5,000,000 | 6,074,291 | 2,250,000 | 19,435,131 | 3,800,000 | 238,106,215 |
| 60 | 0 | 272,166,812 | 0 | 0 | 0 | 0 | 0 | 0 | 272,166,812 |
| 61 | 0 | 69,488,439 | 21,868,276 | 7,500,000 | 8,683,197 | 3,000,000 | 27,782,514 | 3,800,000 | 142,122,426 |
| 62 | 0 | 271,435,440 | 0 | 0 | 0 | 0 | 0 | 0 | 271,435,440 |
| 63 | 0 | 156,932,772 | 15,939,090 | 5,000,000 | 6,328,906 | 2,250,000 | 20,249,789 | 3,800,000 | 210,500,557 |
| 64 | 0 | 156,196,120 | 0 | 0 | 0 | 0 | 0 | 0 | 156,196,120 |
| 65 | 0 | 95,991,396 | 12,287,941 | 5,000,000 | 4,879,151 | 2,250,000 | 15,611,194 | 3,800,000 | 139,819,681 |
| 66 | 0 | 211,423,411 | 12,765,566 | 5,000,000 | 5,068,800 | 2,250,000 | 16,217,991 | 3,800,000 | 256,525,769 |
| 67 | 0 | 234,111,160 | 0 | 0 | 0 | 0 | 0 | 0 | 234,111,160 |
| 68 | 0 | 38,480,291 | 21,394,382 | 7,500,000 | 8,495,029 | 3,000,000 | 27,180,456 | 3,800,000 | 109,850,158 |
| 69 | 0 | 247,502,417 | 15,578,741 | 5,000,000 | 6,185,822 | 2,250,000 | 19,791,984 | 3,800,000 | 300,108,964 |
| 70 | 0 | 352,986,738 | 0 | 0 | 0 | 0 | 0 | 0 | 352,986,738 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delievry Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 71 | 0 | 281,092,532 | 13,073,975 | 5,000,000 | 5,191,260 | 2,250,000 | 16,609,809 | 3,800,000 | 327,017,577 |
| 72 | 0 | 286,482,808 | 0 | 0 | 0 | 0 | 0 | 0 | 286,482,808 |
| 73 | 0 | 158,837,036 | 16,822,870 | 5,000,000 | 6,679,827 | 3,000,000 | 21,372,586 | 3,800,000 | 215,512,318 |
| 74 | 0 | 191,004,478 | 0 | 0 | 0 | 0 | 0 | 0 | 191,004,478 |
| 75 | 0 | 27,696,471 | 19,220,901 | 7,500,000 | 7,632,008 | 3,000,000 | 24,419,160 | 3,800,000 | 93,268,539 |
| 76 | 0 | 170,052,007 | 17,888,111 | 5,000,000 | 7,102,800 | 3,000,000 | 22,725,920 | 3,800,000 | 229,568,838 |
| 77 | 0 | 345,326,107 | 0 | 0 | 0 | 0 | 0 | 0 | 345,326,107 |
| 78 | 0 | 248,492,419 | 14,750,977 | 5,000,000 | 5,857,144 | 2,250,000 | 18,740,354 | 3,800,000 | 298,890,894 |
| 79 | 0 | 313,167,220 | 0 | 0 | 0 | 0 | 0 | 0 | 313,167,220 |
| 80 | 0 | 96,354,860 | 22,818,686 | 7,500,000 | 9,060,575 | 3,750,000 | 28,989,960 | 3,800,000 | 172,274,081 |
| 81 | 0 | 217,548,275 | 0 | 0 | 0 | 0 | 0 | 0 | 217,548,275 |
| 82 | 0 | 58,029,108 | 18,966,128 | 7,500,000 | 7,530,846 | 3,000,000 | 24,095,485 | 3,800,000 | 122,921,567 |
| 83 | 0 | 173,828,325 | 19,419,061 | 7,500,000 | 7,710,692 | 3,000,000 | 24,670,913 | 3,800,000 | 239,928,991 |
| 84 | 0 | 259,767,601 | 0 | 0 | 0 | 0 | 0 | 0 | 259,767,601 |
| 85 | 0 | 119,481,698 | 17,672,828 | 5,000,000 | 7,017,318 | 3,000,000 | 22,452,414 | 3,800,000 | 178,424,259 |
| 86 | 0 | 207,592,081 | 19,987,638 | 7,500,000 | 7,936,455 | 3,000,000 | 25,393,260 | 3,800,000 | 275,209,435 |
| 87 | 0 | 411,041,848 | 0 | 0 | 0 | 0 | 0 | 0 | 411,041,848 |
| 88 | 0 | 249,826,210 | 0 | 0 | 0 | 0 | 0 | 0 | 249,826,210 |
| 89 | 0 | 160,393,716 | 14,253,300 | 5,000,000 | 5,659,532 | 2,250,000 | 18,108,080 | 3,800,000 | 209,464,628 |
| 90 | 0 | 235,973,615 | 17,410,695 | 5,000,000 | 6,913,233 | 3,000,000 | 22,119,387 | 3,800,000 | 294,216,931 |
| 91 | 0 | 295,708,588 | 0 | 0 | 0 | 0 | 0 | 0 | 295,708,588 |
| 92 | 0 | 127,989,911 | 19,517,486 | 7,500,000 | 7,749,773 | 3,000,000 | 24,795,957 | 3,800,000 | 194,353,128 |
| 93 | 0 | 230,142,213 | 0 | 0 | 0 | 0 | 0 | 0 | 230,142,213 |
| 94 | 0 | 13,035,827 | 22,838,457 | 7,500,000 | 9,068,425 | 3,750,000 | 29,015,078 | 3,800,000 | 89,007,788 |

