JURNAL ILMIAH TEKNIK INDUSTRI
ISSN: 1412-6869 (Print), ISSN: 2460-4038 (Online)
Journal homepage: http://journals.ums.ac.id/index.php/jiti/index
doi: 10.23917/jiti.v25i1.16470

Optimizing Transportation Cost in Information Media Equipment Distribution: A Transportation Model Approach

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Abstract. *Organization X is an agency that distributes electronic products supporting broadcasting information systems for the community. There are 8 supply locations that will deliver goods to 21 destination points, with a total of 87,310 units. The large transportation demand and geographically dispersed delivery locations across Indonesia create challenges related to high transportation costs. To optimize the distribution plan, a Transportation Method analysis was conducted using Northwest Corner, Least Cost, and Vogel's Approximation Method (VAM). POM-QM was used as a mathematical operations tool to verify and generate the optimal shipment allocation. The study objective is to minimize total transportation cost subject to supply and demand constraints. Previously, Organization X had planned distribution with a total transportation cost of IDR 2,859,935,100. Based on the optimization analysis, cost was reduced to IDR 2,707,472,000, resulting in cost savings of IDR 152,463,100, equivalent to a 5.33% reduction in transportation expenses. All three methods—Northwest Corner, Least Cost, and VAM—converged to the same optimal cost after MODI verification, confirming robustness of the solution. As a secondary observation, the optimized allocation also produced shorter estimated delivery times in several routes; however, this is noted as a favorable by-product and warrants further analysis in future studies.*

Keywords: *transportation, distribution, transportation cost, cost optimization, Northwest Corner, Least Cost, Vogel's Approximation Method, POM-QM, sensitivity analysis, POM-QM*

I. INTRODUCTION

Logistics is integral part of supply chain management that involves planning, implementing, and controlling the efficient and effective flow of goods, services, and information from the point of origin to the point of consumption (Christopher, 2016). The operational management of physical distribution is considered one of the most critical and complex components of macro-level supply chain management (SCM), as it requires real-time scheduling and coordination of hundreds of thousands of parcels and containerized goods within a dynamic logistics environment (Ren et al., 2020). In the rapidly evolving information era, goods distribution not only serves to fulfill physical needs but also plays a crucial role in a very wide range of implications ranging from facilitating the distribution of information, supporting educational activities, to enabling the growth of the creative sectors. Efficient distribution systems are therefore essential to ensure timely delivery, cost efficiency, and accessibility across various sectors.

One sector where the role of logistics shows critical contribution is in public information distribution. In this context, physical distribution is not only logistics problem, but also a determinant in how equitably society can access information and participate in social, educational, and civic activities. Consequently, the information broadcasting equipment closely related to broader social welfare since the limited or delayed access limits society's ability to access public information. However, physical mass distribution to extensive and remote delivery commonly faces problems in cost and time efficiency, challenges that become especially pronounced when the distribution network spans multiple origins and geographically dispersed destinations, as is the case for Organization X.

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Submited: 29-02-2026 Revised: 16-05-2026
Accepted: 23-06-2026

Organization X is a structured institution that implements various social support initiatives as part of its mission to improve social welfare. One of its current programs involves the distribution of electronic equipment to support public information broadcasting systems. The right to access public information is an essential right in a democratic system, very important for transparency, in social control over the government (Carmen et al, 2023). Therefore, ensuring equitable access to information has become a critical priority. The program conducted by organization X involves distributing a total of 87,310 units across various regions in Indonesia, representing a large-scale logistics operation. Such a large-scale distribution includes numerous and geographically dispersed destinations and presents significant challenges in logistics planning, particularly in terms of transportation cost and delivery efficiency. Without proper optimization, the distribution process may result in excessive transportation costs and inefficient delivery performance.

