CHAPTER I

INTRODUCTION

This chapter contains the research background, problem formulation, research objectives, research scopes, and an outline of the report.

1.1 Background

One element of competitive advantage that all sectors must have is distribution network management. As a result, businesses fight to find solutions to distribution and transportation issues. Due to customer demands and industry competitiveness, the firm improved the distribution and transportation infrastructure (Pujawan & Mahendrawathi, 2017). A statement from the chairman of the Indonesian Logistics Association (ALI) quoted from Saputra (2022) stated that a total of 23% of supply chain costs to GDP, 9% are caused by transportation costs.

Distribution is a part of logistics that has a fundamental function for the company. Transportation costs are the biggest cost in logistics costs, this is because the process of shipping goods can reach 4-30% of sales (Garside & Rahmasari, 2017). The research conducted by Sang et al. (2021), transportation costs are 40%-50% of the total logistics costs and 4%-10% of the selling price of the final product. It is so abundantly evident that transportation decisions have a direct impact on the overall cost of logistics as well as costs in other areas of the business.

Operational expenses are one of many factors that must be taken into account while a firm is operating its business. Effective control of transportation expenses may help a firm enhance profits because they are one of the main operating cost drivers (Daft, 2015). The importance of managing transportation costs can affect the efficiency and effectiveness of the overall supply chain. So, companies need to pay attention to transportation costs as one of the key factors in

supply chain management. Transportation costs can affect the effectiveness of the supply chain in meeting customer needs and maintaining company profits (Gattorna, 2016).

Abdurrahman et al. (2019), Nasser et al. (2021), and Fatma et al. (2022) discovered that planning distribution routes can reduce the cost of transportation. Several factors are taken into account while choosing a route, including total distance, trip duration, vehicle capacity, and fuel costs. The amount of gasoline consumed is one of the elements that determine transportation expenses. A corporation must take the environment into account while performing a distribution since it might have an influence on greenhouse gas emissions and other environmental effects. The fuel usage of vehicles is a significant factor in rising gas emissions. According to Poonthalir & Nadarajan (2018), the weight of the load is one aspect that affects fuel usage. According to US Departement of Energy (2008) in Ramadhani & Garside (2021), Reduced fuel consumption is policy-relevant, especially for businesses involved in transportation logistics, as fuel consumption rises by 2% for every extra 100 pounds of capacity.

Plastic bottles, plastic cups, and plastic jugs are just a few of the several packaging options for bottled drinking water. The 19-liter jug used for packaging is referred to as a gallon in Indonesia. In Indonesia, the market for bottled water is considered to be rather sizable. Quoted from Lestari (2022) the general chairman of the Bottled Drinking Water Industry Association (Aspadin), Rachmat Hidayat said that the production of Bottled Drinking Water (AMDK) is expected to increase this year by 5% to 32.41 billion liters from the 30.87 billion liters predicted realized in 2021. Gallon-sized packaging accounts for 70% of the market, with bottled and glass drinking water goods making up the remaining 20%. Both small- and large-scale bottled drinking water businesses may be found all around Indonesia. Aqua, Cleo, Pristine, and Nestlé Pure Life are a few of Indonesia's well-known manufacturers of gallon bottles of water.

PT Tina Dimans Raya is a company engaged in the distributor of products from Danone which is located at Jalan Veteran No.80 Ujung Gurun, Padang City. The company has warehouses storing products from Danone such as Aqua, Vit, Mizone, and Tea Caaya. The products to be distributed are presented in boxes and gallons. Product distribution activities at this company from 8 am to 5 pm.

