

Decision Support for Urban E-Grocery Operations

Completed Research

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Abstract

We discuss an alternative logistics concept for e-grocery operations using an urban network of refrigerated grocery lockers. Regarding the last mile delivery of food and other fast-moving consumer goods, customers either collect their orders by themselves or the products are delivered by means of electric cargo bicycles. To determine the optimal grocery locker locations and both, the routes from the lockers to the consumers as well as the routes from the depot to the grocery lockers, we propose a 2-echelon optimization model minimizing total costs. We present a Location Routing Problem (LRP) in combination with a customized Vehicle Routing Problem (VRP). With our decision support system (DSS), we react to the call of Malhotra et al. (2013) and Gholami et al. (2016) and address the lack of solution-oriented research. We contribute to the Green IS domain by extending the concept of e-grocery with an environmental and social component.

Keywords

Decision Support System, Green IS, Urban Logistics, E-Grocery, Sustainability.

Introduction

The growing population in cities implies an increasing demand for all kind of goods in urban areas. In addition, e-commerce is prospering accounting for a rising number of delivery activities and resulting traffic on the last mile to satisfy customer needs (Van Duin et al., 2016). The politics is called to mitigate the global warming potential by enacting appropriate laws to reduce the greenhouse gas emissions. For instance, the European Commission defines the objectives of excluding conventionally powered vehicles by 2050 and achieving “essentially CO₂-free city logistics in major urban centers by 2030” (EUC, 2011). To attain clean air for all inhabitants, national emission ceilings for different pollutants (PM₁₀, NO_x, etc.) are currently discussed. If those limits are exceeded, municipal authorities might be forced to ban certain vehicles from the urban traffic. For example, driving bans can cover diesel cars (e.g., Oslo, January 2017), vehicles with even/uneven-numbered registration plates (e.g., Athens, Beijing, Mexico City), and so forth. Despite vehicle bans, urban inhabitants need to be supplied with various goods. As one result, the number of electric cars, light-duty vans, and other transport vehicles such as cargo bi- and tricycles is rising in urban areas.

In addition, the delivery of groceries to end-customers (e-grocery) is a steadily increasing market. Figure 1 shows the e-grocery market value in billion USD (United States Dollar) for selected countries in 2015 and 2020 (forecast). The predicted growth rates vary between 77.8% (France) and 300% (Netherlands), which illustrates the significant rise of the e-grocery industry in different regions worldwide. One of the biggest challenges for e-grocery activities is the food delivery and its necessary compliance with the refrigeration chain. As one result, some vendors are not delivering any refrigerated food making additional grocery shopping necessary.