Modelling logistic decisions of firms and carriers

Tabitha Maes, Katrien Ramaekers, An Caris, Gerrit K. Janssens, and
Tom Bellemans

Hasselt University, Transportation Research Institute,
{tabitha.maes,katrien.ramaekers,an.caris,
gerrit.janssens,tom.bellemans}@uhasselt.be

Abstract

Due to the rapid increase of freight transport, more attention is paid to the modelling of future freight flows. This paper focuses on the logistic decisions made within freight transportation models. Two main logistic decisions are highlighted. The first one is the choice of an appropriate inventory level and transport mode, made by the firm responsible for the transport. For this problem most authors refer to the inventory-theoretic approach. The second item is the order request selection process performed by the carrier to maximize his profit. This problem may be formulated in the form of a pickup and delivery selection problem.

Keywords: Logistic decisions, Freight transport modelling

In a growing globalised context and consumption economy, freight transport is of crucial importance. Activities of firms are expanding, even across borders. This causes an increase in logistics activities of firms as they become more dynamic. Public and private decision makers need to take these trends into consideration with regard to their decisions and a better projection of freight traffic flows becomes necessary. Being able to understand the drivers of freight flows makes it possible to forecast freight flows in the future and to calculate the impact of different policies on freight traffic. Still, freight demand modelling is lacking behind on the efforts made in passenger transport models.

The most important aspect that is missing in almost every existing freight transportation model is a comprehensive integration of the logistic decisions made by the different agents. For this reason an activity-based freight transportation framework is developed, which takes the logistic decisions into account. The key agents in our framework are senders, receivers, carriers and forwarders and are modelled separately as well as their logistic decisions.

One of the important logistic decisions with which firms are confronted is the choice

of an appropriate inventory level and transport mode. In our model framework this decision is made by minimizing the total logistic costs (TLC) to determine which transport mode is most appropriate for the desired inventory level and the corresponding shipment size. The TLC is determined by taking into account all costs in the supply chain that are influenced by the mode choice. The optimal shipment size that will be used is calculated into two steps. First an initial shipment size is determined, after which this is optimized depending on the interaction between the firm responsible for the transport and the carrier.

Secondly, logistic decisions made by a carrier are modelled. A carrier faces the daily problem of optimally scheduling his transport orders. Each day a carrier receives transport request from his clients, which have to be executed within a certain time period. To obtain a maximal profit the carrier has to group certain orders and create an optimal sequence of pickup and delivery of the different orders. The assumption mostly made is that all requests have to be fulfilled. In reality a carrier can refuse a transport order, when he believes this order is not profitable. Sometimes non-profitable orders are accepted, due to reasons of competition or long term commitment to a client. If a request is accepted it will generate revenue when the transport is completely fulfilled. A penalty may be determined in the contract for not or incompletely satisfying the request. When a carrier has to decide whether a certain request is accepted, the problem is defined as a pickup and delivery selection problem (PDSP).

Future research is required to determine which aspects have to be included into the total logistic cost function. Furthermore, solution methods for the PDSP have to be investigated in relationship to this particular problem.