| Day | PT. Rakabu Sejahtera | | Supplier A | | Supplier B | | UD. Trenggalek Lestari | | Supply Chain Cost |
|---|---|---|---|---|---|---|---|---|---|
| | Shortage Cost (Rp) | Holding Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | Production Cost (Rp) | Delievry Cost (Rp) | Production Cost (Rp) | Delivery Cost (Rp) | |
| 95 | 0 | 163,475,906 | 20,962,040 | 7,500,000 | 8,323,359 | 3,000,000 | 26,631,187 | 3,800,000 | 233,692,492 |
| 96 | 0 | 299,104,149 | 0 | 0 | 0 | 0 | 0 | 0 | 299,104,149 |
| 97 | 0 | 118,984,246 | 20,351,380 | 7,500,000 | 8,080,886 | 3,000,000 | 25,855,376 | 3,800,000 | 187,571,888 |
| 98 | 0 | 336,542,890 | 0 | 0 | 0 | 0 | 0 | 0 | 336,542,890 |
| 99 | 0 | 177,325,819 | 18,945,814 | 7,500,000 | 7,522,780 | 3,000,000 | 24,069,677 | 3,800,000 | 242,164,090 |
| 100 | 0 | 244,263,080 | 0 | 0 | 0 | 0 | 0 | 0 | 244,263,080 |

From the table, it can be seen that the supply chain cost for PT. Rakabu Sejahtera and its suppliers is obtained from the holding cost in PT. Rakabu Sejahtera, production cost in Supplier A, Supplier B, and UD. Trenggalek Lestari, and delivery cost in Supplier A, Supplier B, and UD. Trenggalek Lestari. For this scenario, there is no shortage happens, so the shortage cost will be Rp 0. The holding cost includes the maintenance cost, salary for workers, and building cost. The production cost includes the salary for workers for cutting down the tree, loading cost, and materials' purchasing. The delivery cost includes the drivers fee, unloading cost, and fuel cost. Thus, the average supply chain cost of the scenario can be calculated. For scenario 6, the average supply chain cost is Rp 458,518,875.

