

CHAPTER I Introduction

I.1 Background

PT. XYZ is a pasteurization milk processing company that produce milk drink from pure cow milk which located in Lembang, Bandung. PT. XYZ produce 16 variants of milk drink such as chocolate, strawberry, mocca, etc. PT. XYZ receive raw material every morning, which is fresh cow's milk, from local cattle breeder cooperatives that located near their factory. PT. XYZ use make-to-order approach in their production system. So, the production quantity is determine after customer's order is received. They also use just-in-time philosophy which is to produce goods at the time required by customer, in the amount that meet the customer's need in the most economical or most efficient way through eliminating waste and continuous improvement (Yasuhiro, 2000).

PT. XYZ don't sell their product directly to end user, instead they distribute their product to many companies which serve milk for their employees or operators in lunch time. So, their customer is mostly a manufacture company from various kinds of industry. They have about 40 customers and most of them are outside Bandung. It can be seen in the customer's distribution map in Figure I.1.

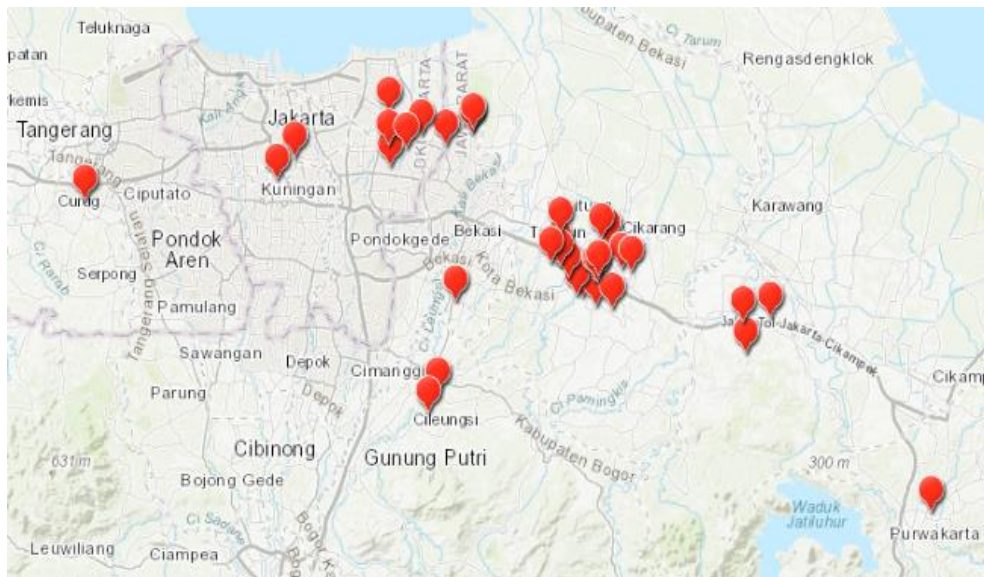


Figure I.1 Customer's Distribution Map

Source : Sales Division of PT. XYZ

To meet customer's demand, PT. XYZ have to ensure that their distribution process is going smoothly. Because it is one of the key process of their supply chain. Moreover, their product is categorize as perishable product that have short life time and have to be maintained in certain degree. Their milk drink has shelf life around five days and the optimum degree to keep the milk in good condition is around 8°C. Therefore to distribute their product, PT. XYZ use refrigerator truck to maintain the optimum degree. The truck also equipped by GPS, so that the location of the truck can be known and if there's route change, the company will also know. PT. XYZ have two type of refrigerator truck which explained in the Table I.1.

Table I.1 Fleet Type

Source : Distribution Division of PT. XYZ

Fleet Type	Numbers of fleet	Capacity
Colt Diesel Double (CDD)	5	18.000 cup of milk
Colt Diesel Engkel (CDE)	2	9.000 cup of milk

PT. XYZ determine the fleet used based on customer order, so in one day all of the fleet may be used or only just several fleet. The departure delivery will also be adjusted. Usually there are two departures, in the morning and evening. However, if customer orders are high there can be three departures. PT. XYZ also devide the route into Cikampek-Cikarang route and Cikarang-Jakarta route to make the delivery easier, but which customer will be deliver first is determined by driver operator. PT. XYZ just inform the delivery order (DO) to driver operator that contain which customer will be delivered, what flavor is ordered by each customer, and the quantity of each customer's order. The driver operator also informed about each customer time window, so he can estimate the sequence of the delivery. However, the delivery may not be done as planned. From the given time window by each customer, the delivery cannot make it on time. It can be seen in the data of delivery delay frequency in Table I.2.

