A sharing economy and multi-period vehicle routing model for online to offline service network

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E-commerce is a thriving industry that has created numerous services and business opportunities over the past decade. Every year, the growth rate for e-commerce sales maintains at double digit. For example, in China, e-commerce sales amounted to US$473 billion in 2014, and they are expected to reach US$1200 billion by 2017 (eMarketer, 2015). The e-commerce market is also highly competitive, particularly in terms of customer service. For online shops, speedy pickup from suppliers and delivery to customers has become one of the key competitive factors among them. In addition, online shopping has resulted in a high volume of return requests from customers. Combined, these cause surge demand for logistic services creating a number of problems, including high operating costs, exhaust gas emissions, carbon emissions and traffic congestion. To address these problems, there is a pressing need to reduce the number of trucks on the road with the aim of efficiently utilising the capacity of vehicles and drivers.

Applying the concept of sharing economy onto logistics operations is considered as one of the solutions. Trucks can be shared to fully utilize their spare capacities. However, a traditional vehicle routing model cannot effectively meet this need because all vehicle paths originate from and terminate at a central depot. Moreover, the model only allows one stop to be made at each location on the route. In this study, we propose a multi-period vehicle routing model with no central depot with two objectives: (1) minimise total cost and (2) minimise total carbon emissions. Suppliers can fulfil all customer demands from different locations. A customer can also order goods from multiple suppliers, and a particular location can be visited more than once, if needed. We will develop a heuristic algorithm for solving the proposed multi-period vehicle routing model. The proposed model can be applied to various online to offline activities such as the delivery of physical commodities, drop-shipments, last-mile deliveries, truck sharing, and return shipments.