

Optimasi Pemilihan Rute Pelayaran Kapal Oil Tanker Menggunakan Algoritma Ant Colony Optimization = Optimization of Oil Tanker Shipping Route Selection Using Ant Colony Optimization Algorithm

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Abstrak

Penelitian ini mengoptimalkan pemilihan rute pelayaran kapal oil tanker menggunakan algoritma Ant Colony Optimization (ACO) dengan fokus pada efisiensi biaya operasional dan mitigasi risiko. Studi dilakukan dengan menggunakan ACS. Data rute kapal Gamsunoro milik PT Pertamina (Balikpapan–Rotterdam, 6 pelabuhan) digunakan sebagai studi kasus. ACS berhasil menemukan 3 rute optimal (jarak 12.000 km), memangkas 36% dari rute konvensional (18.753 km). Keberhasilan ACS dicapai melalui mekanisme kolaboratif semut, pembaruan feromon strategis (global-lokal), dan aturan transisi dinamis yang menyeimbangkan eksplorasi-eksploitasi. Dampak optimasi: 1.) Waktu tempuh berkurang dari 28 hari menjadi 18 hari; 2.) Konsumsi bahan bakar turun 350.000 liter/trip (dari 980.000 liter menjadi 630.000 liter). Kesimpulan utama menunjukkan ACS dapat digunakan dalam menangani lingkungan dinamis dan multi-constraint. Rekomendasi mencakup integrasi variabel real-time (cuaca, arus) dan validasi lapangan untuk pengembangan lebih lanjut.

.....This study optimizes the selection of oil tanker shipping routes using the Ant Colony Optimization (ACO) algorithm with a focus on operational cost efficiency and risk mitigation. The study was conducted using ACS. The route data of the Gamsunoro ship owned by PT Pertamina (Balikpapan–Rotterdam, 6 ports) was used as a case study. ACS successfully found 3 optimal routes (distance 12,000 km), cutting 36% from the conventional route (18,753 km). The success of ACS was achieved through the collaborative mechanism of ants, strategic pheromone updates (global-local), and dynamic transition rules that balance exploration-exploitation. The impact of optimization: 1.) Travel time reduced from 28 days to 18 days; 2.) Fuel consumption decreased by 350,000 liters/trip (from 980,000 liters to 630,000 liters). The main conclusion shows that ACS can be used in handling dynamic and multi-constraint environments. Recommendations include integration of real-time variables (weather, current) and field validation for further development.