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Research Article

Implementation of the Nearest Neighbour Method for Determining Distribution Routes to Enhance Distribution Efficiency

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ABSTRACT

Non-optimal determination of distribution routes can lead to excessive travel distances, delivery delays, and increased operational costs. This problem commonly occurs when route planning is conducted manually and without the support of optimization methods. This study was conducted at CV. XYZ, a beverage distribution company located in Batuphat Timur, Muara Satu District, Lhokseumawe City. The company distributes beverage products such as Teh Botol Sosro and Sosro Fruitea to 57 customer outlets across the Lhokseumawe area. Currently, distribution routes are determined based on drivers' experience, which may result in inefficiencies in travel distance, distribution time, and operational costs. This study aims to determine optimal distribution routes using the Nearest Neighbour method and to analyze its impact on distribution cost efficiency. The research methods include field observation, interviews, and distance measurement using Google Maps, which were subsequently analyzed using the Nearest Neighbour algorithm with the assistance of MATLAB software. The results indicate that the total distribution distance was reduced from 936.25 km to 708.01 km, resulting in a distance saving of 228.24 km (24.38%). Distribution time decreased from 81.65 hours to 77.84 hours, achieving an efficiency improvement of 4.66%. In addition, distribution costs were reduced from IDR 3,161,952 to IDR 2,902,950, yielding a cost saving of IDR 258,131 (8.17%). Based on these findings, it can be concluded that the Nearest Neighbour method is effective in optimizing distribution routes and improving efficiency in terms of distance, time, and operational costs.

Keywords: Distribution; Vehicle Routing Problem; Nearest Neighbour; Efficiency; Route Optimization

1. INTRODUCTION

Supply Chain Management encompasses the comprehensive management of materials from procurement and production processes to the distribution of products to end consumers (Nurjanaha & Siti Nursyamsiah, 2022). Each stage in the supply chain is interconnected through three main flows, namely product flow, information flow, and financial flow, which operate bidirectionally (Mudhifatul Jannah & Rahmawati, 2020) (Sengkey et al., 2020). One of the most critical aspects of supply chain management is distribution and transportation, as route accuracy and delivery efficiency play a significant role in determining a company's competitiveness. Efficiency itself is defined as the ratio between input and output, where a higher output-to-input ratio indicates a higher level of efficiency (Rozalina et al., 2020). In practice, distribution and transportation management involves several fundamental functions, including service level determination, selection of transportation modes, shipment consolidation, scheduling and route planning, and distribution cost control (Andriyas Puji & Cantika, 2023). However, many companies still face challenges in determining optimal distribution routes. One such case is CV. XYZ, a beverage distribution company serving business partners in the city of Lhokseumawe with a total of 57 customer outlets. Currently, route determination relies heavily on the drivers' subjective experience, resulting in non-optimal travel distances, longer delivery times, and relatively high and fluctuating distribution costs. Operationally, the distribution problem faced by the company can be classified as a Vehicle Routing Problem (VRP), which involves determining delivery routes from a single depot to multiple customers with the objective of minimizing distance, time, or distribution costs (Chandra & Setiawan, 2018). Various VRP variants have been developed to accommodate different operational conditions, such as Capacitated VRP, Time Windows VRP, and Split Delivery VRP (Elatar et al., 2023). One of the simplest and most widely used heuristic methods for solving VRP is the Nearest Neighbour method, which determines routes based on the shortest distance between customers (Martono & Warnars, 2020)**;**(Kurnia et al., 2021).

Numerous previous studies have demonstrated that the application of the Nearest Neighbour method (Maula & Bahri, 2024)(Ardiyansyah et al., 2024), either independently or in combination with other methods, can significantly reduce travel distance and distribution costs. Studies by (Abadi et al., 2014)(Kasus et al., 2014) showed that the Nearest Neighbour algorithm is effective in determining more efficient distribution routes for bakery and ice block products. Other studies conducted by (Oktavia et al., 2019), (Lestari et al., 2022), and (Parvez, 2020) also confirmed that this method improves distribution efficiency across various industrial sectors (Metode et al., 2021); (Payungi, 2022). Furthermore, the combination of the Nearest Neighbour method with the Saving Matrix method and other algorithms has been reported to produce better optimization results in minimizing distribution costs (Ariyanto & Suseno, 2023); (Azhar et al., 2023); (X & Wulandari, 2020). Based on these previous studies, it can be concluded that route optimization methods, including the Nearest Neighbour approach, are capable of significantly reducing travel distance and distribution costs (Oetomo et al., 2022); (Ariyanto & Suseno, 2023). Therefore, this study aims to apply the Nearest Neighbour method to determine distribution routes at CV. XYZ in order to optimize travel distance, delivery time, and distribution costs more efficiently.

