

Dette resumé er publiceret i det elektroniske tidsskrift
Artikler fra Trafikdage på Aalborg Universitet
(Proceedings from the Annual Transport Conference
at Aalborg University)
ISSN 1603-9696
www.trafikdage.dk/artikelarkiv



Collaborative delivery strategies for goods delivery

Ahmed Karam and Kristian Hegner Reinau

Division of Transportation Engineering, Department of Civil Engineering, Aalborg University, Denmark

Akam@civil.aau.dk and khr@civil.aau.dk

Abstract

Transportation sector has the highest growth rate of greenhouse gas emissions compared to other sectors. The fact that the current practice of freight transportation strategies is not sustainable in the long run, motivates the urgent need of sustainable transportation strategies with less negative effects on the environment and the society. As one of the possible sustainable solutions, collaborative planning of freight delivery has attracted the interest of professional and scientific communities. This work illustrates some strategies of the collaborative freight transportation.

Introduction

Transportation sector highly affects the three main dimensions of sustainability, i.e. society, environment, and economy. Figure 1 shows how the European economy (indicated by GDP) is tightly correlated to the growth in the goods transportations for several years [1]. On the one hand, such tight correlation indicates the important role that road transportation plays in the sustainable growth of the economy in Europe. On the other hand, this increasing use of road transportation has negative impacts on the environment. As shown in figure 2 [1], compared to other sectors in Europe, CO₂ emissions due to transport activities are increasing with an average rate of 2.6% from 1995 to 2016. In 2016, CO₂ emissions due to road transportation accounted for 72% of the total CO₂ emissions due to all modes of transportation (see figure 3 [1]). Road transportation also affects the society, for example around 39,000 deaths in EU in 2008 are due to road transportation [2]. Adding to these facts that in 2011, cities has 69 % of road accidents [2].

To alleviate the externalities of road transportation, sustainable transportation solutions have been paid an increasing attention by governmental and private business organizations. The fact that the current practice of urban transportation strategies is not sustainable in the long run, motivates the urgent need of sustainable transportation strategies. Thus, the current practice of logistics companies needs to be changed into a sustainable logistics management with less negative effects on the environment and the society. There is a wide variety of solutions related to the green transportation, such as the use of electric vehicles, collaborative transportation systems, and other environment-friendly transportation network configurations.

The literature on collaborative logistics is very rich in several works. Most of existing works on collaborative logistics have focused on maritime and air transport, while research on collaborative logistics in road transportation is still rare and recent. In general, there are two types of collaboration, i.e. vertical and horizontal collaboration. Vertical collaboration is made by actors in the same supply chain at different levels, an example can be found in the work of Azab et al. [3] while horizontal collaboration is made by actors in the supply network, working at the same level and having compatible performance on the market, an example

can be found in the work of Karam and Attia [4]. For a more boarder and detailed description of the collaboration in freight transportation, the reader can examine the survey of L. Verdonck [5].

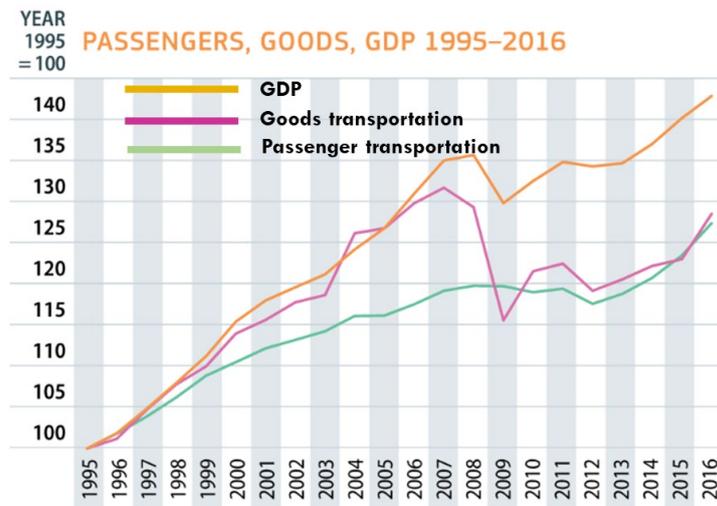


Figure 1: Variation in GDP, goods transportation, and passenger transportation with reference to values in 1995 [1].

