

ABSTRAK

Penelitian ini bertujuan mengoptimalkan rute distribusi tabung gas LPG 3 kg bersubsidi di PT Permata Babakan Indah, Bekasi, menggunakan *algoritma Sweep* sebagai *metode heuristik* untuk menyelesaikan permasalahan *Capacitated Vehicle Routing Problem (CVRP)*. Metodologi penelitian melibatkan pengumpulan data permintaan dari 27 sub-agen (total 1.443 tabung/hari), koordinat lokasi dari *Google Maps*, penyusunan matriks jarak menggunakan *GeoGebra*, dan transformasi koordinat *Kartesianus* ke sistem polar untuk pengurutan berdasarkan sudut polar (θ). *Algoritma Sweep* diterapkan melalui tahapan: (1) konversi koordinat polar (r, θ), (2) pengurutan pelanggan berdasarkan sudut terkecil hingga terbesar, (3) clustering berurutan hingga batas kapasitas kendaraan (560 tabung/truk), dan (4) evaluasi jarak tempuh serta biaya uang jalan (Rp20.000/km). Hasil optimasi menunjukkan pengurangan signifikan total jarak tempuh harian dari 124,25 km (kondisi eksisting, 5 truk) menjadi 92,23 km (3 truk), atau penghematan 32,02 km (25,78%). Biaya operasional turun dari Rp2.485.000 menjadi Rp1.844.600 per hari, menghemat Rp640.400 (25,78%) tanpa mempertimbangkan variabel eksternal seperti kemacetan atau kondisi jalan. Rute hasil Sweep lebih terstruktur secara geografis dan memaksimalkan utilisasi kapasitas kendaraan. Penelitian merekomendasikan implementasi sistem informasi rute berbasis algoritma untuk agen LPG dan pengembangan lebih lanjut dengan algoritma *metaheuristik*.

Kata Kunci : Algoritma Sweep, Vehicle Routing Problem (VRP), Capacitated VRP (CVRP), Optimasi distribusi LPG, Koordinat polar, PT Permata Babakan Indah, Penghematan biaya logistic, Matriks jarak GeoGebra

ABSTRACT

This research aims to optimize the distribution routes of 3 kg subsidized LPG cylinders at PT Permata Babakan Indah, Bekasi, using the Sweep algorithm as a heuristic method to solve the Capacitated Vehicle Routing Problem (CVRP). The research methodology involves collecting demand data from 27 sub-agents (total 1,443 cylinders/day), location coordinates from Google Maps, distance matrix construction using GeoGebra, and transformation of Cartesian coordinates to polar system for sorting based on polar angle (θ).

The Sweep algorithm is implemented through four stages: (1) polar coordinate conversion (r , θ), (2) customer sorting from smallest to largest polar angle, (3) sequential clustering up to vehicle capacity limits (560 cylinders/truck), and (4) evaluation of travel distance and road allowance costs (Rp20,000/km). Optimization results show a significant reduction in total daily travel distance from 124.25 km (existing condition, 5 trucks) to 92.23 km (3 trucks), saving 32.02 km (25.78%). Operational costs decreased from Rp2,485,000 to Rp1,844,600 per day, saving Rp640,400 (25.78%) without considering external variables such as traffic congestion or road conditions.

The Sweep algorithm routes are more geographically structured and maximize vehicle capacity utilization. The research recommends implementing algorithm-based route information systems for LPG agents and further development using metaheuristic algorithms.

Keywords: *Sweep Algorithm, Vehicle Routing Problem (VRP), Capacitated VRP (CVRP), LPG Distribution Optimization, Polar Coordinates, PT Permata Babakan Indah, Logistics Cost Savings, GeoGebra Distance Matrix*