### 4.3.5 Scenario Selection

From all of the scenario result, the total cost for each scenario has been summarized. The result of all scenario is shown in Table 4.25 below:

Table 4.27 Summary of Scenario

| Description | Initial Model | Scenario 1 | Scenario 2 | Scenario 3 | Scenario 4 | Scenario 5 | Scenario 6 |
|---|---|---|---|---|---|---|---|
| **Shortage Frequency** | 0 | 0 | 2 | 0 | 0 | 11 | 0 |
| **Shortage Quantity (pcs)** | 0 | 0 | 10,105 | 0 | 0 | 95,406 | 0 |
| **Average Inventory Level (pcs)** | 411,626 | 315,681 | 233,492 | 311,974 | 309,192 | 74,929 | 83,087 |
| **Average Inventory Cost (Rp)** | 2,887,856,125 | 2,057,766,427 | 1,485,284,842 | 2,031,816,206 | 2,012,339,739 | 399,361,775 | 429,605,536 |
| **Average Supplier Cost (Rp)** | 16,143,815 | 31,355,000 | 28,650,435 | 29,383,054 | 30,356,353 | 26,971,381 | 28,913,339 |
| **Average Supply Chain Cost (Rp)** | 2,923,603,145 | 2,089,121,427 | 1,513,935,277 | 2,061,199,260 | 2,042,696,092 | 426,333,156 | 458,518,875 |

From the table above, it can be seen that the average inventory level for the initial model or current system is as much as 411,626 pieces. From all scenarios, it can be resumed that the average inventory level is decreasing, which will lead to the reduce of the inventory or holding cost. the result shows that the average inventory level for Scenario 1 is 315,681, Scenario 2 is 233,492, Scenario 3 is 311,974, scenario 4 is 309,192, Scenario 5 is 74,929, and Scenario 6 is 83,087. Besides, for the current system there is no shortage happen while from all scenarios only Scenario 2 and Scenario 5 that have shortage as much as 10,105 and 95,406 pieces respectively. The average supplier cost for the initial model or current system is Rp 16,143,815. From all scenarios, it can be seen that the average supplier cost is increasing. However, the average supply chain cost for all the scenarios have been decreasing from Rp 2,923,603,145. The average supply chain cost for Scenario 1 is Rp 2,089,121,427, Scenario 2 is Rp 1,513,935,277, Scenario 3 is Rp 2,061,199,260, Scenario 4 is Rp 2,042,696,092, Scenario 5 is Rp 426,333,156, and Scenario 6 is Rp 458,518,857.

# CHAPTER V

# DISCUSSION

## 5.1 Result Analysis

Based on the observation, the relation between PT. Rakabu Sejahtera, its supplier, and customers can be analyzed. PT. Rakabu Sejahtera with its supplier only implement traditional setting of the supply chain which is order some material to the supplier based on the customer's demand and inventory condition with the amount of orders are based on the expert experience. There is no other advance agreement between PT. Rakabu Sejahtera and its supplier since it has not been implemented collaborative supply chain system yet. According to Badea et al. (2014), there are five alternatives which are the most important activities in order to fulfill a new strategy for good collaboration. The alternatives are information sharing, decision synchronization, incentive alignment, resource and skill sharing, and knowledge management. In this case, PT. Rakabu Sejahtera with its supplier could be implement two out of five available alternatives which are information sharing and decision synchronization.

For the information sharing, PT. Rakabu Sejahtera could share all the information related to the customer's demand and their inventory condition to the suppliers. Hence, the supplier can deliver the material based on PT. Rakabu Sejahtera inventory's condition. However, this condition might be efficient to be implemented if the PT. Rakabu Sejahtera and its supplier have a long-term relationship, trust, and commitment in order to provide benefits or win-win solution for both parties. Moreover, both of PT. Rakabu Sejahtera and its supplier could make policy for the inventory controlling. This condition lead to the implementation of decision synchronization for both of PT. Rakabu Sejahtera and its supplier. The decision synchronization for both parties could be started by making the procedures or agreements which accommodate advantages for both parties. In this case, the decision making should be made by PT. Rakabu Sejahtera with

its suppliers, which is the delivery time for suppliers to deliver the material to PT. Rakabu Sejahtera, when the material should be delivered by the suppliers to PT. Rakabu Sejahtera, and the amount of material that should be delivered by each supplier. Moreover, PT. Rakabu Sejahtera and its suppliers also has to make an advance agreement about the technical problem that might occur during the process of replenishing the material.

However, collaborative supply chain also has incentive alignment, resource and skill sharing, and knowledge management as the alternatives for the collaborative supply chain. In this research, it only focuses on information sharing and decision synchronization as the first step for PT. Rakabu Sejahtera and its suppliers to implementing collaborative supply chain as has been implemented in Spreadsheet Simulation.