Currently, Organization X is designing a distribution plan from multiple supplier locations in different cities to various destinations with a large shipment volume. There are eight origin locations supplying the products, which will be distributed to 21 different cities across Indonesia. Each origin location has a different supply capacity, while each destination city has different demand requirements. The destination locations are distributed across several provinces and cities, including Bali Province (four distribution points), Lampung Province (one distribution point), Central Java Province (one distribution point), East Kalimantan Province (two distribution points), Riau Province (three distribution points), Riau Islands Province (one distribution point), West Kalimantan Province (two distribution points), West Sumatra Province (four distribution points), East Nusa Tenggara Province (four distribution points), and West Papua Province (two distribution points). These destination areas require information-supporting equipment to improve access to information, particularly in smaller cities and rural areas with limited information accessibility.

Previously, Organization X developed an initial distribution plan with an estimated total transportation cost of approximately IDR 2,859,935,100. The calculation is based on a special delivery using express postal service, with the assumption of rate per kilogram for two products. However, the transportation planning was conducted without considering the distance between supply origin and destination locations, indicating that the current distribution plan may not be optimal. The large shipment volume and wide geographic coverage present significant logistics challenges, particularly in transportation cost management. Therefore, optimizing the distribution plan is essential to minimize total transportation cost. The primary objective of this study is cost minimization; delivery time is not part of the optimization model but is noted as a secondary observation.

With an effective distribution system, Organization X is expected to improve the efficiency of product delivery, thereby supporting the continuity of social, educational, and commercial activities aligned with the organization's mission. Therefore, thorough distribution management planning plays a crucial role in achieving these objectives. One of the most important aspects of physical distribution is transportation, which is directly related to distance and shipping costs. Transportation distance significantly influences distribution costs and delivery performance, making transportation planning a critical factor in logistics management. The transportation method aims to determine the optimal solution for distributing goods from production facilities or warehouses to destination locations at the lowest possible cost. This has been demonstrated in postal logistics contexts, where transportation optimization significantly reduced pick-up costs and improved route efficiency (Lati et al., 2023).

These studies demonstrate that transportation methods are widely applicable across different industries and distribution scenarios. More recent studies have further extended transportation optimization frameworks. Malacký and Madlenák (2023) conducted a comprehensive literature review confirming that classical transportation algorithms remain valid and competitive for structured supply-demand matching problems. Fadlallah et al. (2022) demonstrated the integration of transportation models with sustainability goals in humanitarian distribution contexts. Singh and Gupta (2023) confirmed that VAM-based solutions remain near-optimal under realistic operational variability. However, most existing studies analyze relatively simple distribution structures: single regions, limited origin points, or commercial products. A clear research gap remains: the combination of 1) a multi-origin, multi-destination network spanning 8 supply points and 21 destination cities dispersed across multiple islands of Indonesia, and 2) a public service distribution context involving information access equity, is underrepresented in existing transportation optimization literature.

Classical transportation methods suitable for this case as the problem fit the transportation structure: a fixed number of supply origins with known capacities, a fixed number of demand destinations with known requirements and known transportation cost between each origin to destination point. Since Organization X satisfies this conditions, the exact and heuristic transportation method can be implemented directly without complex routing formulation or or complext network flow.

Northwest Corner, Least Cost, and Vogel's Approximation method selected as they represent standard heuristic procedures in solving the transportation problem that offering different initial strategies. POM QM is used to verify and optimize the initial solutions to obtain the same minimum cost. By comparing these 3 models, this study ensures that optimal allocation is not only gained by only one heuristic model, resulting in more accurate decision making for Organization X in delivering the products.

Therefore, this study employs transportation methods to provide decision support for Organization X in optimizing the distribution of goods from eight supply locations to 21 destination locations. The primary objective is to minimize total transportation cost subject to supply and demand constraints. Delivery time is not included in the mathematical objective function; any observed improvement in delivery time is treated as a secondary observation and discussed separately as a topic for further analysis.

II. RESEARCH METHOD

Data Collection

The data collection process was performed by gathering information regarding product demand at each distribution point (8 different suppliers), the capacity of each supplier, and the transportation costs from each shipping origin to each destination point (21 different cities).

The data inputs in this study consist of: (1) supply capacity of 8 origin locations, presented in table 3 expressed in unit product (2) the demand quantity from each 21 destination cities presented in table 2 expressed in units product. . This data was obtained from organization X for the relevant program period (3) unit transportation cost from each origin to each destination, derived form postal delivery rate per kilogram then converted to per unit cost as shown in table 4.

