

ABSTRAK

Pendistribusian transformator merupakan aspek krusial dalam rantai pasok PT. Bambang Djaja karena variasi dimensi dan berat muatan menuntut pemilihan armada yang efisien. Permasalahan yang dihadapi perusahaan adalah belum optimalnya penggunaan kapasitas kendaraan vendor, yaitu CDD, Fuso, dan Tronton, sehingga menyebabkan tingginya biaya distribusi. Penelitian ini bertujuan menentukan kombinasi jenis kendaraan yang optimal untuk meminimalkan biaya distribusi menggunakan pendekatan *Multidimensional Knapsack Problem* (MKP) yang diselesaikan dengan algoritma genetika. Parameter algoritma yang digunakan meliputi ukuran populasi sebanyak 500, jumlah generasi 100, probabilitas *crossover* sebesar 0,9, dan probabilitas mutasi sebesar 0,1. Model optimasi mempertimbangkan kendala kapasitas berat, kapasitas volume kendaraan, dan total biaya distribusi. Seluruh kapasitas kendaraan dan kebutuhan muatan trafo dikonversi ke dalam bentuk kotak berat dan kotak ruang untuk mempermudah proses perhitungan kapasitas serta pengalokasian muatan. Melalui mekanisme seleksi, *crossover*, mutasi, dan *elitism*, algoritma genetika menghasilkan nilai *fitness* terbaik sehingga mampu menentukan kombinasi kendaraan yang paling optimal. Hasil penelitian menunjukkan bahwa pada pengiriman area Jakarta periode 1 terjadi penurunan biaya distribusi dari Rp 22.066.881 menjadi Rp 21.381.240 yang menghemat sebesar Rp 685.641. Sementara itu, pada pengiriman area Jakarta periode 2 biaya distribusi berhasil diturunkan dari Rp 53.694.963 menjadi Rp 51.436.125 yang menghemat sebesar Rp 2.258.838. Hasil tersebut menunjukkan bahwa penerapan algoritma genetika mampu menentukan kombinasi kendaraan yang lebih optimal berdasarkan kapasitas muatan dan biaya pengiriman, sehingga dapat meningkatkan efisiensi distribusi serta mendukung pencapaian *Sustainable Development Goals* (SDGs) poin 9 mengenai industri, inovasi, dan infrastruktur.

Kata Kunci: algoritma genetika, biaya distribusi, *multidimensional knapsack problem*, optimasi.

ABSTRACT

Transformer distribution is a crucial aspect in PT. Bambang Djaja due to the variation in dimensions and weight of the cargo demands efficient fleet selection. The problem faced by the company is that the capacity of vendor vehicles, namely CDD, Fuso, and Tronton, has not been optimal, causing high distribution costs. This study aims to determine the optimal combination of vehicle types to minimize distribution costs using the Multidimensional Knapsack Problem (MKP) approach which is solved by genetic algorithms. The algorithm parameters used include a population size of 500, a generation of 100, a crossover probability of 0.9, and a mutation probability of 0.1. The optimization model considers the constraints of heavy capacity, vehicle volume capacity, and total distribution costs. All vehicle capacity and transformer load needs are converted into weight boxes and space boxes to simplify the process of calculating capacity and allocating loads. Through the mechanisms of selection, crossover, mutation, and elitism, genetic algorithms produce the best fitness values so that they are able to determine the most optimal combination of vehicles. The results of the study showed that in the delivery of the Jakarta area period 1, there was a decrease in distribution costs from IDR 22,066,881 to IDR 21,381,240 which saved IDR 685,641. Meanwhile, in the Jakarta area delivery period 2, the distribution cost was successfully reduced from IDR 53,694,963 to IDR 51,436,125 which saved IDR 2,258,838. These results show that the application of genetic algorithms is able to determine a more optimal combination of vehicles based on load capacity and shipping costs, so as to improve distribution efficiency and support the achievement of Sustainable Development Goals (SDGs) point 9 regarding industry, innovation, and infrastructure.

Keywords: *genetic algorithms, distribution costs, multidimensional knapsack problems, optimization.*