Moreover, the system should be used by PT. Rakabu Sejahtera after implementing vendor managed inventory by considering alternatives in a collaborative supply chain as depicted in Figure 5.1 below:

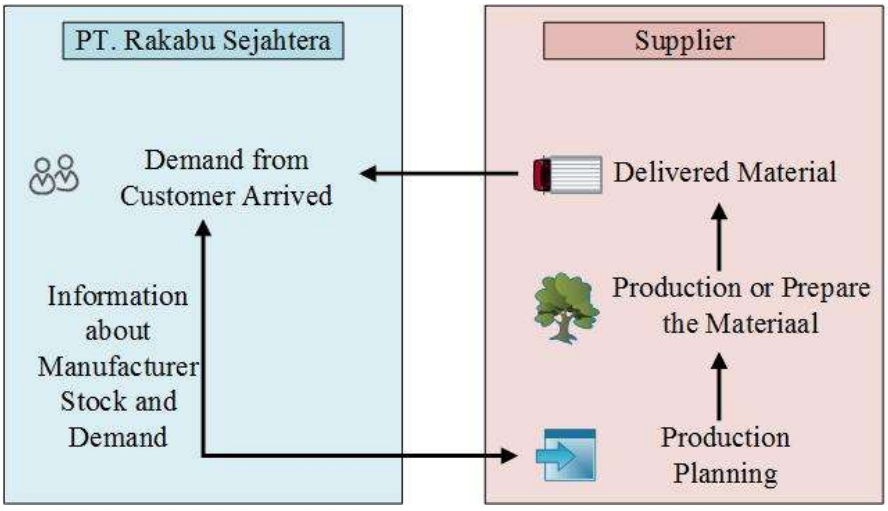



Figure 5.1 System After Implementing Vendor Managed Inventory

From the figure above, it can be seen that after implementing vendor managed inventory by considering two of alternatives in a collaborative supply chain, the system of stock replenishment will be more efficient. The figure depicted that after demand from

customer arrived and product needed for production will effect the inventory condition of PT. Rakabu Sejahtera. While the suppliers conduct production planning in order to fulfill the manufacturer's need, the suppliers and PT. Rakabu Sejahtera should always maintain the information flow about manufacturer inventory condition and demand from customer. The supplier should ensure that the safety stock in PT. Rakabu Sejahtera is still maintained. Then, the supplier should make a production planning and prepare for the material. More over, the delivery time of the material also depends on the suppliers by considering the agreement has been made.

There are some benefits from vendor managed inventory for both vendor/supplier and manufacturer perspective. For supplier perspective, supplier can identify the sales and inventory condition data of manufacturer so it could improve the overall service level by having right amount of product at the right time. The supplier is also able to monitor manufacturer operation, which provides an information about manufacturer's inventory needs. The supplier pushes inventory down to the retailer in smaller batches, more frequently, based on how quickly the items are sold. Other than that, the supplier is able to more accurately predict how much to produce the material because of the linked supply chain, so supplier can reduce their production cost.

Besides, vendor managed inventory also gives some benefits for the manufacturer. In vendor managed inventory, the manufacturer might be the party who benefits most than the rest of supply chain members. The manufacturer could avoid extra purchases to ensure that the products remain stable in numbers. Hence, the manufacturer is more focused in providing great service. The manufacturer does not need to hold as much inventory to ensure they can fulfill orders from customers. This means that they can reduce the financial liabilities of inventory since it reduces the risk of holding inventory or holding cost. Moreover, vendor managed inventory implementation can make the supply chain more stable because all supply chain members are linked. This condition could reduce the risk of major disruptions that can affect all supply chain members that are linked directly and indirectly. Other than that, supply chain members could give better service to the end customer by having the correct item in stock when the end customer needs it.