Research Method

This study employs the Transportation Method as the analytical approach. The transportation problem is a classic optimization model in operations research in determining the most cost-effective way to transport goods from multiple sources or origin to multiple destinations at the same time satisfying supply and demand constraints (Malacký, 2023). The objective of this method is to minimize the total transportation cost subject to supply and demand constraints. The mathematical formulation is: Minimize $Z = \sum_i \sum_j C_{ij} \cdot X_{ij}$, subject to $\sum_j X_{ij} \leq a_i$ (supply) and $\sum_i X_{ij} \geq b_j$ (demand), with $X_{ij} \geq 0$. This is a single-objective cost minimization model; delivery time is explicitly excluded. The problem is balanced (total supply = total demand = 87,310 units).

Zulfikarijah, as cited in Azizah (2018), states that the transportation problem has several characteristics:

1. There are a number of specific sources and a number of specific destinations.
2. The quantity of goods supplied by each source and demanded by each destination is predetermined.
3. The number of goods shipped from a certain source to a specific destination must be consistent with the source capacity and the destination demand.
4. The transportation cost from each source to each destination is known and unchanged.

The transportation model employs a matrix as a tool to represent distribution cases (Ardini, 2018). Siswanto, as cited in Ardini (2018), states that the balance between supply and demand does not always occur, meaning that the total supply capacity of sources (Σsi) is not necessarily equal to the total demand requirements of destinations (Σtj). There are three possible conditions: (a) Σsi = Σtj; (b) Σsi ≤ Σtj; and (c) Σsi ≥ Σtj. The general form of a transportation matrix is ilustrated in Table 1.

Table 1. The general form of a transportation matrix

Source	Destination				Source capacity per period
	T_1	T_2	....	T_n	
S_1	C_{11} X_{11}	C_{12} X_{12}	....	C_{1n} X_{1n}	S_1
S_2	C_{21} X_{21}	C_{21} X_{21}	....	C_{2n} X_{2n}	S_2
S_m	C_{m1} X_{m1}	C_{m2} X_{m2}	....	C_{mn} X_{mn}	S_m
Destination demand per period		t_2	....	t_n	Σs Σt

Source: (Siswanto in Ardini 2018)

The transportation algorithm consists of three different computational procedures: the Northwest Corner Method, which begins by allocating as much as possible starting from the northwest cell of the initial transportation table; the Least Cost Method, initiates the solution process by prioritizing the lowest transportation cost without initially considering its overall impact on the entire allocation process; and the Vogel's Approximation Method (VAM), which allocates shipments to the cell with the smallest Cij located in the row or column that has the largest difference between the two smallest Cij values (Ardini, 2018). Therefore, three stages must be carried out in each distribution allocation process (Ardini, 2018):

1. Determining the difference between the two smallest values of Cij in each row and column.
2. Selecting the row or column with the biggest difference between the two smallest Cij values.
3. Allocating the maximum possible quantity to the selected row or selected column consists of the smallest Cij value.

Transportation problems can be formulated mathematically as follows (Azizah, 2018):

Minimize Z = $\sum_{i=1}^{m}\sum_{j=1}^{n} C_{ij}X_{ij}$

Limitation:

$\sum_{i=1}^{m} C_{ij}\,X_{ij} = a_i; i = 1, 2, \ldots\ldots, m$

$\sum_{j=1}^{n} C_{ij}\,X_{ij} = b_j; j = 1, 2, \ldots\ldots, n$

Explanation:

Cij = transportation cost per unit of goods from the source i to destination j

Xij = the quantity of goods distributed from source i to destination j

ai = the number of goods supplied or the capacity of source i

bj = the number of goods demanded or ordered by destination j

m = number of sources

n = number of destinations

$\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j$

The transportation problem can be intrepreted in a transportation table, where sources are arranged in rows and destinations in columns, forming an $m \times n$ matrix. The unit transportation cost, Cij, is placed in the upper-right corner of each cell. The demand for each destination is presented in the rightmost column. The bottom-left corner cell implies that total supply (S) is equal to total demand (D), reflecting a balanced transportation problem. The decision variable Xij in each cell represents the number or quantoty of goods transported from source i to destination j (Azizah, 2018).

