

ABSTRACT

The distribution of goods is a crucial component of supply chain management, especially for companies operating in the logistics sector. Efficiency in the distribution process can have a direct impact on operational costs and customer satisfaction. One of the key challenges in a distribution system is how to optimally allocate driver resources to serve various delivery requests. Many logistics companies face difficulties due to the limited number of internal drivers and the high costs associated with using external drivers from third-party logistics providers (3PL). Therefore, a systematic and structured approach is needed to solve the driver assignment problem in an optimal way, in order to reduce delivery costs and improve operational efficiency.

This study aims to develop an optimization model to address the Driver Assignment Problem in a national logistics company. The problem is compounded by the presence of two categories of drivers: internal drivers (partners), whose daily availability is limited, and external drivers (3PL), who are more flexible but incur significantly higher costs. In addition, the company enforces a maximum travel distance per delivery route, representing a work hour limit of 8 hours. If the total route distance exceeds this threshold, a special additional cost will be incurred, which only applies to 3PL drivers. This research does not consider vehicle capacity or customer service time windows, thus focusing solely on cost efficiency in driver assignment and route formation.

The mathematical model developed in this research combines the Vehicle Routing Problem (VRP) approach with driver assignment, referred to as the Vehicle Routing Problem with Driver Assignment (VRP-DA). The main objective of the model is to minimize total transportation costs, which include fuel costs, driver costs, and additional charges if the travel distance exceeds a predefined limit. The solution to this model is obtained using the Genetic Algorithm (GA), an evolutionary algorithm that simulates the natural selection process to find the optimal solution. The chromosome representation in this algorithm consists of a combination of delivery ID sequences and assigned driver IDs, which are

processed through a population and evaluated using a fitness function based on the total delivery cost.

The optimization process is carried out through stages of population initialization, selection, crossover, and mutation, which are specifically designed to handle the combination of driver assignment and route planning. This study utilizes actual data from the company, consisting of 218 delivery IDs with information on distances between delivery points and the type of driver assigned. The output of the algorithm includes the optimal route and driver assignment combination for each route, along with the corresponding total transportation cost.

The results of the study indicate that the use of the Genetic Algorithm significantly reduces the total delivery cost compared to the manual method currently used by the company. The utilization of internal drivers can be maximized efficiently, while the reliance on 3PL drivers can be reduced by more than 30% in certain scenarios. The average cost per kilometer also falls below the company's Key Performance Indicator (KPI) thresholds for all truck types. Moreover, all optimized routes comply with the maximum daily travel distance, thereby avoiding additional costs for overextended routes.

This research provides a tangible contribution in the form of an algorithm-based decision-making strategy that can be implemented by logistics companies to enhance distribution efficiency. In the future, this model can be further developed by incorporating vehicle capacity constraints, delivery time windows, multi-depot scenarios, or even integration with the company's logistics information systems.

Keywords — Driver Assignment, Cost Optimization, Vehicle Routing Problem, Genetic Algorithm