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ANALYSIS OF THE GOODS SUPPLY DISTRIBUTION AT CV. AMB

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ABSTRACT

Goods distribution is one of the critical aspects of supply chain management that directly affects a company's operational efficiency. Optimal delivery efficiency can reduce logistics costs and improve customer service levels. CV. AMB, as a company engaged in electronic goods distribution, faces challenges in determining efficient and effective delivery routes. Irregularities in route planning can lead to increased costs and delivery time. The use of optimization algorithms, such as Dijkstra's Algorithm, has been proven to assist companies in determining the shortest and fastest routes. Therefore, this study aims to analyze and optimize the distribution routes of CV. AMB in order to improve delivery efficiency. This study utilizes primary and secondary data. The primary data consist of interview survey results with the management of CV. AMB regarding the existing conditions of goods supply distribution from the central warehouse to all retail outlets, as well as distance data between outlets and the distribution warehouse obtained using Google Maps/Earth. The secondary data include road network data in the Province of Bali. The results of this study indicate that Dijkstra's Algorithm is able to improve delivery efficiency by identifying the shortest route with a distance of 41.6 km and the fastest travel time of 124 minutes. In addition, the alternative routes obtained are capable of reducing travel costs in terms of fuel consumption by 26.923% compared to the previous costs.

Keywords: delivery eficiency; djikstra algorithm; route distribution

INTRODUCTION

Minimarkets continue to strengthen their market presence by expanding their networks or opening new branches across various regions, while maintaining relatively uniform pricing with their central stores. This price consistency is one of the main factors that encourages customer loyalty. Several major minimarket chains that are widely recognized in Indonesia, such as Indomaret, Alfamart, and Circle K, have now reached almost all regions of the country, from urban to rural areas. Their success has also stimulated the emergence of new minimarkets that adopt similar concepts and network-based systems. One such example is CV. AMB, a networked minimarket originating from Bali that has demonstrated significant growth. Headquartered in Gianyar Regency, AMB currently operates 17 branches distributed across the Gianyar area and Denpasar City. The distinctiveness of CV. AMB compared to other minimarkets in Bali lies in its business approach, which integrates local Balinese cultural values. In its operations, one of the key success factors of this networked minimarket is the goods distribution system from the central logistics hub to each branch. Timeliness and reliability of distribution are crucial aspects in ensuring product availability, particularly for high-turnover (fast-moving) products.

Goods distribution is one of the critical aspects of supply chain management that directly influences a company's operational efficiency (Chopra & Meindl, 2016). Optimal delivery efficiency can reduce logistics costs and improve customer service levels (Ballou, 2004). CV. AMB, as a company engaged in the retail sector, faces challenges in determining efficient and effective delivery routes. Irregularities in route planning can lead to increased delivery costs and transit time (Toth & Vigo, 2014). The application of optimization algorithms, such as Dijkstra's Algorithm, has been proven to assist companies in identifying the shortest and

fastest routes (Dijkstra, 1959; Cormen et al., 2009). Therefore, this study aims to analyze and optimize the distribution routes of CV. AMB in order to improve delivery efficiency.

Under the current existing conditions, CV. AMB does not have a fixed or standardized delivery route. Delivery routes are entirely determined by the drivers and helpers on duty, while the company only provides travel allowances (fuel expenses and meal allowances for two personnel), the amounts of which are estimated by management within reasonable limits. According to the research team, this practice requires further examination to assess whether the management's decision-making is already optimal or whether additional efficiencies can still be achieved, particularly in reducing previous travel costs.

Therefore, this study is important to conduct an analysis of the shortest (optimal) delivery routes for goods distribution at CV. AMB, from the central warehouse to all retail outlets/branches, in order to optimize distribution time, distance, and costs.

METHOD

This research will conduct data analysis techniques using Djikstra Algorithm, conducting literature studies, preliminary surveys, preparing and conducting survey, processing and analysing data and drawing conclusions. The research was conducted from March to September 2025. The data that has been obtained will be processed using Djikstra Algorithm analysis with Ms Exel. There are several stages in conducting the analysis in this study:

1. Collecting data
   The data collection technique that will be used by the author in this study is by interview, namely by asking open and direct questions to the informants of this study, so that the data needed by the author is obtained.

2. Conducting Djikstra Algorithm Analysis
   This method can be used to determine the shortest route in term of time and distance. Djikstra Algorithm can provide information on how much the suppy distribution can improve. The more eficient the supply distribution, it's mean the more efficient the route.

3. Conducting PCI (Transportation Operation Cost) Analysis
   This method can be used to determine the Transportation operation costDjikstra Algorithm can provide information on how much the suppy distribution can improve. The more eficient the supply distribution, it's mean the more efficient the route.

