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New opportunities and challenges for city logistics

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Abstract

The information revolution is creating both opportunities and challenges for improving the sustainability of urban freight systems. A range of vehicle movement data can now be automatically collected from low cost sensors that are able to assist in improving understanding distribution systems and increasing their efficiency. Vehicle monitoring technologies that have the potential to charge both passenger and goods vehicles for using the road system, allow a new array of pricing schemes to be introduced. However, E-commerce (B2C) is creating a surge in home deliveries that is increasing the social and environmental costs of goods distribution systems. This paper describes some applications of big data systems and decision support systems that can be used to enhance the design and evaluation city logistics schemes. The need to develop improved tools for understanding logistics sprawl and reducing its effects are described. Developments in alternative fuel vehicles and advanced manufacturing systems are also presented.

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Keywords: big data; e-commerce; decision support systems; road pricing; logistic sprawls; co-modality; alternative fuel vehicles

1. Introduction

City Logistics is based on the systems approach that involves a number of technical processes including modelling, evaluation and the application of information technologies (Taniguchi and Thompson, 2014). Advances in Information and Communication Technology (ICT) provide opportunities for improving the performance of urban freight systems. ICT also creates the potential for developing more advanced urban freight management systems such as joint delivery

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systems and road pricing schemes.

2. Big data and analysis

Thanks to the development and deployment of ICT (Information and Communication Technology) and ITS (Intelligent Transport Systems), we can easily collect "big data" of pickup-delivery truck movements or goods movements in urban areas at lower costs. Global Positioning Systems (GPS) devices are typically equipped in trucks allowing the location of trucks to be precisely measured every second. Fig. 1 shows a GPS device which is used for recording the routes of urban trucks.

Fig. 1. GPS device which is equipped in a pickup-delivery truck

The analysis of big data of truck movements in urban areas allows us to gain insights into the behaviour of drivers. Ehmke and Mattfeld (2010) highlighted data provision of time-dependent travel times for city logistics routing demands. Telematics based traffic data collection and conversion from legal empirical traffic data into information models are discussed. Lin et al. (2013) applied data mining technique to find routing patterns from the past cases of vehicle routing plans of truck drivers. They designed a real time mobile intelligent routing system, which was installed on drivers' smart phone. It was demonstrated that the proposed method was successful in reducing the travel times on congested urban road networks in case studies. Xu et al. (2014) undertook a study where data was used to design a high-efficient flow path using Petri-Nets and offered a city logistics model based on a cloud based platform. Teo et al. (2015) analysed probe data of pickup-delivery trucks data with a multi-layered Geographical Information System (GIS) in Osaka using vehicle routing and scheduling with time windows (VRPTW) model. They indicated that considering the land use in particular the residential zone into the optimisation of VRPTW to understand how freight carriers can help to improve on their deliver operations under the existing land use plans while providing a better urban environment, especially for city dwellers within the residential zones.

3. Decision support systems

Decision support systems have been studied for choosing appropriate policy measures for city logistics. Developing decision support systems require several steps: (a) identifying problems, (b) choosing candidate