EURO J Decis Process
https://doi.org/10.1007/s40070-019-00105-5

ORIGINAL ARTICLE

Decision support for sustainable and resilience-oriented urban parcel delivery

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Received: 5 March 2019 / Accepted: 20 November 2019

Abstract

The worldwide trend of urbanization, the rising needs of individuals, and the continuous growth of e-commerce lead to increasing urban delivery activities, which are a substantial driver of traffic and pollution in cities. Due to rising public pressure, emission-reducing measures are increasingly likely to be introduced. Such measures can cover diesel bans or even entire car-free zones, causing drastic effects on delivery networks in urban areas. As an option to reduce the risk of a regulation-induced shock, we present a resilience-oriented network and fleet optimization. We propose an innovative parcel delivery concept for last mile delivery (LMD) operations and develop an optimization model to support tactical planning decisions. Our model minimizes overall operating costs by determining optimal locations for micro depots and it allocates transport vehicles to them. An adjustable CO_2-threshold and external costs are included to consider potential regulatory restrictions by city authorities. We implement our model into a decision support system (DSS) that allows analyzing and comparing different scenarios. We provide a computational study by evaluating and discussing our DSS with an example of a mid-sized German city. Our results and findings demonstrate the trade-off between cost and emission minimization by quantifying the impacts of various fleet compositions. The proposed logistics concept represents an option to achieve environmentally friendly, cost-efficient, and resilient LMD of parcels.

Keywords City logistics · Environmental sustainability · Resilience · Last mile delivery · Decision support system

Mathematics Subject Classifcation 68U35 · 90B06 · 90C11

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Published online: 06 December 2019