RESULT AND DISCUSSION

The researchers conducted field data collection activities and utilized the Google Maps application, as well as performed survey data validation at all delivery points of CV. AMB in the Denpasar area. The delivery points (branch outlets), along with their addresses and location coordinates, are as follows:

Table 1.
Node Code Delivery

1	AMB Pusat (Singapadu)	6	AMB Pakerisan
2	AMB Nangka	7	AMB Sesetan
3	AMB Badak Agung	8	AMB Batanta
4	AMB Jaya Giri	9	AMB Buana Raya
5	AMB Sidakarya	10	AMB Pulau Galang

Table 2.
Travel Distance Matrix Between Delivery Points

GERAI	1	2	3	4	5	6	7	8	9	10
1	0	6,8	10,6	10,8	15	14	15,6	14,7	15,1	16,1
2	6,8	0	6,2	6	10,3	9,3	9,2	9,2	7,8	10,7
3	10,6	6,2	0	0,45	5,4	4,1	6,2	6	8,7	7,5
4	10,8	6	0,45	0	6,9	4,5	6,4	5,6	8,2	7,1
5	15	10,3	5,4	6,9	0	1	0,75	4,5	8,8	4,8
6	14	9,3	4,1	4,5	1	0	2,1	5,9	9,1	6,2
7	15,6	9,2	6,2	6,4	0,75	2,1	0	3,9	8,2	4,2
8	14,7	9,2	6	5,6	4,5	5,9	3,9	0	4,3	1,5
9	15,1	7,8	8,7	8,2	8,8	9,1	8,2	4,3	0	6,3
10	16,1	10,7	7,5	7,1	4,8	6,2	4,2	1,5	6,3	0

Table 3.
Travel Time Matrix Between Delivery Points

GERAI	1	2	3	4	5	6	7	8	9	10
1	0	18	29	30	40	37	43	41	43	45
2	18	0	15	15	29	25	27	24	25	29
3	29	15	0	1	15	11	17	16	24	20
4	30	15	1	0	16	13	17	15	23	19
5	40	29	15	16	0	3	3	13	26	14
6	37	25	11	13	3	0	6	16	26	17
7	43	27	17	17	3	6	0	11	23	12
8	41	24	16	15	13	16	11	0	13	5
9	43	25	24	23	26	26	23	13	0	21
10	45	29	20	19	14	17	12	5	21	0

Table 4.
Travel Distance Vs Time Matrix Between Delivery Points

GERAI	1	2	3	4	5	6	7	8	9	10
1	0	122,4	307,4	324	600	518	670,8	602,7	649,3	724,5
2	122,4	0	93	90	298,7	232,5	248,4	220,8	195	310,3
3	307,4	93	0	0,45	81	45,1	105,4	96	208,8	150
4	324	90	0,45	0	110,4	58,5	108,8	84	188,6	134,9
5	600	298,7	81	110,4	0	3	2,25	58,5	228,8	67,2
6	518	232,5	45,1	58,5	3	0	12,6	94,4	236,6	105,4
7	670,8	248,4	105,4	108,8	2,25	12,6	0	42,9	188,6	50,4
8	602,7	220,8	96	84	58,5	94,4	42,9	0	55,9	7,5
9	649,3	195	208,8	188,6	228,8	236,6	188,6	55,9	0	132,3
10	724,5	310,3	150	134,9	67,2	105,4	50,4	7,5	132,3	0

Based on the three matrices above, the researchers proceeded with data analysis in the form of iterations based on the shortest travel distance, iterations based on the fastest travel time, and iterations based on a combination of travel time and travel distance for all delivery points (branch outlets).

Based on the results of the iterations and the compiled distance data for all alternative routes, the shortest route was identified with a total distance of 29.1 km, as illustrated in the following figure:

Figure 1. Shorthest Path based on Traveling Distance

Based on the results of the iterations and the compiled travel time data for all alternative routes, the route with the shortest travel time was identified at 81 minutes, as illustrated in the following figure:

Figure 2. Fastest Time Path Based on Travelling Time

Based on the results of the iterations and the compiled distance–time analysis for all alternative routes, the route with the minimum distance × time value of 377 was identified, as illustrated in the following figure:

Figure 3. Shortest and Fastest Path Based on Travelling Distance and Time

Discussion on Route Selection

Based on the summary of iterations for the shortest distance, fastest time, and the combination of distance and time, the same route was obtained as follows:

9 – 8 – 10 – 7 – 5 – 6 – 3 – 4 – 2 – 1

AMB Bhuana Raya – AMB Batanta – AMB Pulau Galang – AMB Sesetan – AMB Sidakarya – AMB Tukad Pekerisan – AMB Badak Agung – AMB Jayagiri – AMB Nangka – AMB Singapadu

This route covers the shortest distance of 29.1 km and also achieves the fastest travel time (under the conditions observed during the survey) of 81 minutes.