2. RESEARCH METHOD

This study employs a descriptive observational approach, with the object of research focusing on distribution routes from the depot to customer outlets. Data collection was conducted through direct observation to obtain the actual conditions of the distribution process, interviews with company management to identify distribution route problems, and distance measurements using Google Maps, which were subsequently processed with the assistance of MATLAB software. The data used consist of primary data, including vehicle capacity, loading time, maximum working hours for distribution, the number and types of vehicles, customer locations and demand levels, and transportation costs. Secondary data were obtained from interviews with company management and drivers.

2.1 Operational Variable Definition

The operational variables in this study are used to describe the factors that influence the determination of distribution routes (Ismail et al., n.d.)(Sipil et al., 2025). These variables include the distance between the depot or warehouse and customer outlets, as well as the distance between outlets, which serve as the basis for determining the shortest distribution routes. In addition, the quantity of products delivered to each outlet and vehicle capacity are considered as constraints in the distribution process to ensure that deliveries do not exceed the vehicle's carrying capacity.

2.2 Analysis Method

The analysis stage begins with the identification of distances between the depot and customers, as well as distances among customers. The distance between locations is calculated using the Euclidean Distance formula as follows (Distance et al., 2022)(Nurnaningsih et al., 2021)(Pln, 2022):

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

The depot is designated as the starting point of distribution, after which the nearest customer is selected as the first destination. Subsequently, the distribution route is constructed by selecting the next nearest unvisited location until all customers are served, while still considering the maximum vehicle capacity. If the vehicle capacity is insufficient, a new distribution route is formed. The calculation of distribution time includes vehicle preparation time, loading time, travel time, and unloading time, which are formulated as follows(Fatma & Manurung, 2020)(Meilani & Iswara, 2018):

1) Loading time = demand quantity / loading rate
2) Travel time = (travel distance / vehicle speed) × 60
3) Unloading time = (demand quantity × service time) / 60
4) Total distribution time = setup time + loading time + travel time + unloading time

Distribution costs are calculated based on labor costs and fuel costs, using the following equations(Pangesty et al., 2021):

1) Fuel cost = (travel distance / fuel consumption ratio) × fuel price
2) Total distribution cost = labor cost + fuel cost

All stages of the Nearest Neighbour method are implemented and visualized using MATLAB software to obtain the most efficient distribution routes.

3. RESULTS AND DISCUSSION

3.1 Distribution Area

CV. XYZ serves 57 customers distributed across the Lhokseumawe City area. The company operates a single depot that functions as both the starting and ending point for product distribution. Each customer has a different demand level, and the distribution addresses are presented in **Table 1**.