Research Intrument

Mathematical operation in this study was conducted using POM-QM software for the transportation method. POM-QM is a computer-based application designed to solve quantitative problems in the area of production and operations management to support managerial decision-making (Ilahi, 2023).

Table 2. Quantity of Product Required for Each Destination Point

No	Province	Destination	Number of Recipient/city (unit)
1	Bali	City 1	389
		City 2	317
		City 3	464
2	Jawa Tengah	City 4	208
3	Lampung	City 5	1008
4	Kalimantan Timur	City 6	833
		City 7	871
5	Kepulauan Riau	City 8	336
6	Sumatera Barat	City 9	1051
		City 10	184
		City 11	248
		City 12	120
7	Nusa Tenggara Timur	City 13	75
		City 14	16185
		City 15	9000
			856
		City 16	11324
8	Papua Barat	City 17	8633
		City 18	2977
9	Riau	City 19	12163
		City 20	12666
		City 21	5000
			2402
			87310

Table 3 Supply Capacity of Each Supplier

No	Supplier	Supply Capacity (unit)	Supllier Origin
1	Supplier A	6104	Kabupaten Kudus
2	Supplier B	16185	Jakarta Pusat (1)
3	Supplier C	9000	Jakarta Pusat (2)
4	Supplier D	15924	Kota Semarang
5	Supplier E	11324	Cikarang Selatan
6	Supplier F	11610	DKI Jakarta
7	Supplier G	12163	Jakarta Barat
8	Supplier H	5000	Kab. Tangerang
Total		87310	

III. Result and Discussion

The study started with the data collection of products required at each distribution point, the capacity of each supplier, and the transportation costs from each origin to each destination. The following presents the data on the quantity of products required for each destination, as seen at Table 1.

The data of product demand and supply capacity shown in Tables 2 and 3 indicate a balanced condition between total demand and total supply, or a model in which $\sum si = \sum tj$. Subsequently, the authors collected transportation cost data from each supply point to each destination point. Table 4 shows the shipping cost per kilogram from each origin point to each destination point.

Table 4 presents the shipping cost per kilogram from each origin point to each destination point. It should be noted that one kilogram of shipment can accommodate two units of the product. Therefore, the shipping cost per unit becomes one-half of the shipping cost shown in Table 5, under the assumption that two product units can be transported within one kilogram. Based on this assumption, the shipping cost per unit of the product is presented in Table 5.

The data were processed using POM-QM for Windows 4.0. All three initial solution methods—Northwest Corner, Least Cost, and VAM—were applied then verified using the MODI optimality check. Table 6 presents a comparison of initial solution costs across the three methods before and after MODI optimization: NWC initial cost IDR 3,098,212,000, LC initial cost IDR 2,784,396,000, VAM initial cost IDR 2,731,048,000; all three converge to optimal IDR 2,707,472,000 after MODI. This comparison confirms robustness of the solution. The final optimal allocation is presented in Table 6.

The results in Table 7 indicate the allocation of shipments from each source to each destination, with a total transportation cost of IDR 2,707,472,000. This represents a cost saving of IDR 152,463,100 (5.33%) compared to Organization X's initial plan. All three initial

Table 4 Shipping Cost Per Kilogram from Each Origin Point To Each Destination Point