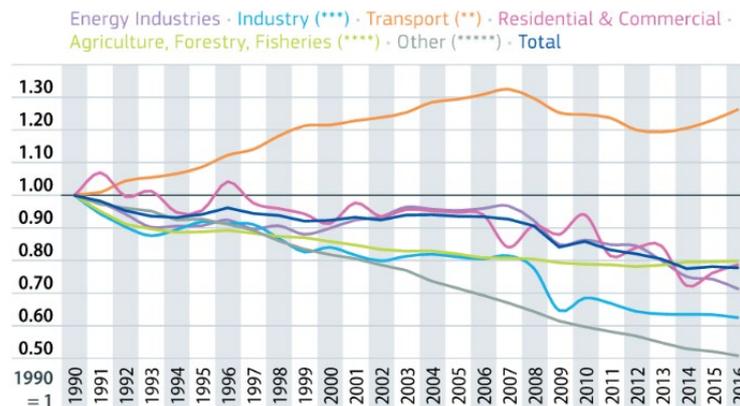


Figure 2: Variation of CO2 emissions in different sectors with reference to the values in 1995 [1].

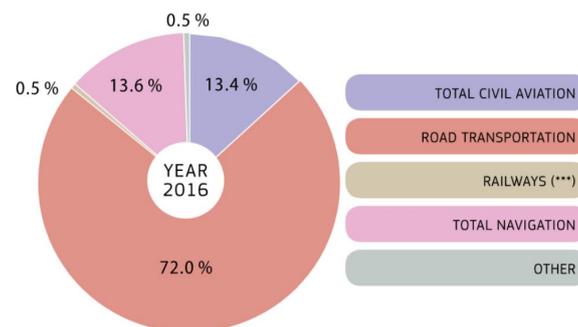


Figure 3: Share of different sectors in the total amount of CO2 emissions through 2016 [1].

Collaborative freight transportation strategies

In the past decade, many scholars have studied collaborative freight transportation strategies, i.e. order sharing or joint route planning, capacity sharing or backhauling, and consolidation center.

- **Joint route planning:** this strategy is also known as order sharing which necessitates that all carriers deliver all their logistics data about delivery orders, delivery costs, and the delivery fleet to a 3PL who makes all routing decisions for all collaborating carriers such that overall delivery performance of all carriers are improved compared to non-collaborative delivery. This collaboration strategy may

require some logistics costs to transfer the delivery loads between the depots of the collaborating carriers. Figure 4 shows an example of joint route planning between three carriers.

- **Capacity sharing:** this strategy is also known as backhauling which aims to reduce empty running by filling completely empty vehicles or to increase loading factor of vehicles running. Online freight exchange platforms are good tools that can help carriers to match available capacity and advertised loads. In addition, when carriers collaborate by sharing the capacity of their vehicles, this does not require carriers to share their full logistics data about their orders and delivery fleet and so, carriers are still able to make some of their routing decisions separately. Figure 5 shows an example of capacity sharing between three carriers.
- **Consolidation centers:** consolidation center is a cargo handling facility located close to the delivery area. Consolidation center is usually an intermediate stage in a two-level delivery structure. Carriers send their goods by large trucks to the consolidation center, then the delivered goods are consolidated onto friendly environmental vehicles for delivery to their final customers. Consolidation centers enable increasing load utilization through consolidating loads of different carriers in the same delivery vehicles.

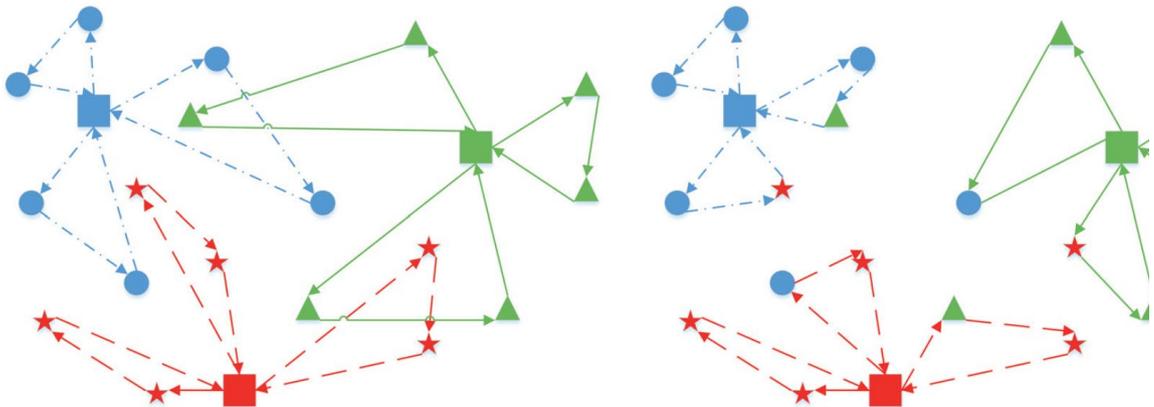


Figure 4: Non-collaborative (left) vs. collaborative scenarios (right) for joint route planning between three carriers [9].