Then, the system after implementing vendor managed inventory in collaborative supply chain will be later implemented in Spreadsheet Simulation. In the Spreadsheet Simulation, it has 5 scenarios which have been defined. The scenarios are the suppliers deliver the raw material to PT. Rakabu Sejahtera everyday as much as the maximum capacity for one truck for each suppliers (Scenario 1), the suppliers deliver the raw material to PT. Rakabu Sejahtera once in three days as much as the maximum capacity for three trucks for each suppliers (Scenario 2), the suppliers deliver the raw material to PT. Rakabu Sejahtera once in three days as much as the demand of the last three days (Scenario 3), the suppliers deliver raw material to PT. Rakabu Sejahtera everyday based on the random number generation result of each suppliers' historical data (Scenario 4), the suppliers deliver raw material to the PT. Rakabu Sejahtera only when the inventory level reach the re-order point as much as safety stock amount added by demand on the day it reached the re-order point, and half amount of the previous day (Scenario 5), and the suppliers deliver raw material to the PT. Rakabu Sejahtera only when the inventory level reach the re-order point as much as safety stock amount added by demand on the day it reached the re-order point (Scenario 6). From the spreadsheet simulation, it can be seen that supply chain cost for all scenarios have been decreased from the current system. The comparison of scenarios result can be seen in Table 5.1, Table 5.2 and Table 5.3 below:

Table 5.1 Comparison of Inventory Cost of PT. Rakabu Sejahtera Result

| Description | Initial Model | Scenario 1 | Scenario 2 | Scenario 3 | Scenario 4 | Scenario 5 | Scenario 6 |
|---|---|---|---|---|---|---|---|
| Average Inventory Cost (Rp) | 2,887,856,125 | 2,057,766,427 | 1,485,284,842 | 2,031,816,206 | 2,012,339,739 | 399,361,775 | 429,605,536 |
| Decreased Inventory Cost (Rp) | | 830,089,698 | 1,402,571,283 | 856,039,919 | 875,516,386 | 2,488,494,350 | 2,458,250,589 |
| Percentage of Decreased Inventory Cost | | 28.74 % | 48.57 % | 29.64 % | 30.32 % | 86.17% | 85.12% |

Table 5.2 Comparison of Supplier Costing Activities Result

| Description | Initial Model | Scenario 1 | Scenario 2 | Scenario 3 | Scenario 4 | Scenario 5 | Scenario 6 |
|---|---|---|---|---|---|---|---|
| Average Supplier Cost (Rp) | 16,143,815 | 31,355,000 | 28,650,435 | 29,383,054 | 30,356,353 | 26,971,381 | 28,913,339 |
| Increased Supplier Cost (Rp) | | 15,211,185 | 12,506,620 | 13,239,239 | 14,212,537 | 10,827,566 | 12,769,524 |
| Percentage of Increased Supplier Cost | | 94.22 % | 77.47 % | 82.01 % | 88.04 % | 67.07% | 79.10% |

Table 5.3 Comparison of Supply Chain Cost Result

| Description | Initial Model | Scenario 1 | Scenario 2 | Scenario 3 | Scenario 4 | Scenario 5 | Scenario 6 |
|---|---|---|---|---|---|---|---|
| Average Supply Chain Cost (Rp) | 2,923,603,145 | 2,089,121,427 | 1,513,935,277 | 2,061,199,260 | 2,042,696,092 | 426,333,156 | 458,518,875 |
| Decreased Supply Chain Cost (Rp) | | 834,481,717 | 1,409,667,868 | 862,403,885 | 880,907,053 | 2,497,269,989 | 2,465,084,269 |
| Percentage of Decreased Supply Chain Cost | | 28.54 % | 48.22 % | 29.50 % | 30.13 % | 85.42% | 84.32% |

Table 5.1 shows the comparison of inventory cost of PT. Rakabu Sejahtera result. The inventory cost of initial model is Rp 2,887,856,125. After conducting simulation, it can be resulted from simulation that all the inventory cost is decreasing. The inventory cost of Scenario 1 is Rp 2,057,766,427, Scenario 2 is Rp 1,485,284,842, Scenario 3 is Rp 2,031,816,206, Scenario 4 is Rp 2,012,339,739, Scenario 5 is Rp 399,361,775, and Scenario 6 is Rp 429,605,536. From this data, it can be calculated that the decresing of inventory cost from initial model to Scenario 1 is Rp 830,089,698, to Scenario 2 is Rp 1,402,571,283, to Scenario 3 is Rp 856,039,919, to Scenario 4 is Rp 875,516,386, to Scenario 5 is Rp 2,488,494,350, and Scenario 6 is Rp 2,458,250,589. In order to make it easier to be analyzed, the percentage of the decreasing have been calculated. The percentage of inventory cost decreasing for Scenario 1 is 28.74%, Scenario 2 is 48.57%, Scenario 3 is 29.64%, Scenario 4 is 30.32%, Scenario 5 is 86.17%, and Scenario 6 is 85.12%.