For Aqua gallon, this is a product that is included in the category of cheap goods. This is because, in the distribution process, the number of products that can be transported is small and the price of these products is not expensive. PT Tina Dimans Raya has a distribution process that starts from the warehouse or depot. In the warehouse, the process of loading goods into vehicles is carried out. After that, the product will be sent to store. In the delivery process to store, delivery and pickup activities occur. Water-filled gallons are delivered to stores as part of delivery activities, while empty gallons are returned as part of pickup activities. After that, the vehicle continues delivery to other stores without returning to the stores that has been visited. If all stores have been visited or the gallons contained in the vehicle have run out, the vehicle will return to the warehouse or depot. **Figure 1.1** depicts the distribution of Aqua gallon at PT Tina Dimans Raya.
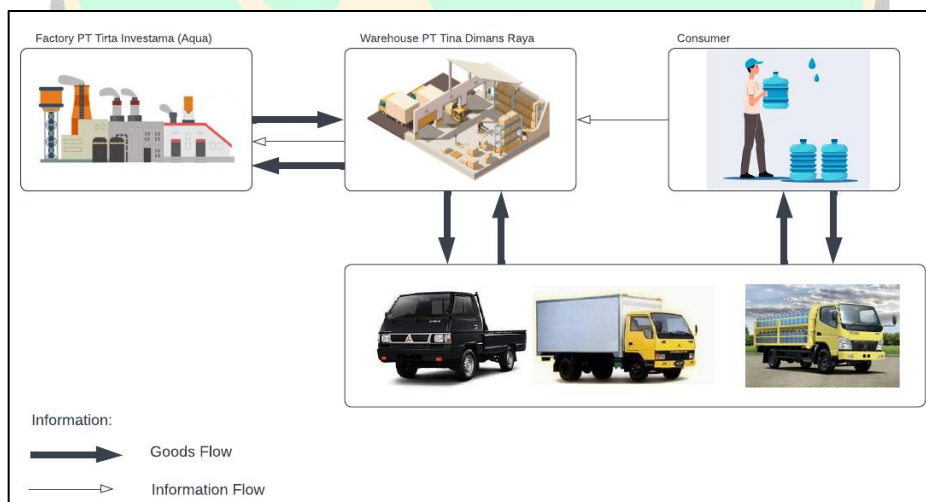

Figure 1.1 Aqua gallon distribution process at PT Tina Dimans Raya

PT Tina Dimans Raya distributes Aqua gallon in all cities in West Sumatra, especially in the Padang city. The number of stores that were sent Aqua gallons was

approximately 52 outlets in the city of Padang. In shipping gallons, there are two types of shipping. The first is the dropping type. With this type, stores will contact the company to order the required Aqua gallons. After receiving the number of gallons orders by the company, the company sends the product according to the request from the store that has placed the order. The second type is the canvassing type. According to the vehicle's maximum capacity, the business loads gallons into it. Following that, the business will use its own cars to distribute goods to every part of the city of Padang. Products are delivered to the closest store to be sold by salespeople. The location of the store to be visited is shown in **Figure 1.2** as follows.
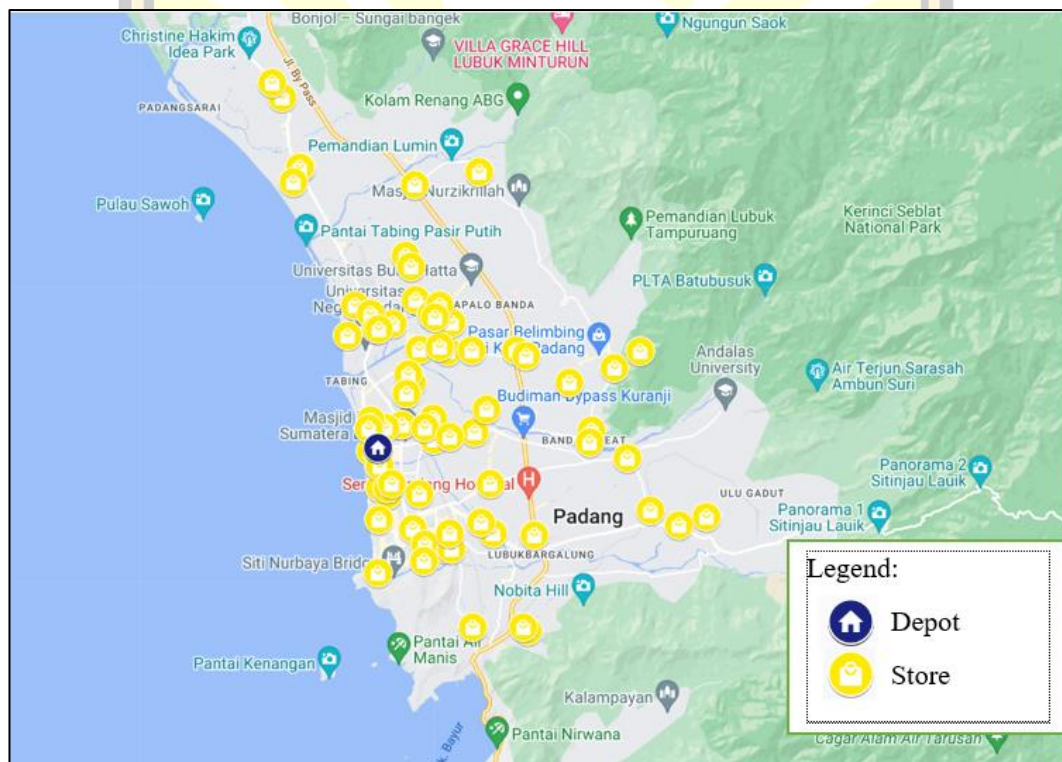