However, since the distribution source has been established at CV. AMB Singapadu (point 1), all the above iteration summaries were adjusted to include the initial distance and time from AMB Singapadu at the start and the return to AMB Singapadu at the end. The results are as follows:

Table 5. Travelling Distance Recapitulation of Alternative Route

ITERASI	RUTE	JARAK TEMPUH (KM)	JARAK START/FINISH KEMBALI KE TITIK 1	TOTAL JARAK TEMPUH (KM)
1	1 - 2 - 4 - 3 - 6 - 5 - 7 - 8 - 10 - 9 - 1	30,8	15,1	45,9
2	1 - 2 - 4 - 3 - 6 - 5 - 7 - 8 - 10 - 9 - 1	39,1	6,8	45,9
3	1 - 3 - 4 - 6 - 5 - 7 - 8 - 10 - 9 - 2 - 1	33	10,6	43,6
4	1 - 4 - 3 - 6 - 5 - 7 - 8 - 10 - 9 - 2 - 1	30,8	10,8	41,6
5	1 - 5 - 7 - 6 - 3 - 4 - 8 - 10 - 9 - 2 - 1	35,4	15	50,4
6	1 - 6 - 5 - 7 - 8 - 10 - 9 - 2 - 4 - 3 - 1	38,3	14	52,3
7	1 - 7 - 5 - 6 - 3 - 4 - 8 - 10 - 9 - 2 - 1	34,3	15,6	49,9
8	1 - 8 - 10 - 7 - 5 - 6 - 3 - 4 - 2 - 1 - 9	39,9	14,7	54,6
9	1 - 9 - 8 - 10 - 7 - 5 - 6 - 3 - 4 - 2 - 1	29,1	15,1	44,2
10	1 - 10 - 8 - 7 - 5 - 6 - 3 - 4 - 2 - 1 - 9	39,6	16,1	55,7

Based on the summary table of total distances for the alternative routes above, the shortest distance or route was identified as Alternative Route 4, as follows:

1 – 4 – 3 – 6 – 5 – 7 – 8 – 10 – 9 – 2 – 1

AMB Singapadu – AMB Jayagiri – AMB Badak Agung – AMB Pakerisan – AMB

Sidakarya – AMB Sesetan – AMB Batanta – AMB Pulau Galang – AMB Bhuana Raya – AMB Nangka – AMB Singapadu
This route has the shortest distance of 41.6 km.

Table 6.
Travelling Time Recapitulation of Alternative Route

ITERASI	RUTE	WAKTU TEMPUH (MENIT)	WAKTU START/FINISH KEMBALI KE TITIK 1	TOTAL WAKTU TEMPUH (MENIT)
1	1 - 2 - 3 - 4 - 6 - 5 - 7 - 8 - 10 - 9	90	43	133
2	2 - 3 - 4 - 6 - 5 - 7 - 8 - 10 - 9 - 1	115	18	133
3	3 - 4 - 6 - 5 - 7 - 8 - 10 - 9 - 2 - 1	127	29	156
4	4 - 3 - 6 - 5 - 7 - 8 - 10 - 9 - 2 - 1	98	30	128
5	5 - 6 - 7 - 8 - 10 - 4 - 3 - 2 -1 - 9	121	40	161
6	6 - 5 - 7 - 8 - 10 - 4 - 3 - 2 - 1 - 9	118	37	155
7	7 - 5 - 6 - 3 - 4 - 8 - 10 - 9 - 2 - 1	102	43	145
8	8 - 10 - 7 - 5 - 6 - 3 - 4 - 2 - 1 - 9	111	41	152
9	9 - 8 - 10 - 7 - 5 - 6 - 3 - 4 - 2 - 1	81	43	124
10	10 - 8 - 7 - 5 - 6 - 3 - 4 - 2 - 1 - 9	110	45	155

Based on the summary table of total travel times for the alternative routes above, the route with the shortest travel time was identified as Alternative Route 9, with a total travel time of 124 minutes (2 hours and 4 minutes) to visit all outlets. Alternative Route 9 is as follows:
1 – 9 – 8 – 10 – 7 – 5 – 6 – 3 – 4 – 2 – 1
AMB Singapadu – AMB Bhuana Raya – AMB Batanta – AMB Pulau Galang – AMB Sesetan – AMB Sidakarya – AMB Tukad Pekerisan – AMB Badak Agung – AMB Jayagiri – AMB Nangka – AMB Singapadu.
This route has the fastest time travelling of 124 minutes.