Table I.2 Delivery Delay Frequency

Source : Distribution Division of PT. XYZ

Month	Delivery Frequency	Delay Frequency	Percentage of On Time Delivery
Jan	57	5	91.2%
Feb	41	0	100.0%
Mar	48	3	93.8%
Apr	53	3	94.3%
Mei	40	0	100.0%
Jun	59	2	96.6%

As we can see from the graph the average on time delivery is around 96%. it is below PT. XYZ target which is 98%. The impact of the delay itself is vary between customers. Because when delay occur, each customer has their own regulation that has been settled in agreement contract. The delay's consequences can be penalty cost or invoice reduction based on how long is the delay, fine, warning letter, and reject. The consequences are very disadvantageous for PT. XYZ. This problem certainly give negative impact to PT. XYZ, moreover customer satisfaction may also be decreased. Therefore, it is necessary to solve this problem to improve delivery performance that can satisfy customers.

PT. XYZ always monitor the delivery process to customer. By using GPS in their vehicles, they know whether the delivery is on time or not. PT. XYZ also can monitor the sequence of delivery to customer in each vehicle. Based on the recapitulation of each delay from PT. XYZ, there are several factors that influenced than can be seen in Figure I.2.

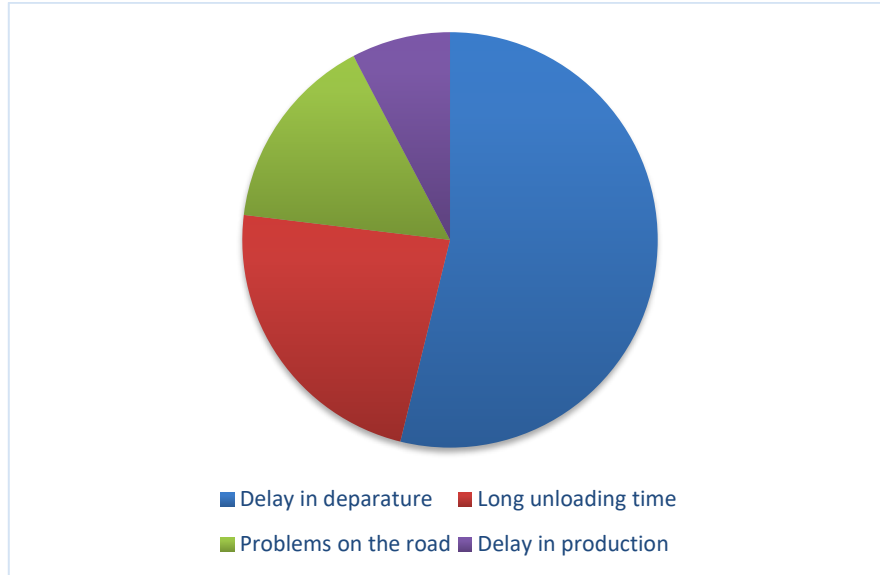


Figure I.2 Factors Causing Delay

Based on the Figure I.2 about factors causing delivery delay, the most influential factors is delay in departure. It is because PT. XYZ don't have fixed schedule of delivery and they miscalculate the departure time because of improper route determination that also leads to longer travel distance. Route determination is left entirely to driver operator therefore there's no proper calculation that can optimize the distrubution processes. They also spent a lot of time in goods unloading activity because operators have to move the milk from the vehicle into customer's refrigerator and put each cup one by one to stack the milk neatly inside the refrigerator. As mention before, the driver operator is the one who make decision which customer to be visited first. Observation is done for one day horizon plan to know the sequence of delivery to total 40 customer. Table I.3 shows the result of one day observation .

Table I.3 One Day Distribution route

Fleet	Existing Distribution Route	Distance (Km)
CDD 1	D - C8 - C27 - C28 - C19 – C01 – D	241.208
CDD 2	D - C35 - C36 - C32 - C5 - C22 - C40 - C16 - C15 - C13 - C14 - C12 - C3 - C24 - C11 – D	357.111
CDD 3	D - C20 - C2 - C33 – D	609.436
CDD 4	D - C23 - C17 - C30 - C21 - C29 - C18 - C9 – D	299.959

Table I.3 One Day Distribution route (Continuation)

Fleet	Existing Distribution Route	Distance (Km)
CDD 5	D - C25 - C26 - C34 - C4 - C10 – D	298.604
CDE 1	D - C38 - C37 - C39 - C6 - C7 - C31 – D	330.171
CDE 2	-	-
Total distance		2136.489

From total seven vehicle available, PT. XYZ only use six vehicle. The total travel distance is 2340.949 Km. For further analysis, observation is done for one week (five days) to compare each day horizon plan with the same number of customer which is 40. The result of one week observation shows in Figure I.3.

