

LOGISTICS COST SIMULATION: BASELINE VS. OPTIMIZED MODEL

Distribution Network Optimization Strategy (Route Clustering & Cost Analysis)

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1. EXECUTIVE SUMMARY

This document details the calculation logic and results of the logistics simulation conducted for the Consumer Electronics (Washing Machines) distribution case study. The simulation compares the financial and operational performance of the existing Baseline Model (Manual Convoy) against the proposed Optimized Model (Cluster-Based Routing).

Simulation Scope & Methodology

To ensure the analysis reflects realistic operational challenges, the simulation was conducted using a **High-Volume Delivery Schedule (Monday, Wednesday, Friday)**.

- **Rationale:** These days were specifically selected to represent **peak operational load constraints**, where vehicle capacity utilization and route efficiency are most critical. Validating the model under these peak conditions confirms its viability for daily operations.
 - **Route Scope:** Distribution from Central Distribution Center (Kudus) to 16 Destination Cities for 9 Key Accounts.
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2. PERFORMANCE COMPARISON (BEFORE VS. AFTER)

The following table summarizes the cumulative metrics derived from the simulation of the peak schedule (Mon, Wed, Fri).

Metric	Baseline	Optimized	Saving / Improvement
Total Distance (km)	3,237	1,079	66.67%
Total Logistics Cost	Rp24,221,970.00	Rp6,915,300.00	26.93%

Calculation Formula

The Total Cost Saving percentage is derived using the standard efficiency formula:

$$\text{Savings \%} = \frac{(\text{Baseline} - \text{Optimized})}{\text{Baseline}} \times 100\%$$

Result: The transition to clustered routing yields a **26.93% reduction in total logistics costs**, primarily driven by minimized empty-haul distances and optimized vehicle space utilization for bulky items.

3. MODEL LOGIC & VARIABLE ASSUMPTIONS

To ensure accuracy, the cost calculator integrates both variable and fixed cost components relevant to heavy-cargo logistics in Indonesia.

Cost Components (Variables)

The simulation engine processes the following input variables:

1. Variable Costs:

- **Fuel Consumption:** Calculated based on vehicle type (Diesel/Solar pricing) and distance.
- **Driver Allowance:** Variable rate per trip/distance.
- **Toll Fares:** Integrated rates for Trans-Java routes (Golongan II/III vehicles).

2. Fixed Costs:

- **Vehicle Depreciation:** Amortization cost allocated per trip.
- **Maintenance Overhead:** Estimated maintenance cost per km traveled.

Optimization Method: Saving Matrix

The route restructuring utilizes the **Saving Matrix** algorithm to identify the most efficient combination of delivery points, followed by the **Nearest Insert** method for route sequencing.

Savings Matrix

	Bandung	Banyuwangi	Bekasi	Cirebon	Depok	Jember	Kediri	Malang	Semarang	Solo	Sukabumi	Surabaya	Tangerang	Yogyakarta
Bandung	0													
Banyuwangi	1.02	0												
Bekasi	25.15	0.24	0											
Cirebon	16.12	0.68	15.58	0										
Depok	26.93	0.43	29.93	15.87	0									
Jember	1.25	26.57	0.39	0.86	0.61	0								
Kediri	1.98	13.18	1.01	1.53	1.30	13.42	0							
Malang	1.37	18.52	0.53	1.00	0.75	18.73	13.51	0						
Semarang	4.34	0.67	4.03	4.30	4.13	0.79	1.24	11.67	0					
Solo	4.27	3.04	3.43	3.94	3.70	3.24	3.91	12.60	3.16	0				
Sukabumi	14.69	1.57	13.31	13.44	13.87	1.80	2.52	17.05	4.47	4.78	0			
Surabaya	0.36	18.16	0.02	0.25	0.08	17.64	11.29	15.49	0.41	2.33	0.80	0		
Tangerang	26.60	0.31	30.24	15.73	33.73	0.48	1.14	0.62	4.07	3.55	13.64	0.04	0	
Yogyakarta	7.16	4.51	5.75	6.24	6.26	4.77	5.46	14.41	3.62	6.31	7.62	3.20	6.03	0

Nearest Insert

Cluster I				
Fleet: 1 Fuso + 2 CDD				
No	Region	Modern	Marketplace	Total Volume
4	Cirebon	0	2	2
11	Sukabumi	0	2	2
1	Bandung	3	0	3
3	Bekasi	0	2	2
5	Depok	1	1	2
13	Tangerang	4	2	6
			Total	17

Nearest Insertion Calculation			
0-13-0	36.22	0-4-13	36.61
0-5-0	34.06	0-4-5-0	34.31
0-3-0	30.27	0-4-3-0	30.81
0-1-0	28.28	0-4-1-0	28.29
0-4-0	16.12	0-4-11-0	17.91
0-11-0	15.23		
0-4-11-1-13-	41.14	0-4-11-1-3-13-0	42.60
0-4-11-1-5-0	38.64	0-4-11-1-3-5-0	40.76
0-4-11-1-3-0	36.63	0-4-11-1-3-5-13-0	43.25