Table 7.
Travelling Distance and Time Recapitulation of Alternative Route

ITERASI	RUTE	JARAK Vs WAKTU	START/FINISH ke Titik 1	TOTAL JARAK Vs WAKTU TEMPUH
1	1 - 2 - 4 - 3 - 5 - 6 - 7 - 8 - 10 - 9	492,15	649,3	1141,45
2	2 - 4 - 3 - 6 - 5 - 7 - 8 - 10 - 9 - 1	972,8	122,4	1095,2
3	3 - 4 - 6 - 5 - 7 - 8 - 10 - 9 - 2 - 1	564,3	307,4	871,7
4	4 - 3 - 6 - 5 - 7 - 8 - 10 - 9 - 2 - 1	550,9	324	874,9
5	5 - 6 - 7 - 8 - 10 - 9 - 4 - 3 - 2 - 1	602,75	600	1202,75
6	6 - 5 - 7 - 8 - 10 - 9 - 4 - 3 - 2 - 1	592,4	518	1110,4
7	7 - 5 - 6 - 3 - 4 - 8 - 10 - 9 - 2 - 1	592	670,8	1262,8
8	8 - 10 - 7 - 5 - 6 - 3 - 4 - 2 - 1 - 9	970,4	602,7	1573,1
9	9 - 8 - 10 - 7 - 5 - 6 - 3 - 4 - 2 - 1	377	649,3	1026,3
10	10 - 8 - 7 - 5 - 6 - 3 - 4 - 2 - 1 - 9	962,9	724,5	1687,4

Analysis of Optimal Routes and Cost Comparison
Based on the summary of the total distance × time for all alternative routes, the route exhibiting the shortest combined distance and travel time was identified as Alternative Route 3, with an indicator value of 871.7 for visiting all outlets. The route is as follows:
1 – 3 – 4 – 6 – 5 – 7 – 8 – 10 – 9 – 2 – 1
AMB Singapadu – AMB Badak Agung – AMB Jayagiri – AMB Pakerisan – AMB Sidakarya – AMB Sesetan – AMB Batanta – AMB Pulau Galang – AMB Bhuana Raya – AMB Nangka – AMB Singapadu

Comparison of Existing Routes with Optimized Routes

The existing delivery routes for transporting goods to each CV. AMB outlet in Denpasar do not follow fixed paths. Route selection is entirely dependent on the judgment and preferences of the drivers on duty, resulting in highly irregular and inconsistent routing. This makes it challenging to evaluate or standardize existing routes. In contrast, the proposed routes derived from the present study incorporate considerations of both shortest distance and fastest travel time. Implementing these optimized routes is expected to minimize delivery costs, particularly in terms of travel allowances.

Comparison of Existing Delivery Costs with Optimized Route Costs

Previously, delivery costs (travel allowances) had no standardized basis and were estimated solely based on travel distance. Under these conditions, the total cost for a single trip covering all AMB branch outlets in Denpasar was IDR 200,000, comprising IDR 130,000 for fuel and IDR 35,000 per person for meals.

For the optimized route with the shortest distance and travel time, fuel costs were calculated using the current diesel price of IDR 6,800 per liter. Vehicle specifications and operational parameters were as follows:

- Vehicle type: Mitsubishi PS 100
- Average speed: 40 km/h

Fuel consumption (Y) was calculated using the Vehicle Operating Cost (VOC) method from Pacific Consultants International (PCI):

$Y = 0{,}21692\ V^2 - 24{,}15490\ V + 954{,}78624$

$Y = (0{,}21692 \times 40^2) - (24{,}15490 \times 40) + 954{,}78624$

$Y = 335{,}66224$

Fuel Cost / KM = (335,66224 x Rp 6.800)/1000
= Rp 2.282.503,23/1000
= Rp 2.282,50323

Thus, the fuel consumption cost for a single delivery along the optimized route (41.6 km) is:

Fuel Cost = Rp 2.282,50323 x 41,6
= Rp 94.952,1344
= ≈ Rp 95.000

Consequently, the travel cost is reduced from the previous IDR 130,000 to IDR 95,000, yielding a savings of IDR 35,000. In percentage terms, the fuel consumption cost reduction alone accounts for 26.923%.

CONCLUSION

The conclusions that can be drawn from this study are as follows:

1. The existing distribution routes for goods delivery from AM Singapadu Central to all AM branch outlets in Denpasar are random (non-fixed) and depend on the routes selected by the drivers and helpers on duty. This condition occurs because management does not establish rigid delivery time targets, but only requires that deliveries be completed within the same day. Consequently, drivers tend to seek their own alternative routes in order to maximize the travel allowance provided by the company.

2. The results of the Dijkstra Algorithm analysis indicate that the proposed alternative routes are able to improve delivery efficiency, particularly in terms of travel costs. The alternative route with the shortest distance is 41.6 km, while the fastest alternative route requires 124 minutes (2 hours and 4 minutes). For the combined distance and time criteria, the shortest

route yields a value of 871.7. The above alternative routes were calculated using the Vehicle Operating Cost (VOC) method from PCI, resulting in fuel consumption cost savings of IDR 35,000, or 26.923% compared to the previous fuel consumption costs.

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