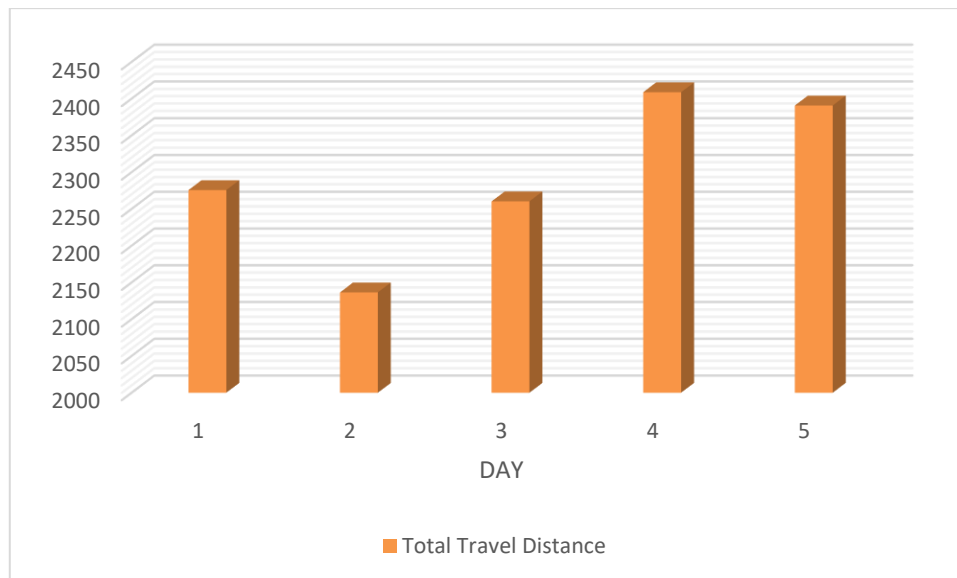


Figure I.3 One Week Travel Distance

Based on Figure I.3, the total travel distance is different each day. Even though the customer who must be visited is the same, but the driver operator choose different route and sequence of delivery each day. From this data, we can conclude that route selection is influential factors in distribution. Improper distribution route can lead to late delivery and also longer distance means longer travel time. This problem occur because PT. XYZ not precisely choosing the route and they miscalculate the departure time because of improper route determination. Route determination is left entirely to driver operator therefore there's no proper calculation that can optimize the distrubution processes. They also spent a lot of time in goods unloading activity

because operators have to move the milk from the vehicle into customer's refrigerator and put each cup one by one to stack the milk neatly inside the refrigerator.

Based on the issues that have been stated, the main problem that occur in PT. XYZ is a classical transportation problem which is Vehicle Routing Problem (VRP). In this research, capacitated VRP with heterogeneous fleet of vehicles considering time windows will be solved.

I.2 Problem Formulation

Based on background problem that has been explained in the background problem, the problem formulation of this research is

1. How is the optimum distribution route to deliver goods to customer in order to minimize travel distance?
2. How is the minimum travel distance of the optimum distribution route?

I.3 Research Objectives

Based on the problem formulation that has been stated, the objectives of this research is

1. To determine the optimum distribution route to deliver goods to customer in order to minimize travel distance.
2. To determine minimum travel distance of the optimum route distribution.

I.4 Problem Limitations

Problem limitation is needed to make the research to be more directed. The following problem limitations are:

1. Data that used in this research is historical data from January 2017 until June 2017.
2. This research used dynamic deterministic demand.
3. Traffic jam is not considered by this research.
4. The horizon planning is one day.
5. Speed used in this research is average speed from each fleet type.
6. Route between node is route between DC and customers also between customers.

7. Transportation cost and penalty cost are not consider in this research.

I.5 Research Benefits

The benefit of this research are:

1. As an advice and consideration for the company in order to optimize distribution system with route determination, so that delivery delay can be prevented.
2. Able to implement knowledge and solve the industry problem.
3. As a reference and comparison for further research in related fields.

I.6 Writing Systematic

Systematics sequence of this research is

Chapter 1 Introduction

This chapter contains of background research, problem formulation, research objective, research benefit, problem limitation, and writing systematics.

Chapter II Literature Review

This chapter contains description about theory and literature that will be used in this research. This chapter also discusses about relationship between research benefit and concept of studies.

Chapter III Research Methodology

In this chapter, the detail steps of this research in sequence order is explained. It is also include problems formulation, data analysis, data processing, describing the hypothesis, designing process, and conduct the conclusion and recommendation for the company.

Chapter IV Collecting and Processing Data

In this chapter, data that used in this research to solve the problem is shown and processed according to the method that has been stated on research methodology.

Chapter V Analysis

This chapter describes analysis of the data that has been processed and calculated on chapter IV. It is also explained about comparison between proposed improvement and current state of the company regarding the problem.

Chapter VI Conclusion and Suggestion

This chapter contain conclusion and suggestion for the company and readers for next research.