Table 5.2 shows the comparison of supplier cost of the suppliers for PT. Rakabu Sejahtera result. The supplier cost of initial model is Rp 16,143,815. After conducting simulation, it can be resulted from simulation that all the supplier cost is increasing. The supplier cost of Scenario 1 is Rp 31,355,000, Scenario 2 is Rp 28,650,435, Scenario 3 is Rp 29,383,054, Scenario 4 is Rp 30,356,353, Scenario 5 is Rp 26,971,381, and Scenario 6 is Rp 28,913,339. From this data, it can be calculated that the increasing of supplier cost from initial model to Scenario 1 is Rp 15,211,185, to Scenario 2 is Rp 12,506,620, to Scenario 3 is Rp 13,239,239, to Scenario 4 is Rp 14,212,537, and to Scenario 5 is Rp 10,827,566, and to Scenario 6 is Rp 12,769,524. In order to make it easier to be analyzed, the percentage of the increasing have been calculated. The percentage of supplier cost increasing for Scenario 1 is 94.22%, Scenario 2 is 77.47%, Scenario 3 is 82.01%, Scenario 4 is 88.04%, Scenario 5 is 67.07%, and Scenario 6 is 79.10%.

Table 5.3 shows the comparison of supply chain cost of PT. Rakabu Sejahtera result and its suppliers. The supply chain cost of initial model is Rp 2,923,603,145. After conducting simulation, it can be resulted from simulation that all the supply chain cost is decreasing. The supply chain cost of Scenario 1 is Rp 2,089,121,427, Scenario 2 is Rp 1,513,935,277, Scenario 3 is Rp 2,061,199,260, Scenario 4 is Rp 2,042,696,092, Scenario

5 is Rp 426,333,156, and Scenario 6 is Rp 458,518,875. From this data, it can be calculated that the decreasing of supply chain cost from initial model to Scenario 1 is Rp 834,481,717, to Scenario 2 is Rp 1,409,667,868, to Scenario 3 is Rp 862,403,885, to Scenario 4 is Rp 880,907,053, to Scenario 5 is Rp 2,497,269,989, and to Scenario 6 is Rp 2,465,084,269. In order to make it easier to be analyzed, the percentage of the decreasing have been calculated. The percentage of supply chain cost decreasing for Scenario 1 is 28.54%, Scenario 2 is 48.22%, Scenario 3 is 29.50%, Scenario 4 is 30.13%, and Scenario 5 is 85.42%, and Scenario 6 is 84.32%.

From the result, it can be seen that the supply chain cost of all scenarios decreased compared to the initial model. This condition happens because the supply chain cost in all scenarios decreased gradually while in the initial model increased gradually. The decreasing of supply chain cost is affected by the raw material arrived from the suppliers, different with the initial model which is the raw material arrived is relatively high which affect the holding cost. However, the increasing of supplier cost is affected by the number of material delivered by suppliers for all scenario is increased and relatively stable compared to the initial model. In the initial model, the number of material delivered by suppliers is very fluctuated.

In Scenario 1, Scenario 2, Scenario 3, and Scenario 4, the changes of supply chain cost is not really fluctuated because in those scenarios, the amount of material delivered by suppliers is relatively stable which gives impact to holding cost for the manufacturer, and production and delivery cost for the suppliers. However, the supply chain costs for those scenarios could be decreased because of the decreasing in manufacturer's holding cost.

Eventhough all scenarios' supply chain costs are reduced, considerable changes occur in Scenario 5 and Scenario 6. This condition happens because in Scenario 5 and Scenario 6, the suppliers will wait for the inventory condition in PT. Rakabu Sejahtera reached the reorder point. Thus, the company could reduce the excess inventory or high level of material in inventory. However, the suppliers cost increased because in the scenarios the number of material production cost is increased. The material production

cost increased because in the scenario the amount of material need to be delivered is high compare to the initial model which deliver the material almost everyday with different amount.