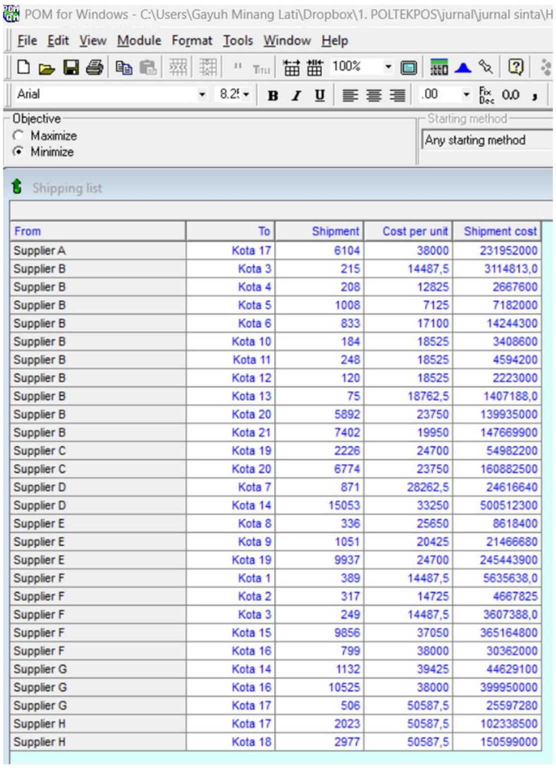
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	supply (unit)
A	12825	12825	12825	12350	5225	16625	27075	22800	17100	18525	18525	18525	20900	33725	31350	32300	38000	38000	23275	23275	18525	6104
B	14487,5	14725	14487,5	12825	7125	17100	34437,5	25650	20425	18525	18525	18525	18762,5	39425	37050	38000	50587,5	50587,5	24700	23750	19950	16185
C	14487,5	14725	14487,5	12825	7125	17100	34437,5	25650	20425	18525	18525	18525	18762,5	39425	37050	38000	50587,5	50587,5	24700	23750	19950	9000
D	15675	15675	15675	13775	4750	18050	28262,5	24225	21850	19000	19000	19000	20900	33250	30875	31825	47025	47025	23750	23750	19000	15924
E	14487,5	14725	14487,5	12825	7125	17100	34437,5	25650	20425	18525	18525	18525	18762,5	39425	37050	38000	50587,5	50587,5	24700	24700	19950	11324
F	14487,5	14725	14487,5	12825	7125	17100	34437,5	25650	20425	18525	18525	18525	18762,5	39425	37050	38000	50587,5	50587,5	24700	23750	19950	11610
G	14487,5	14725	14487,5	12825	7125	17100	34437,5	25650	20425	18525	18525	18525	18762,5	39425	37050	38000	50587,5	50587,5	24700	24700	19950	12163
H	14487,5	14725	14487,5	12825	7125	17100	34437,5	25650	20425	18525	18525	18525	18762,5	39425	37050	38000	50587,5	50587,5	24700	24700	19950	5000
Demand	389	317	464	208	1008	833	871	336	1051	184	248	120	75	16185	9856	11324	8633	2977	12163	12666	7402	87310

Table 5. Shipping Cost per Unit of Product

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	supply (unit)
A	12825	12825	12825	12350	5225	16625	27075	22800	17100	18525	18525	18525	20900	33725	31350	32300	38000	38000	23275	23275	18525	6104
B	14487,5	14725	14487,5	12825	7125	17100	34437,5	25650	20425	18525	18525	18525	18762,5	39425	37050	38000	50587,5	50587,5	24700	23750	19950	16185
C	14487,5	14725	14487,5	12825	7125	17100	34437,5	25650	20425	18525	18525	18525	18762,5	39425	37050	38000	50587,5	50587,5	24700	23750	19950	9000
D	15675	15675	15675	13775	4750	18050	28262,5	24225	21850	19000	19000	19000	20900	33250	30875	31825	47025	47025	23750	23750	19000	15924
E	14487,5	14725	14487,5	12825	7125	17100	34437,5	25650	20425	18525	18525	18525	18762,5	39425	37050	38000	50587,5	50587,5	24700	24700	19950	11324
F	14487,5	14725	14487,5	12825	7125	17100	34437,5	25650	20425	18525	18525	18525	18762,5	39425	37050	38000	50587,5	50587,5	24700	23750	19950	11610
G	14487,5	14725	14487,5	12825	7125	17100	34437,5	25650	20425	18525	18525	18525	18762,5	39425	37050	38000	50587,5	50587,5	24700	24700	19950	12163
H	14487,5	14725	14487,5	12825	7125	17100	34437,5	25650	20425	18525	18525	18525	18762,5	39425	37050	38000	50587,5	50587,5	24700	24700	19950	5000
Demand	389	317	464	208	1008	833	871	336	1051	184	248	120	75	16185	9856	11324	8633	2977	12163	12666	7402	87310

methods converge to this same optimal cost after MODI verification, confirming the uniqueness of the optimal solution.

