# *ABSTRACT*

*Transportation costs are one of the largest components in logistics operations and often become a crucial point in a company's efficiency efforts. This is also experienced by PT XYZ, an LPG 3 Kg distribution company that serves 23 base points in South Jakarta. Over the past few months, specifically from June to November 2024, there has been an indication that the company's transportation expenses have tended to increase, especially during periods of high customer demand. Based on this data, it is suspected that the existing distribution routes and vehicle allocation are not yet optimal—not due to a deliberate use of fixed routes, but rather because the planning approach has not fully considered overall cost efficiency.*

*One indication of the problem is the uneven utilization of the fleet, where some vehicles operate at very high capacity, while others are underutilized. In fact, PT XYZ operates two types of fleets with different capacities: the Suzuki Carry Pick Up with an optimal capacity of 200 cylinders, and the Mitsubishi FE with an optimal capacity of 560 cylinders. This imbalance contributes to increased operational costs in terms of fuel usage, travel time, and vehicle wear and tear. Moreover, when the actual delivery costs in November 2024 exceeded the company's budget limit of Rp 25,600,000, it reinforced the urgency to evaluate the existing distribution system.*

*Based on these issues, this study aims to design an optimal distribution route using a mathematical optimization approach. The problem addressed falls under the Capacitated Vehicle Routing Problem (CVRP) with a heterogeneous fleet, considering the different vehicle capacities. The chosen method is Mixed Integer Linear Programming (MILP), as it can generate optimal solutions for multi-point distribution with various constraints such as fleet capacity, customer demand, and total transportation cost.*

*The data used in this study were obtained from the company's internal records, including six months of customer demand, coordinates of each distribution point, travel distances and times between locations, fixed and variable vehicle costs, and*

*operating hours. The mathematical model was developed based on this data, and the problem-solving process was carried out using the Python programming language with the assistance of the CBC (COIN-OR Branch and Cut) solver.*

*The results of the modeling show that the proposed route solution can significantly reduce total transportation costs. From the initial cost of Rp 25,861,018 in the current distribution route, the cost decreased to Rp 25,505,830, achieving a 2% savings. Additionally, the total travel distance was reduced from 2,789.8 km to 2,368.5 km, resulting in a 15% distance efficiency. This distance efficiency has a direct impact on reducing fuel consumption, driver working hours, and fatigue risks that may affect delivery safety.*

*This study proves that distribution route planning should not rely solely on operational habits or intuition. With the right quantitative approach, companies can achieve tangible cost savings without adding more vehicles or making major structural changes. Indirectly, this study also demonstrates that data-driven and scientific methods in distribution management can significantly enhance overall logistics efficiency. It is hoped that the results of this design can serve as a useful recommendation for PT XYZ in formulating a more optimal LPG 3 Kg distribution policy. Furthermore, this research is expected to serve as a reference for future studies and the development of information technology-based distribution systems in a sustainable manner.*

***Keywords**: Distribution Route, Transportation Optimization, Mixed Integer Linear Programming, CVRP, Heterogeneous Fleet*