Figure 1.2 The location of the store to be visited

Source: Google Maps

Route determination is carried out by the company based on the number of orders and shops that are in the same direction as the order. In the distribution process, the determination of the visited store only comes from improvised and the driver's experience. The driver visits the store starting from the nearest warehouse and then continues to the surrounding store. Because the company has never made

rules in minimizing mileage and distribution time, resulting in the length of time and transportation costs of shipping gallons being large.

PT Tina Dimans Raya supplies Aqua gallons throughout the city using 6 units of fleet, each of which delivers to a separate location. Canter-type cars with two-level shell adaptation make up 4 of the 6 vehicles in the fleet. For the transportation of Aqua gallons, the company also has 1 unit of L300 vehicle and a box type car. The corporation does a decent job of delivering gallons of Aqua to all of its outlets, but delivery distances, distribution times, and truck capacity all prevent it from being used to its full potential. Fleets with the Canter type may load 225 gallons, 140 gallons for L300 vehicles, and 200 gallons for box cars. The majority of delivery methods employed by businesses operate on a canvas system, which increases distribution time and results in less profit for the business. The total capacity of each vehicle in sending Aqua gallons can be seen in **Table 1.1**.

Table 1.1 Vehicle capacity in the delivery of Aqua gallon

No	Transportation Type	Vehicle Capacity (Gallon)	Number of Vehicles
1	L300	140	1
2	Box	200	1
3	Canter	225	4

Based on interviews with PT Tina Dimans Raya's employees in the field of transportation, gallons are shipped twice a day on average. Fixed costs and variable costs are separated from the computed transportation costs. Fixed includes the expense of depreciating a car, which has a monthly depreciation value of Rp2.083.333 and the administration Rp119.048. Fuel costs, maintenance expenses like the price of replacing tires and oil, and salesperson and driver wages are all included in the variable cost. A month's worth of fuel costs between Rp1.520.000 and Rp1.600.000, maintenance is Rp500.000, and the minimum pay in Padang Rp2.742.476 is paid to drivers and salespersons. In some stores, there are additional fees, such as parking and unloading fees for a total of Rp200.000 per month. **Table 1.2** shows the transportation cost for each vehicle.

Table 1.2 Component of transportation cost in a month

No	Information	Cost (Month)	
1	Fixed Cost	Rp	2.202.381
2	Variable Cost	Rp	7.704.952
Transportation Cost		Rp	39.629.332

According to research from Yohanes et al. (2020), applying the vehicle routing problem to bottled water distributors can save transportation costs by 31.27% per day. If it is assumed that the delivery system of this research is the same as yohanes' research with different constraints. If a month is 30 days, PT Tina Dimans Raya can save approximately Rp12.392.092. If the company can calculate fuel consumption, then the company can minimize costs at variable costs so that transportation costs can be further reduced.