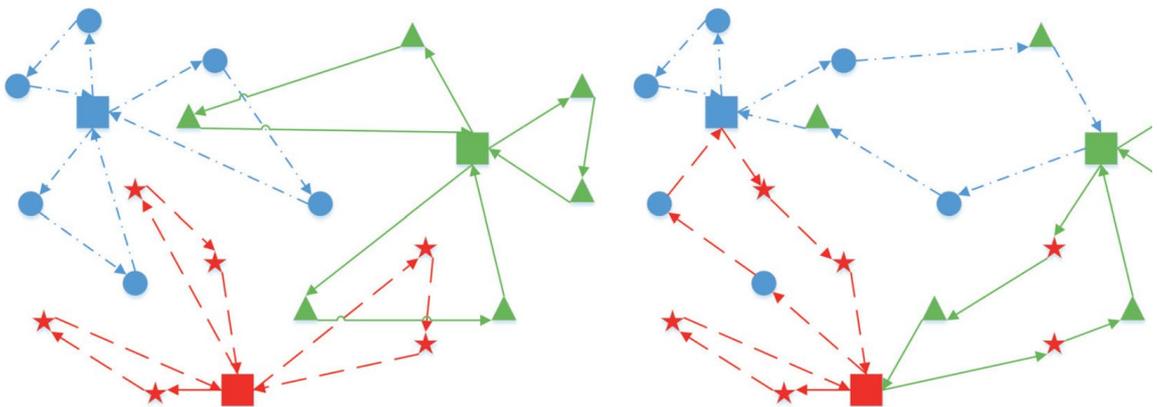


Figure 5: Non-collaborative (left) vs. collaborative scenarios (right) for capacity sharing between three carriers [9].

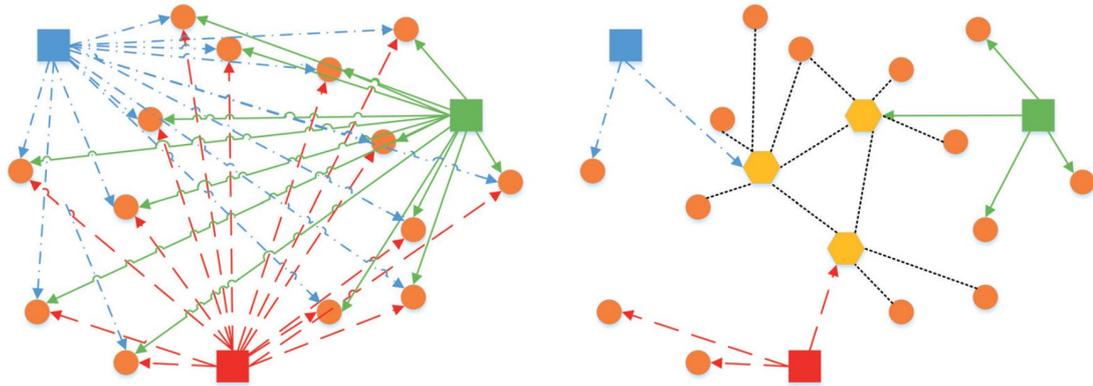


Figure 6: Non-collaborative (left) vs. collaborative scenarios (right) for freight consolidation center [9].

Reference

1. Statistical pocketbook 2018, accessed online on 12/9/2019 at <https://publications.europa.eu/en/publication-detail/-/publication/52f721ed-c6b8-11e8-9424-01aa75ed71a1>.
2. Commission of the European Communities (2009) Action plan on urban mobility. Technical Report COM (2009) 490. <http://ec.europa.eu>
3. Azab, A. Karam and A. Eltawil, "A simulation-based optimization approach for external trucks appointment scheduling in container terminals," International Journal of Modelling and Simulation, 2019, DOI: 10.1080/02286203.2019.1615261 2019.
4. A. Karam and E-A. Attia, "Integrating collaborative and outsourcing strategies for yard trucks assignment in ports with multiple container terminals," International Journal of Logistics Systems and Management, vol. 32, pp.372–391, 2019.
5. L. Verdonck, A. N. Caris, K. Ramaekers and G. K. Janssens, "Collaborative Logistics from the Perspective of Road Transportation Companies," Transport Reviews, vol. 33, pp.700-719, 2013.
6. A. Serrano-Hernández, A. A. Juan, J. Faulin, and E. Perez-Bernabeu, "Horizontal collaboration in freight transport: concepts, benefits and environmental challenges," SORT-Statistics and Operations Research Transactions, vol. 40, no.1, pp. 393-414., 2017.