Table 1. Customer Distribution Area

Code	Address	Code	Address
o1	Jl. Komplek Arun – Samping Ponpes Putri	o30	Jl. Simpang Rancong–Blangtupat
o2	Jl. Komplek Arun	o31	Jl. Pelabuhan Blang Naleng Mameh
o3	Jl. Komplek Arun	o32	Jl. Medan Banda Aceh–Blang Pulo
o4	Jl. Perumahan Komplek PAG	o33	Jl. Darussalam–Hagu Selatan
o5	Jl. Medan Banda Aceh Blangtupat Timur	o34	Jl. Darussalam–Depan MAN
o6	Jl. Medan Banda Aceh Blangtupat Timur (Depan SPBU)	o35	Jl. Kampung Jawa Lama
o7	Jl. Medan Banda Aceh Blang Pulo (Depan Arifa)	o36	Jl. Darussalam–Hagu Selatan (Samping SMP 2)
o8	Jl. Medan Banda Aceh Blang Pulo (Depan Arifa)	o37	Jl. Darussalam
o9	Jl. Paloh	o38	Jl. Darussalam–Simpang Pertamina
o10	Jl. Simpang Len (Samping Foto Copy)	o39	Jl. Darussalam–Simpang Pertamina
o11	Jl. Kampus Unimal (Lorong Depan Pintu Masuk)	o40	Jl. Darussalam–Hagu Teungoh
o12	Jl. Kampus Unimal Blang Puloe (Depan Lorong Kampus)	o41	Jl. Darussalam–Jomblang
o13	Jl. Kampus Unimal–Blang Pulo	o42	Jl. Listrik–Hagu Teungoh
o14	Jl. Medan Banda Aceh (Lorong Meunasah–Blang Pulo)	o43	Jl. Darussalam–Simpang Pertamina
o15	Jl. Medan Banda Aceh–Blang Pulo (Lorong Meunasah)	o44	Jl. Darussalam–Depan SMA 1 Lhokseumawe
o16	Jl. Telkom Blang Pulo	o45	Jl. Darussalam–Gp. Jawa Baru
o17	Jl. Medan Banda Aceh–Simpang Len	o46	Jl. Darussalam No. 3 – Kp. Jawa Lama
o18	Jl. Medan Banda Aceh Blang Pulo	o47	Jl. Darussalam No. 34 – Kp. Jawa Baru
o19	Jl. Medan Banda Aceh Blang Pulo (Depan Arifa Mart)	o48	Jl. Darussalam No. 44 – Kp. Lama
o20	Jl. Medan Banda Aceh–Blangtupat (SPBU Blangtupat)	o49	Jl. Darussalam–Jomblang
o21	Jl. Medan Banda Aceh–Blang Pulo	o50	Jl. Darussalam–Kp. Jawa Baru
o22	Jl. Medan Banda Aceh Blang Puloe	o51	Jl. Panglateh – Sp. 4
o23	Jl. Medan Banda Aceh–Blangtupat (Depan Tuah Ibu 2)	o52	Jl. Panglateh – Sp. 4
o24	Jl. Medan Banda Aceh (Depan Tuah Ibu)	o53	Jl. Panglateh – Sp. 4
o25	Jl. Medan Banda Aceh–Blangtupat	o54	Jl. Teungku Chik Ditiro – Lancang Garam
o26	Jl. Rancong	o55	Baiturrahman
o27	Jl. Simpang Rancong–Blangtupat	o56	Jl. Teungku Chik Ditiro – Lancang Garam
o28	Jl. Rancong–Simpang Rancong	o57	Jl. Mon Geudong
o29	Jl. Simpang Rancong–Blangtupat (Depan Taufiqah)		

3.2 Customer Demand and Distribution Facilities

Based on customer demand data in June, the company served 57 customers across various distribution areas with a total demand of 8,424 cartons and a total distribution distance of 73.75 km. Customer demand varies considerably, with the highest demand recorded at Arifa Mart (o18) at 1,560 cartons, followed by Toko Jasa Sinar (o5) with 1,260 cartons and UD. Maulida (o42) with 300 cartons. In contrast, several customers exhibit relatively low demand levels, ranging from 12 to 60 cartons per delivery period.

The shortest distribution distances are observed in areas surrounding Komplek Arun and Blang Pulo, while the longest distance reaches 11.66 km in the Darussalam area. To meet customer demand, the company utilizes a single CDD (Colt Diesel Double) box truck with a maximum carrying capacity of 700 cartons per trip. The combination of limited vehicle capacity and varying customer demand and distances highlights the need for optimal distribution route planning to ensure efficient vehicle utilization and complete demand fulfillment.

3.3 Actual Distribution Data and Costs

Actual distribution data represent the company's operational conditions during June, including travel distance, travel time, and distribution costs based on existing delivery routes. The company operated 12 distribution routes departing from a single depot to serve all customers.

Table 2. Recapitulation of Actual Travel Distance and Time

Description	Value
Number of distribution routes	12 routes
Total travel distance	936.25 km
Average distance per route	78.02 km
Total travel time	4,898.71 minutes

Description	Value
Average travel time per route	408.23 minutes
Shortest distance	67.97 km
Longest distance	88.34 km

The actual distribution routes exhibit substantial variation in distance and travel time, influenced by the number of customers served and the geographical characteristics of the distribution areas. Based on travel distance data, distribution costs were calculated, consisting of variable costs (fuel) and fixed costs (driver wages).

