ABSTRACT

PT Al-Qosbah is an Al-Qur'an production and distribution company in Indonesia that faced a 21% delivery delay in October. This delay impacted customer satisfaction and increased transportation costs. One of the main causes was the lack of efficient delivery route planning, particularly in managing a heterogeneous fleet and time windows. The existing routes use a routing system that visits multiple locations before returning to the warehouse, resulting in extended delivery times. This research applies three route design methods, namely Saving Matrix, Mixed Integer Linear Programming (MILP), and direct shipment as a comparison. Saving Matrix produces routes with mileage savings and considers vehicle capacity. MILP is optimized using the Gurobi solver to minimize transportation costs by considering vehicle capacity, fleet size, time windows, speed, and mileage between locations. Meanwhile, direct shipment tests the impact of direct point-to-point delivery to customers. The results of the research show that the Saving Matrix reduces travel distance by 16% and transportation costs by 6%. MILP is more optimal with a 21% reduction in travel distance, a 9% reduction in transportation costs, and a reduction in delivery delays from 21% to 0%. Direct shipment speeds up delivery but increases transportation costs by up to 48% compared to existing routes. This study also produced an Excel-based information system using the Saving Matrix and MILP methods to help companies plan routes independently. These findings indicate that data-driven route planning can improve operational efficiency and customer satisfaction at PT Al-Qosbah.

Keywords - *Delay, Direct Shipment, Saving Matrix, Mixed Integer Linear Programming (MILP), Delivery Route Optimization.*