

# Simulation-Based Efficiency Assessment of Integrated First-Mile Pickup and Last-Mile Delivery in an E-Commerce Logistics Network

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**Abstract** - Logistics operations are crucial in the e-commerce supply chain as they deal with high costs as well as they have a significant environmental impact. The first-mile and last-mile delivery operations in e-commerce logistics are regarded as the operations with the highest costs. As a result, e-commerce service providers are keen to improve their first mile and last-mile delivery processes. Therefore, this study has been conducted to optimize transportation cost and distance of combined first-mile pickup and last-mile delivery operations while meeting some practical requirements such as a variety of package types, package compatibility on different types of vehicles, and a heterogeneous fleet of vehicles. After a careful literature review, this paper introduces a mathematical model to optimize the simultaneous first-mile pickup and last-mile delivery. The proposed mathematical model was simulated in SupplyChainGuru® modelling and simulation software. The study concluded that when first-mile pickup and last-mile delivery are routed simultaneously, rather than distributing and collecting the products as two separate operations, the overall cost is minimized by about 34%, and the distance is reduced by about 42% while reducing the number of vehicles on the route and utilising the maximum possible capacity of vehicles. This simultaneous pickup and delivery will improve the routing of e-commerce logistic supply chain and will serve as a platform for extending the simultaneous pickup and delivery process to other industries as well.

**Keywords** - e-commerce, first-mile, last-mile, simulation, simultaneous delivery and pickup