
Optimizing a reverse logistics system for plastic waste: the Netherlands case-study

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Abstract

Recyclable waste collection systems are often characterized by a logistics setup which is typically municipality-driven. This means that each system is responsible to collect a certain number of municipalities and the municipalities' boundaries are also the boundaries for the system's intervention area. Given this type of operation, there is some room for improvement if a broader approach is followed where the boundaries of each individual logistics system are broken and a global collection setup at a country level is followed. The present work explores this challenge and for that takes as case study the plastic packaging waste collection of Netherlands. Such system consists of 10 different companies, involving a total of 49 depots and 8 sorting stations. Currently, each one of the 370 municipalities is served by the closest depot and inter-municipality collection is not allowed. Moreover, all routes must start and end at the same depot, i.e., only closed routes are allowed. Aiming at optimizing this reverse logistics system, a mathematical model is developed to define the optimal service areas for each depot and the optimal collection routes. The municipality-driven setup is broken while promoting a higher integration by allowing inter-depot routes. The problem is modelled as a Multi-Depot Vehicle Routing Problem with Inter-Depot Routes. The objective function is to minimize the total distance, including the distance from the collection sites to depots and from these to sorting stations. A solution method based on a hybrid approach combining mathematical models with heuristics is devised to solve the real problem.

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