Table 3. Recapitulation of Actual Distribution Costs

Route	Cost (Rp)		
	Fuel Cost (6km/L)		
	(Variable Cost)	*Fixed Cost*	Total *Cost*
1	Rp90.179	Rp175.000	Rp265.179
2	Rp100.118	Rp175.000	Rp275.118
3	Rp90.417	Rp175.000	Rp265.417
4	Rp93.874	Rp175.000	Rp268.874
5	Rp91.800	Rp175.000	Rp266.800
6	Rp77.032	Rp175.000	Rp252.032
7	Rp88.196	Rp175.000	Rp263.196
8	Rp83.810	Rp175.000	Rp258.810
9	Rp79.401	Rp175.000	Rp254.401
10	Rp77.486	Rp175.000	Rp252.486
11	Rp90.723	Rp175.000	Rp265.723
12	Rp98.044	Rp175.000	Rp273.044
Total	Rp1.061.083	Rp2.100.000	Rp3.161.083

3.4 Distance Matrix Identification

The distance matrix serves as the basis for distribution route planning by representing travel distances between the depot and customer locations. Distance calculations were performed using the OpenRouteService (ORS) Matrix API with a driving-car profile to reflect actual road network conditions. Coordinate data were arranged in [longitude, latitude] format, with the depot designated as the starting point. The calculations were conducted using MATLAB, resulting in a distance matrix expressed in kilometers. This matrix served as the primary input for the route optimization process. A sample of the distance matrix is presented in **Table 4**.

Table 4. Distance Matrix

	Depot	o1	o2	o3	o4	o5	o6	o7	o8	o9	o10
Depot	0	1,14	1,19	1,07	0,97	0,25	0,64	2,02	1,99	4,84	3,06
o1	1,14	0	0,05	0,08	1,98	0,9	0,71	2,09	2,07	4,92	3,01
o2	1,19	0,05	0	0,13	2,03	0,95	0,76	2,14	2,11	4,97	3,05
o3	1,07	0,08	0,13	0	1,9	0,82	0,63	2,01	1,99	4,84	2,93
o4	0,97	1,98	2,03	1,9	0	1,23	1,61	3	2,97	5,7	3,78
o5	0,25	0,9	0,95	0,82	1,23	0	0,39	1,77	1,74	4,6	2,78
o6	0,64	0,71	0,76	0,63	1,61	0,39	0	1,39	1,36	4,21	2,51
o7	2,02	2,09	2,14	2,01	3	1,77	1,39	0	0,03	2,83	1,43
o8	1,99	2,07	2,11	1,99	2,97	1,74	1,36	0,03	0	2,86	1,4
o9	4,84	4,92	4,97	4,84	5,7	4,6	4,21	2,83	2,86	0	1,98
o10	3,06	3,01	3,05	2,93	3,78	2,78	2,51	1,43	1,4	1,98	0

3.5 Distribution Route Determination Using the Nearest Neighbour Method

Distribution route determination in this study employed the Nearest Neighbour (NN) method, a heuristic approach commonly used to solve route optimization problems, particularly the Travelling Salesman Problem (TSP). The method selects the next destination based on the shortest distance until all customers are served and the route returns to the depot. Although the NN method does not guarantee a globally optimal solution, it is effective in generating a good initial solution with low computational complexity. The implementation was performed using MATLAB, with the distance matrix as input. The algorithm followed a sequence of initialization, nearest-point selection, route closure, and total distance calculation, enabling a systematic and automated route determination process.

The results produced 12 proposed distribution routes. The travel sequence and total distance for each route are presented in **Table 5**.

