

## ABSTRAK

Distribusi pakan ternak merupakan salah satu aktivitas penting dalam mendukung kelancaran operasional UD. Perdana Tani. Namun, proses distribusi yang dilakukan masih berdasarkan pengalaman dan belum menggunakan perencanaan rute yang terstruktur, sehingga menyebabkan jarak tempuh distribusi menjadi kurang efisien dan pemanfaatan kendaraan belum optimal. Permasalahan tersebut termasuk ke dalam *Capacitated Vehicle Routing Problem* (CVRP), yaitu permasalahan penentuan rute distribusi dengan mempertimbangkan batasan kapasitas kendaraan. Penelitian ini bertujuan untuk menganalisis sistem distribusi yang berjalan, menerapkan algoritma *Particle Swarm Optimization* (PSO) dalam menentukan rute distribusi yang optimal, serta membandingkan kinerja distribusi sebelum dan sesudah dilakukan optimasi. Data yang digunakan meliputi 62 pelanggan, data permintaan pelanggan, data kendaraan distribusi, dan matriks jarak yang diperoleh dari Google Maps. Implementasi algoritma PSO dilakukan menggunakan bahasa pemrograman Python dengan mempertimbangkan kapasitas kendaraan yang tersedia. Hasil penelitian menunjukkan bahwa algoritma PSO mampu menghasilkan 15 rute distribusi yang memenuhi batasan kapasitas kendaraan. Total jarak distribusi berhasil dikurangi dari 841,3 km pada kondisi eksisting menjadi 594,5 km setelah dilakukan optimasi, sehingga diperoleh penghematan jarak sebesar 246,8 km atau sebesar 29,34%. Hasil tersebut menunjukkan bahwa algoritma PSO mampu meningkatkan efisiensi sistem distribusi dan berpotensi menurunkan biaya operasional pada UD. Perdana Tani. Penelitian ini mendukung pencapaian *Sustainable Development Goals* (SDGs) tujuan ke-9, yaitu Industri, Inovasi, dan Infrastruktur, melalui penerapan metode optimasi berbasis teknologi dalam kegiatan distribusi.

Kata Kunci: Distribusi, *Capacitated Vehicle Routing Problem* (CVRP), *Particle Swarm Optimization* (PSO), Rute Optimal, Kapasitas Kendaraan.

## **ABSTRACT**

*Animal feed distribution is one of the important activities supporting the operational performance of UD. Perdana Tani. However, the distribution process is still carried out based on experience without structured route planning, resulting in inefficient travel distances and suboptimal vehicle utilization. This problem can be classified as a Capacitated Vehicle Routing Problem (CVRP), which involves determining distribution routes while considering vehicle capacity constraints. This study aims to analyze the existing distribution system, implement the Particle Swarm Optimization (PSO) algorithm to determine optimal distribution routes, and compare the distribution performance before and after optimization. The data used in this study include 62 customers, customer demand data, vehicle data, and a distance matrix obtained from Google Maps. The PSO algorithm was implemented using Python programming while considering the available vehicle capacities. The results show that the PSO algorithm successfully generated 15 distribution routes that satisfy vehicle capacity constraints. The total distribution distance was reduced from 841.3 km in the existing condition to 594.5 km after optimization, resulting in a distance saving of 246.8 km or 29.34%. These findings indicate that the PSO algorithm is capable of improving distribution efficiency and has the potential to reduce operational costs at UD. Perdana Tani. This study also supports the achievement of Sustainable Development Goal (SDG) 9, namely Industry, Innovation, and Infrastructure, through the application of technology-based optimization methods in distribution activities.*

**Keywords:** *Distribution, Capacitated Vehicle Routing Problem (CVRP), Particle Swarm Optimization (PSO), Optimal Route, Vehicle Capacity.*