From the result above, can be seen that Scenario 6 is the best scenario. This condition happens because from all scenarios, Scenario 5 has the highest percentage of inventory cost decreasing in PT. Rakabu Sejahtera which is 86.17% but in Scenario 5 there are some shortage happen as much as 95,406 pieces. However, the second highest percentage of inventory decreasing is Scenario 6 which is 85.12%, while the other scenarios' percentage is 28.74% (Scenario 1), 48.57% (Scenario 2), 29.64% (Scenario 3), and 30.32% (Scenario 4).

Besides, the lowest increasing of supplier cost is Scenario 5 with 67.07% and the second lowest increasing of supplier cost is Scenario 2 with 77.47%. However, the material shortage of 10,105 pieces happens in Scenario 2 and the material shortage of 95,406 pieces happens in Scenario 5. While the percentage of supplier cost increasing for Scenario 6 with 79.10% is the lowest if it is compared with Scenario 1 with 94.22%, Scenario 3 with 82.01%, and Scenario 4 with 88.04%.

On the other side, Scenario 5 has the highest decreasing of supply chain cost percentage which is 85.42% but there is a shortage happen in Scenario 5. While the second higest decreasing of supply chain cost percentage is Scenario 6 with 84.32% compare to the other scenario's percentage which is 28.54% (Scenario 1), 48.22% (Scenario 2), 29.50% (Scenario 3), and 30.13% (Scenario 4). Thus, it will be beneficial for the supply chain of PT. Rakabu Sejahtera and its suppliers to implement Scenario 6 which is the suppliers deliver raw material to the PT. Rakabu Sejahtera only when the inventory level reach the re-order point as much as safety stock amount added by demand on the day it reached the re-order point which is 55,597 pieces.

# CHAPTER VI

# CONCLUSION AND RECOMMENDATION

## 6.1 CONCLUSION

After conducting the study, it can be concluded that:

1. The implementation of vendor managed inventory for PT. Rakabu Sejahtera based on the alternatives of a collaborative supply chain, which are information sharing and decision synchronization. PT. Rakabu Sejahtera could share all the information related to the customer demand and their inventory condition to the suppliers. Hence, the supplier can deliver the material with the certain quantity based on PT. Rakabu Sejahtera inventory's condition. Moreover, both of PT. Rakabu Sejahtera and its supplier could make policy for the inventory controlling as the implementation of decision synchronization for both of PT. Rakabu Sejahtera and its supplier. In this case, the decision making that should be made by PT. Rakabu Sejahtera with its suppliers is the delivery time for suppliers to deliver the material to PT. Rakabu Sejahtera, when the material should be delivered by the suppliers to PT. Rakabu Sejahtera, and amount of material that should be delivered by each suppliers.

2. Based on the result of Spreadsheet Simulation, the best scenario is Scenario 6 which is the suppliers deliver raw material to the PT. Rakabu Sejahtera only when the inventory level reach the re-order point (55,597 pieces) as much as safety stock amount added by demand on the day it reached the re-order point. From this scenario, the inventory cost of PT. Rakabu Sejahtera is decreasing as much as 85.12% from Rp 2,887,856,125 to Rp 429,605,536. Thus, PT. Rakabu Sejahtera can save around Rp 2,458,250,589. Besides, the cost for suppliers is increasing as much as 79.10% from Rp 16,143,815 to Rp 28,913,339. However, the supply

chain cost is decreasing as much as 84.32% from Rp 2,923,603,145 to Rp 458,518,875.

## 6.2 RECOMMENDATION

There are some recommendations given based on the discussion for PT. Rakabu Sejahtera with its suppliers and future research. There are:

1. PT. Rakabu Sejahtera and its suppliers have to enchance the collaboration from all aspects including sharing information, resource, and skill in order to get more profit.

2. Other manufacturer with the supplier, and retailer should start to try to implement collaborative supply chain.

3. For future research, conducting simulation and analysis in collaborative supply chain for multi-supplier, multi-manufacturer, and multi-retailer is needed after considering the supply chain condition in real situation.

4. Source or skill sharing, incentive alignment, and knowledge management, as the other alternatives in a collaborative supply chain, risk and effectiveness for supply chain members are also needed to be analyzed in order to know how much the effect given to the supply chain.

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