Table 5. Proposed Distribution Routes Using the Nearest Neighbour Method

Route	Travel Sequence	Total Distance (km)
1	D-o5-o24-o23-o6-o3-o1-o2-o30-o26-o27-o25-o28-o4-o29-o21-o22-o12-o13-o16-o15-o14-o11-o32-o17-o18-o8-o7-o19-o10-o9-o20-o31-o43-o47-o39-o38-o40-o45-o42-o34-o36-o33-o35-o46-o48-o49-o56-o55-o52-o51-o53-o57-D	60,67
2	D-o5-o24-o23-o6-o3-o1-o2-o30-o26-o27-o25-o28-o4-o29-o21-o22-o12-o13-o16-o15-o14-o11-o32-o17-o18-o8-o7-o19-o10-o9-o20-o31-o50-o43-o47-o41-o39-o38-o40-o45-o42-o34-o44-o36-o33-o37-o35-o46-o48-o49-o54-o56-o55- o52-o51-o53-o57-D	61,49
3	D-o5-o24-o23-o6-o3-o1-o2-o30-o26-o27-o25-o28-o4-o29-o21-o22-o12-o13-o16-o15-o14-o11-o32-o18-o8-o7-o19-o10-o9-o20-o31-o43- o47-o39-o38-o40-o45-o42-o34-o44-o36-o33-o37-o35-o46-o48-o49 -o54-o56-o55-o52-o51-o53-o57–D	60,33
4	D-o5-o24-o23-o6-o3-o1-o2-o30-o26-o27-o25-o28-o4-o29-o21-o22-o12-o13-o16-o15-o14-o11-o32-o17-o18 -o8-o7-o19-o10-o9-o20-o31-o43-o47-o41-o39-o38-o40-o45-o42-o34-o44-o36-o33-o37-o35-o46-o48-o49-o54-o56-o55-o52-o51-o53-o57-D	61,36
5	D-o5-o24-o23-o6-o3-o1-o2-o30-o26-o27-o25-o28-o4-o29-o21-o22-o12-o13-o16-o15-o14-o11-o32-o17-o18 -o8-o7-o19-o10-o9-o20-o31-o43-o47-o39-o38-o40-o45-o42-o34-o44-o33-o37-o35-o46-o48-o49-o54-o56-o55-o52-o51-o53-o57-D	60,94
6	D-o5-o24-o23-o6-o3-o1-o2-o30-o26-o27-o25-o28-o4-o29-o21-o22-o12-o13-o16-o15-o14-o11-o32-o18-o8-o7-o19-o10-o9-o20-o57-o53-o51-o52-o55-o56-o54-o49-o48-o46-o44-o36-o33-o37-o45-o42-o34-o35-o47-D	60,67
7	D-o5-o24-o23-o6-o3-o1-o2-o30-o26-o27-o25-o28-o4-o29-o21-o22-o12-o13-o16-o15-o14-o11-o32-o17-o18 -o8-o7-o19-o10-o9-o20-o31-o57-o53-o51-o52-o55-o56-o54-o49-o48-o46-o36-o33-o37-o45-o42-o34-o35-o40-o39-o38-o47-o41–D	52,82
8	D-o5-o24-o23-o6-o3-o1-o2-o30-o26-o27-o25-o28-o4-o21-o22-o12-o13-o16-o15-o14-o11-o32-o18-o8-o7-o19-o10-o9-o20-o31-o57-o53-o51-o52-o55-o56-o54-o49-o48-o46-o36-o33-o37-o45-o42-o34-o35-o40-o39-o47-D	62,55
9	D-o5-o24-o23-o6-o3-o1-o2-o30-o26-o27-o25-o28-o4-o21-o22-o12-o13-o16-o15-o14-o11-o32-o17-o18-o8-o7-o19-o10-o9-o20-o57-o53-o51-o52-o55-o56-o54-o49-o48-o46-o44-o33-o37-o45-o42-o34-o35-o40-o39-o38-o47–D	60,45
10	D-o5-o24-o23-o6-o3-o1-o2-o30-o26-o27-o25-o28-o4-o21-o22-o12-o13-o16-o15-o14-o11-o32-o18-o8-o7-o19-o10-o9-o20-o57-o53-o51-o52-o55-o56-o54-o48-o46-o44-o36-o33-o37-o45-o42-o34-o35-o40-o39-o38-o47-D	53,18
11	D-o5-o24-o23-o6-o3-o1-o2-o30-o26-o27-o25-o28-o4-o29-o21-o22-o12-o13-o16-o15-o14-o11-o32-o17-o18 -o8-o7-o19-o10-o9-o20-o31-o43-o47-o39-o38-o40-o45-o42-o34-o44-o33-o37-o35-o46-o48-o49-o54-o56-o55-o52-o51-o57–D	52,37
12	D-o5-o24-o23-o6-o3-o1-o2-o30-o26-o27-o25-o28-o4-o29-o21-o22-o12-o13-o16-o15-o14-o11-o32-o17-o18 -o8-o7-o19-o10-o9-o20-o31-o50-o43-o47-o39-o38-o40-o45-o42-o34-o44-o36-o33-o37-o35-o46-o48-o49-o54-o56-o55-o52-o51-o53-o57–D	61,18
	Total	708,01

The total distribution distance obtained using the NN method was 708.01 km, which is substantially lower than the company's actual distribution distance of 936.25 km. This result indicates a distance reduction of 228.24 km, demonstrating the effectiveness of the NN method in improving distribution efficiency.