Table 6. Allocation of Shipment Quantities from Each Origin City to Each Destination City



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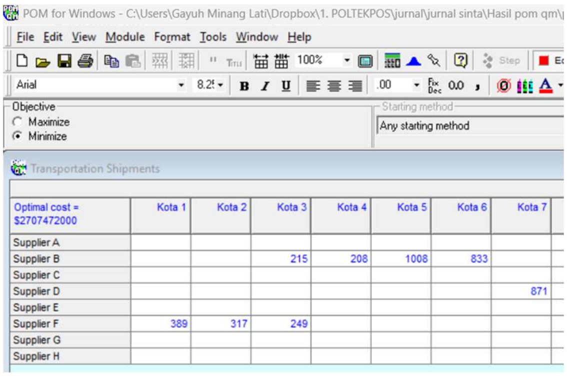
Shipping list

From	To	Shipment	Cost per unit	Shipment cost
Supplier A	Kota 17	6104	38000	231952000
Supplier B	Kota 3	215	14487,5	3114813,0
Supplier B	Kota 4	208	12825	2667600
Supplier B	Kota 5	1008	7125	7182000
Supplier B	Kota 6	833	17100	14244300
Supplier B	Kota 10	184	18525	3408600
Supplier B	Kota 11	248	18525	4594200
Supplier B	Kota 12	120	18525	2223000
Supplier B	Kota 13	75	18762,5	1407188,0
Supplier B	Kota 20	5892	23750	139935000
Supplier B	Kota 21	7402	19950	147669900
Supplier C	Kota 19	2226	24700	54982200
Supplier C	Kota 20	6774	23750	160882500
Supplier D	Kota 7	871	28262,5	24616640
Supplier D	Kota 14	15053	33250	500512300
Supplier E	Kota 8	336	25650	8618400
Supplier E	Kota 9	1051	20425	21466680
Supplier E	Kota 19	9937	24700	245443900
Supplier F	Kota 1	389	14487,5	5635638,0
Supplier F	Kota 2	317	14725	4667825
Supplier F	Kota 3	249	14487,5	3607388,0
Supplier F	Kota 15	9856	37050	365164800
Supplier F	Kota 16	799	38000	30362000
Supplier G	Kota 14	1132	39425	44629100
Supplier G	Kota 16	10525	38000	399950000
Supplier G	Kota 17	506	50587,5	25597280
Supplier H	Kota 17	2023	50587,5	102338500
Supplier H	Kota 18	2977	50587,5	150599000

Table 7 Optimal Cost Result



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Transportation Shipments

Optimal cost = $2707472000	Kota 1	Kota 2	Kota 3	Kota 4	Kota 5	Kota 6	Kota 7
Supplier A							
Supplier B			215	208	1008	833	
Supplier C							
Supplier D							871
Supplier E							
Supplier F	389	317	249				
Supplier G							
Supplier H							

IV. CONCLUSION

Previously, X had implemented an initial shipment plan with a total estimated transportation cost of IDR 2,859,935,100. The following presents a comparison between X's initial plan and the recommended allocation of aid goods generated through POM-QM.

Table 8 shows a distribution planning comparison of 87,310 units of product, with a total transportation cost of IDR 2,859,935,100 (assuming the special express postal rate per kilogram, where 1 kg accommodates 2 units), and the results of the transportation distribution method analysis using POM-QM, which yielded a total cost of IDR 2,707,472,000. This indicates a cost efficiency of IDR 152,463,100, representing a cost reduction of 5.33%.The initial cost of IDR 2,859,935,100 calculated using the express postal

Table 8. Comparison of Transportation Costs Between the Initial Plan and the Proposed Optimized Plan

