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DETERMINATION OF TRANSPORT ROUTES USING THE SAVING MATRIX METHOD AT PT XYZ

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ABSTRACT

PT XYZ is a company engaged in manufacturing that produces electronic components and installation services for these components. In this study, the company will send components and help install them in nine locations in Sumatra. The analysis of determining distribution routes uses the saving matrix method. The results of the analysis using the saving matrix method show that the original distribution distance of 9926 kilometers can be reduced to 2937.7 kilometers, which means that the distance can be shortened and more efficient by 70% or around 6988.3 kilometers. The original cost was Rp. 54,386 .000 down to Rp. 16,716,000 Thus there is a distribution channel savings of Rp. 37,670,000 or about 69.2%.

KEYWORDS

Saving Matrix Method, Efficiency, Transportation Costs.

INTRODUCTION

Consumer demands for quality, product, price, better service, delivery accuracy (Adianto, 2018) and product availability on the market are currently getting higher (Santoso, Mustaniroh, & Pranowo, 2018) and proper distribution is needed (Karundeng, Mandey, & Sumarauw, 2018). Effectiveness in choosing the right destination route will reduce waste in terms of cost, time and power (Trisna, Fatimah, & Nasution, 2019).

Product allocation and determining the route of delivery of goods are important in an industry (Ardhyani, 2017), both small and large scale industries (Musita, 2018). Errors in determining distribution channels (Sibarani, 2013) and delays in product delivery can

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hinder the distribution of products from producers to consumers (Karundeng et al., 2018), which can result in reducing company profits and can also have the potential for losses to the company (Marchelia, 2014).

In an effort to minimize product distribution transportation costs (Huda, 2018), companies must pay attention to the existing transportation network system (Trisna et al., 2019). The transportation network system can be seen in terms of effectiveness (Wulandari & Sudiana, 2018), in terms of safety, high accessibility, integrated, sufficient capacity, orderly, smooth, fast, easy to reach, timely, comfortable, affordable, orderly, safe (Razi & SUMBERDAYA, 2014), and low in pollution as well as in terms of efficiency in transportation (Sitorus, Hidayat, & Prasetya, 2014). the meaning of having a high utility in a unified transportation system network (Amin, Hamidi, & Ekwarso, 2017).

To anticipate this problem, we need a method that can provide minimal product distribution costs (Putra & Handayani, 2018). The Savings Matrix method is a method used to determine product distribution routes (Supriyadi, Mawardi, & Nalhadi, 2017) to marketing areas by determining the distribution routes that must be passed (Bimantara, 2018) and the number of vehicles based on vehicle capacity in order (Muziansyah, 2015) to obtain the shortest route and minimal transportation costs (Huda, 2018). The Savings Matrix method is also one of the techniques (Ikfan & Masudin, 2014) used to schedule a limited number of vehicles from facilities that have a maximum capacity (Suparjo, 2017).

By using the Savings Matrix Method, it is hoped that it can help overcome the problems above, so that the company is able to plan well for each installation item that will be sent.

RESEARCH METHODS

The Savings Matrix method is a method used to determine product distribution routes to marketing areas by determining the distribution routes that must be passed and the number of vehicles based on vehicle capacity in order to obtain the shortest route and minimal transportation costs. The Savings Matrix method is also one of the techniques used to schedule a limited number of vehicles from facilities that have a maximum capacity. By using the Savings Matrix method, it is expected to be able to answer research problems, and the company is able to make plans for each installation that will be sent. The data used in this study are as follows:

1. Primary data is data that is specifically taken for the sole purpose of research, which is obtained from the results of interviews.
2. Secondary Data is data obtained from references originating from sources such as companies, namely PT XYZ Project Cost Data.

RESULTS AND DISCUSSION

A. Consumer Demand Data

Table 1 is data on consumer demand for product shipments and installations in January 2021.

Table 1. Data on Demand for Delivery of Goods and Installation

No	Location Code	Installation Request
1	A	2
2	B	2
3	C	1
4	D	2
5	E	1

6	F	2
7	G	2
8	H	2
9	I	2

Source: Data Cost Project PT XYZ

B. Initial Route

The company divides the distribution and installation into 2 groups due to limited material for that month. Each group is able to serve a maximum of 8 sites in 9 different locations. The company's initial routes amounted to 9 routes with a total distance generated on this initial route of 9926 kilometers. The distance on the initial route is considered too long and must be trimmed so as not to incur transportation costs and long delivery times.

C. Installation Distance Data

Data on the distance between the company and the installation location and the distance between locations are shown in Table 2 and Table 3.

Table 2. Initial Route and Distance

No	Location	Distance (km)
1	P-A-P	606
2	P-B-P	996
3	P-C-P	1612
4	P-D-P	600
5	P-E-P	858
6	P-F-P	996
7	P-G-P	1600
8	P-H-P	1038
9	P-I-P	1620

Source: Data Cost Project PT XYZ

Table 3. Distance between Locations

	P	A	B	C	D	E	F	G	H	I
P	0	303	498	806	300	429	498	800	519	810
A		0	264	527	13	165	264	566	288	576
B			0	342	255	165	0	336	215	346
C				0	560	370	342	16.6	485	4,9
D					0	156	254	555	284	567
E						0	168	470	234	481
F							0	336	215	346
G								0	481	9,8
H									0	487
I										0

Source: data processing

D. Initial Transportation Fee

Initial transportation costs are taken based on company data. Initial transportation costs are listed in Table 4.