3.6 Total Travel Time

The total travel time after route optimization using the NN method was calculated by considering four components: travel time, loading time, setup time, and service time at customer locations. Travel time was determined based on the ratio of travel distance to average vehicle speed and converted into minutes. Loading time at the depot was set at 50 minutes, setup time at 15 minutes, and average service time at each outlet at 5 minutes. All components were calculated in minutes to allow direct aggregation. The results yielded 12 proposed routes with a total distance of 708.01 km and a total travel time of 4,670.20 minutes. Detailed distance and travel time for each route are presented in **Table 6**.

Table 6. Total Travel Time Using the Nearest Neighbour Method

Route	Total Distance (km)	Total Travel Time (minutes)
1	60,67	385,24
2	61,49	411,71
3	60,33	395,34
4	61,36	406,51
5	60,94	395,95

Route	Total Distance (km)	Total Travel Time (minutes)
6	60,67	364,61
7	52,82	397,06
8	62,55	376,45
9	60,45	373,47
10	53,18	367,51
11	52,37	390,97
12	61,18	405,38
Total	708,01	4.670,20

3.7 Comparison of Routes Before and After Optimization

A comparative analysis was conducted to evaluate the effectiveness of the NN method relative to the company's existing distribution system. The evaluation focused on total travel distance as the primary indicator of distribution efficiency. The results show that total distribution distance decreased from 936.25 km before optimization to 708.01 km after optimization.

Table 7. Comparison of Travel Distance Before and After Optimization

Description	Before Optimization (km)	After Optimization (km)	Distance Savings (km)
Total travel distance	936,25	708,01	228,24

These findings confirm that the optimized routes are significantly more efficient than the existing distribution routes.

3.8 Comparison of Distribution Costs Before and After Optimization

Following route optimization using the NN method, distribution costs were calculated to assess the economic efficiency of the proposed routes. Distribution costs were categorized into fixed and variable costs, with variable costs primarily influenced by travel distance. The main component of variable costs was fuel cost. Fuel cost (FC) was calculated assuming a fuel consumption rate of 6 km per liter and a fuel price of Rp6,800 per liter, using the following equation:

$$FC = \text{Travel Distance (km)}/6 \times 6.800$$

Fuel costs per route ranged from Rp59,352 to Rp70,900, depending on route length. Fixed costs were set at Rp175,000 per route in accordance with company policy. The total distribution cost for each route is obtained by summing the fixed cost and the variable cost. A summary of the distribution costs for the proposed routes is presented in **Table 8**.

Table 8. Distribution Cost Summary for the Optimized Routes

Route	Fuel Cost (Rp)	Fixed Cost (Rp)	Total Cost (Rp)
1	68.760	175.000	243.760
2	69.694	175.000	244.694
3	68.384	175.000	243.384
4	69.550	175.000	244.550
5	69.075	175.000	244.075
6	59.864	175.000	234.864
7	70.900	175.000	245.900
8	68.513	175.000	243.513
9	60.276	175.000	235.276
10	59.352	175.000	234.352
11	69.339	175.000	244.339
12	69.239	175.000	244.239
Total	802.952	2.100.000	2.902.952

The calculation results show that fuel costs for each route vary depending on the distribution route length, with the lowest cost amounting to Rp59,352 and the highest reaching Rp70,900. Meanwhile, the fixed cost per route is set at Rp175,000 in accordance with the company's policy.

4. CONCLUSION

Based on the findings of this study, the application of the Nearest Neighbour (NN) method for distribution route planning at CV. XYZ has proven to be effective in improving distribution efficiency. The implementation of the optimized routes reduced the total distribution distance from 936.25 km to 708.01 km, resulting in a distance reduction of 228.24 km (24.38%) compared to the initial routing condition. This result indicates that the routes generated using the NN method are more structured and efficient. Furthermore, route optimization had a direct impact on reducing distribution costs. The total distribution cost decreased from Rp3,161,083 to Rp2,902,952, achieving a cost saving of Rp258,131. The reduction in travel distance and improved route planning also contributed to shorter delivery times, thereby enhancing overall operational efficiency. Therefore, the Nearest Neighbour method is considered a feasible and effective approach for optimizing distribution routes within the company.

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