No	Province	City	Number of Recipients/city	Initial Planning Source	Time estimated (day)	Total cost (Rp)	Cost & Time Optimation Number of Product	Source	Estimated time (day)	Total Optimal Cost
1	Bali	1	389	Supplier A	7	4,988,925	389	Supplier F	4	
		2	317		7	4,065,525	317	Supplier F	4	
		3	464		7	5,950,800	215	Supplier B	4	
							249	Supplier F	4	
		4	208		5	2,568,800	208	Supplier B	2	
2	Jawa Tengah	5	1,008		3	5,266,800	1,008	Supplier B	2	
3	Lampung	6	833		5	13,848,625	833	Supplier B	2	
4	Kalimantan Timur	7	871		7	23,582,325	871	Supplier D	5	
		8	336		7	7,660,800	336	Supplier E	5	
5	Kepulauan Riau	9	1,051		7	17,972,100	1,051	Supplier E	6	
6	Sumatera Barat	10	184		5	3,408,600	184	Supplier B	3	
		11	248		5	4,594,200	248	Supplier B	3	
		12	120		5	2,223,000	120	Supplier B	3	
		13	75		5	1,567,500	75	Supplier B	3	
7	Nusa Tenggara Timur	14	16,185	Supplier B	7	638,093,625	15,053	Supplier D	8	
							1,132	Supplier G	7	
		15	9000	Supplier C	5	333,450,000	9,856	Supplier F		
			856	Supplier D	6	26,429,000			4	
		16	11,324	Supplier E	6	430,312,000	799	Supplier F	5	
							10,525	Supplier G	5	
8	Papua Barat	17	8,633	Supplier F	4	436,721,888	6.104	Supplier A	7	
							506	Supplier G	5	
							2,023	Supplier H	5	
		18	2,977		4	150,598,988	2,977	Supplier H	5	
9	Riau	19	12,163	Supplier G	5	300,426,100	2,226	Supplier C	5	
							9,937	Supplier E	6	
		20	12,666	Supplier D	7	300,817,500	5,892	Supplier B	7	
							6,774	Supplier C	7	
		21	5000	Supplier H	5	99,750,000	7,402	Supplier B	5	
			2402	Supplier D	4	45,638,000				
	Total		87,310			2,859,935,100	87,310			2,707,472,000

rate card by Organization X calculation. Based on physical dimension and product weight, it was estimated that two unit products fit one kilogram per shipment, the cost per unit shown in Table 5 obtained by dividing per kilogram rate in Table 4 by two. The same per-unit cost applied consistently in initial plan and also in POM QM optimization allocation in Table 8, resulting in 5,33% efficiency that reflects cost reduction attributable to reallocating shipments across origins rather than to any change in the underlying rate assumptions. The 5,33% reduction is equal to IDR 152,463,100 saving in this one cycle distribution; even a modest percentage saving of this kind can free up a meaningful share of the logistics budget for additional units or destinations.

Other than in its impact in budgetary plan, this result also gives managerial guidance that allocation decisions for Organization X should not only rely on the nearest supplier, but also calculating the combined effect of rate differences across origins, supporting more systematic logistics policy and budget-planning decisions for future distribution cycles. From the theoretical standpoint, this case shows that classical transportation method heuristic still relevant to be applied in multi-origin and massive shipment, extending their demonstrated effectiveness beyond the commercial and agricultural contexts reported in prior studies.

As a secondary observation, several routes in the optimal allocation showed shorter estimated delivery times compared to the initial plan. This is attributable to cost-efficient suppliers that are also geographically closer in certain cases—a favorable by-product of cost optimization, not a result of time optimization. A rigorous treatment of delivery time would require a multi-objective model with Pareto analysis of cost-time tradeoffs, which is recommended as a direction for future research

Other than the cost figures themselves, recommended allocation is intended to remain operationally feasible because the optimization carried out using the same supplier, destination and express post distribution route. Allocation recommended by POM QM basically only adjust certain supplier that should serve the certain destination with certain number of product shipped without establishing new shipment route, contract and new carriers.

Nevertheless, this model does not explicitly account for the regional logistic constraint such as the Seasonal accessibility issues in remote provinces. This study assumes fixed demand, supply capacity, and transportation rates. Future research is recommended to conduct sensitivity analysis testing parameter variations to further validate the robustness of the proposed allocation. Therefore to ensure the feasibility, Organization X should verify the proposed route and ensure whether the shipment time remains realistic with the regional condition at this time. This verification is recommended as a necessary follow-up step before full operational adoption of the proposed allocation.

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