The weight of one gallon of Aqua is approximately 19.77 kg, or 4358.54 pounds when expressed in pounds. A car usually uses 5.5 km/ L of gasoline when the load is maximal. The price of Pertamina biodiesel as of 3 September 2022 was Rp6.800/L. **Table 1.3** shows the increase in fuel consumption when converted (Anin et al., 2013).

Table 1.3 The fuel data cost and average distance in a month

No	Information	
1	Biodiesel Price	Rp6.800
2	Consumption Rate	5,5 km/L
3	Average Fuel Consumption in a Month	Rp1.520.000
4	Average Mileage in a Month	1229,41 km

According to Kuo & Wang (2011) on Ramadhani & Garside (2021), choosing a route focused on reducing fuel consumption can result in a total distance reduction of 4.05% and a fuel savings of 8.29%. By using route determination and reducing fuel use, the business may travel 49.9 km less and use 18.53 L less fuel. Quoted by Sherif et al. (2021) the thing that can be done to reduce transportation costs is to determine transportation routes by minimizing the total vehicle distance and increasing the effectiveness of product distribution activities.

The distribution of Aqua gallons therefore requires a route that may save transportation costs, where the cost component can be calculated through model building and take into account limits like vehicle capacity and working time each day. A vehicle routing problem (VRP) model, developed by the PT Tina Dimans Raya system, is thus required to handle the transportation issue associated with the distribution of Aqua gallon at the lowest possible cost. The impact of vehicle weight on fuel consumption is a special challenge in this situation. So, cutting down on fuel use is a sensible approach to reducing the cost of transportation. The quantity of requests from each business varies, and settlement will take place on a certain day, thus the route that will be formed is determined dynamically. By this final project, it is planned that this model can reduce the price of Aqua gallons distribution and provide software that can take these dynamic routes into account.

1.2   Problem Formulation

The formulation of the problem in this final project is how to determine the Aqua gallon delivery route to get minimum vehicle fuel cost considering vehicle load at PT Tina Dimans Raya.

1.3   Objectives

The objective of this study is to determine the transportation route for delivery Aqua gallons at PT Tina Dimans Raya to minimize the vehicle fuel costs considering vehicle load.

1.4   Scope of Problems

The assumptions of this study are as follows:
1.   The speed of the fleet is considered fixed around 40km/h.

2.   Traffic jams are ignored.

3.   Unloading and loading time are 2.5 hours.

4.   Total load not exceed capacity of vehicle.

The scopes of the problem in this study are as follows:

1.   The vehicles used are only 4 Canter types.

2.   The type of delivery used is dropping, where customers place an order in advance with the company.

3.   The number of stores is as many as pre-established.

4.   The starting and ending points of distribution are the same, namely the warehouse of PT Tina Dimans Raya on Veteran Street with coverage of outlet areas in the city of Padang.

5.   The route used is dynamic because each trip made depends on store demand.

6.   Each store is visited only once in one distribution route.

1.5   Outline of The Report

The outline of writing this report is as follows:

CHAPTER I INTRODUCTION

This chapter contains the background, problem formulation, objectives, the scope of the problem, and an outline of the thesis.

CHAPTER II LITERATURE REVIEW

This chapter contains a literature review of the thesis, journal, and book related to the topic.

CHAPTER III RESEARCH METHODOLOGY

This chapter contains problem formulation, and methodologies of the thesis to solve the problem.

CHAPTER IV MATHEMATICAL MODEL AND RESULT

This chapter contains mathematical model and result carried out in determining the route of sending Aqua gallons at PT Tina Dimans Raya.

CHAPTER V ANALYSIS

This chapter contains the analysis of the data processing that has been created.

CHAPTER VI CONCLUSION

This chapter contains the conclusion of the research that has been done and suggestions for further research.