Table 4. Initial Transportation Cost

No	Location	Distance (km)	Labor Costs	Transportation and BBM	Shipping Costs
1	A	303	Rp. 2.958.000	Rp. 500.000	Rp. 3.400.000
2	B	498	Rp. 2.069.000	Rp. 550.000	Rp. 3.400.000
3	C	806	Rp. 1.770.000	Rp. 275.000	Rp. 3.400.000
4	D	300	Rp. 1.770.000	Rp. 0	Rp. 3.400.000
5	E	429	Rp. 1.770.000	Rp. 350.000	Rp. 3.400.000
6	F	498	Rp. 2.069.000	Rp. 550.000	Rp. 3.400.000
7	G	800	Rp. 2.950.000	Rp. 1.300.000	Rp. 3.400.000
8	H	519	Rp. 1.170.000	Rp. 375.000	Rp. 3.400.000
9	I	810	Rp. 2.360.000	Rp. 1.000.000	Rp. 3.400.000
Total				Rp. 54.386.000	

Source: PT XYZ project cost data

E. Identify the Savings Matrix

Saving Matrix is obtained by combining two or more location routes simultaneously. The merger is adjusted to the number of consumer requests and the number of combinations is not allowed to exceed the capacity of the transportation means. The table of the savings matrix can be seen in Table 5.

Table 5. Matrix for Savings

	A	B	C	D	E	F	G	H	I
A	-	573	528	590	537	537	537	534	537
B		-	962	543	762	996	962	802	962
C			-	546	865	962	1590	840	1611
D				-	573	544	545	535	543
E					-	759	759	714	758
F						-	96.2	802	962
G							-	838	1600
H								-	842
I									-

Source: data processing

F. Installation Request Allocation

Allocation of consumer demand can be started by looking at the value of the greatest savings. The allocation of each different location can be combined up to the limit of the carrying capacity. The results of the merging of routes can be explained in Table 6. The number of routes originally was 9. After combining, the number of routes became 2. The total load transported was still below the maximum capacity of the transportation equipment, which was 8 pieces. Thus, both routes can be used.

Table 6. Allocation of consumer demand

No	Route	Consumer	Total Transport	Information	Transport Capacity
1	Route 1	0 – C –I – G – F – C - 0	8	OK	8
2	Route 2	0 – H – B – D – A – 0	8	OK	8

Source: data processing

Table 7 Nearest method

No	Route	Consumer	Total Distance	Fuel Transportation	Labor	Cost Shipping
1	Rute 1	0 – C –I – G – F – C - 0	1632.7	Rp. 2.000.000	Rp. 2.958.000	Rp. 3.400.000
2	Rute 2	0 – H – B – D – A – 0	1305	Rp. 2.000.000	Rp. 2.958.000	Rp. 3.400.000
Total			2937.7		Rp. 16.716.000	

Source: data processing

G. Routing

Determination of the product distribution route starts from the process of identifying the distance matrix. This process requires data on the distance between the warehouse to each location and the distance between locations. The next step is to identify the savings matrix. (Suparjo, 2017) Saving matrix is realized by combining 6 or more locations into one route.

The company still implements product delivery using one line, namely from warehouse-location1 - warehouse and warehouse - location 2-warehouse and so on. These conditions can make the product distribution process take longer, longer distances, and more distribution costs. Therefore, a route change is needed that can combine several locations into one route.

Merging these routes can save the number of routes, distance, and distribution costs. By referring to the savings matrix table, the allocation process can be carried out. The allocation of each location into one route can be combined up to the capacity limit of the company's transportation equipment (Suparjo, 2017). The merger starts with the largest savings value. Starting from the saving value of 1611 which is the savings from combining location C and location I. The number of installation requests at both locations is 2 sites while the maximum total is 8 sites. The total is still below the maximum capacity limit of 8 sites. Thus, the merger is feasible, location C and location I are merged into route 1, and so on. Next is to sort the locations in a predefined route.

H. Route Comparison and Initial Transportation Costs

The comparison of product distribution routes before the saving matrix method is applied and after is very clear. Initially, the company had 9 routes for delivery and installation at a site. The total distance traveled by the company during the process of shipping goods and installation at 9 locations is 9926 kilometers. This makes the cost to the company is also not small, namely Rp. 54,386,000. After applying the saving matrix method, the number of routes, total distance, and product distribution costs in the company experienced a significant decrease with the assumption that labor costs and transportation costs were the highest from the initial 9 routes. The company can reduce the mileage by 6988.3 kilometers or about 70%. Product distribution costs also experienced savings of IDR 37,670,000 or 69.2%.

CONCLUSION

The most appropriate shipping route to minimize transportation/distribution costs at PT XYZ can be reduced to a total of 9 routes from 2 routes. The initial distance to send goods must be covered as far as 9926 kilometers with a transportation cost of Rp. 54,386,000. Thus, the company can save about 70% or 6988.3 kilometers of distance and can reduce product delivery distribution costs up to 69.2% or Rp. 37,670,000.

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