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Evaluation of synergy potentials in transportation networks managed by a fourth party logistics provider

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Abstract

As a neutral partner, a 4PL is in an ideal position to manage and promote collaboration between transportation networks. The present article aims to quantify the benefits of a horizontal collaboration and thereby evaluate its feasibility for the different parties. The model developed consists of hierarchically structured scenarios to calculate and evaluate benefits in the dimensions of costs and CO_2 emissions. The model validation is done using data from four transportation networks managed by a European 4PL. The four transportation networks consist of nearly 4000 supply relations in total with about 3100 shipments per week.

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Keywords: fourth party logistics provider (4PL), horizontal cooperation, transportation costs, CO_2 emmissions

1. Introduction

In the last few years, the development and optimization of global networks has become a predominant goal in the field of logistics. In addition, internationalization and globalization have led to an increased complexity of those networks. In this context, the outsourcing of logistics services and cooperation within the supply chain are growing trends. Coordinating cost reduction effort vertically and horizontally across the supply chain helps to achieve greater cost reduction than when firms attempt to do it independently. Thus, the reduction of costs is one of the principal objectives in logistics. At the same time, environmental awareness is growing and logistics managers understand the necessity of reducing emission of greenhouse gases. [1;2]

In order to build a sustainable competitive advantage, logistics services providers are looking for innovative ideas to constantly improve the service they offer to their clients. As a neutral partner, the fourth party logistics provider (4PL) is in an ideal position to manage and promote horizontal collaboration between its partners, combining the benefits of outsourcing and horizontal collaboration for them. The 4PL then optimizes a collaborative network instead of optimizing the networks of its different partners independently. Additional cost savings and reduction of CO_2 emissions are expected from this horizontal collaboration.

Associating a 4PL with horizontal collaboration between manufacturers is a new concept which has not yet been widely studied. Only a few studies have actually investigated the combination of vertical and horizontal collaboration and can provide interesting material. Hingley et al. [3] for example, investigate the benefits and barriers of using a 4PL as a catalyst for horizontal cooperation among grocery retailers; Cruijssen et al. [4] evaluate potential savings with the assistance of joint route planning; and Mason et al. [5] combine vertical and horizontal collaboration as an innovative solution for better transport optimization. The present article

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2. The 4PL as promoter for horizontal collaboration between manufacturers

In general, collaboration is a popular means for companies to improve the effectivity of their logistics networks. The scope for the network planning is then larger and new opportunities and challenges arise. Simatupang and Sridharan define collaboration in the supply chain as like "two or more independent companies [who] work jointly and execute supply chain operations with greater success than when acting in isolation". [6] Different types of classifications for collaboration exist, the most widespread referring to its direction. Horizontal collaboration occurs between partners on the same level of the supply chain, while vertical collaboration occurs between partners on different levels of the supply chain. The main motive for collaboration is the opportunity to reduce costs by the bundling of resources. Collaboration can indeed enlarge the transported throughput, enable a better utilization of the transportation resources and thus increase the productivity of transports. Thus, collaboration is also an opportunity for reducing the number of trucks and the CO_2 emissions. [7]

As expressed in the review of Hingley et al., some authors have shown, however, that firms might be reticent to collaboration. [3] Collaboration between competitors presents for example, a contradiction insofar as the primary long term goal of each partner is its own success over one of the others. [8] Companies may also be afraid to lose their flexibility and their independence. Another impediment could be that they may not know how to get started and how to select potential partners. Moreover, collaboration can imply costs for things such as implementation of IT-systems or interfaces, training and transfer of knowledge. Thus, for horizontal collaborations that have proven to be successful, [3;6;9] key factors like trust, information sharing and relationship building, improved the success chances of collaboration. [6;10;11;12] Moreover, companies are willing to collaborate only if they are sure that there will be a win-win situation between all partners.

The partnership with a 4PL can enhance the benefits of horizontal collaboration and reduce impediments for cooperating manufacturers. First, in addition to the consolidation of the shipments, further economies of scale will be realized through the collaboration with all LSPs working with the 4PL partner. Manufacturers expecting additional cost reduction from the horizontal collaboration should thus reduce their impediments for collaboration. The global perspective brought by the 4PL also reduces the risk of opportunistic behavior of the partners. Furthermore, one of the prerequisites for collaboration success has been identified as the sharing of information. Companies collaborating with a neutral 4PL already share information with it, so that the horizontal collaboration does not require the direct sharing of information with new partners in addition to an expensive investment in additional information and communication technology. Moreover, an impediment for horizontal collaboration is the difficulty of finding partners. The 4PL know-how about the industry should support this task. Finally, as the 4PL has no assets and aims to optimize the costs of its clients due to a neutral position, it can be assumed that manufacturers may trust 4PLs over 3PLs to support a horizontal collaboration. [13] The 4PL can thus act as a promoter for the horizontal collaboration between its networks: it reduces the impediments for manufacturers to collaborate and enhances the benefits in comparison with a classic horizontal collaboration. Cross-company planning and optimization, however, have been identified as challenges. This article aims therefore, to respond to the need to evaluate the benefits of such a situation. This evaluation serves the 4PL as a basis for balancing trade-offs of the collaboration and concluding on its feasibility.

3. Construction of a model to evaluate the horizontal collaboration of transportation networks managed by a 4PL

3.1 Declaration of variables and description of research methodology

Table 1: Variables directory

Symbols for the network description	
S^R = Set of sources in a network R	H^R = Set of hubs in a network R
n_S^R = Number of sources in a network R	n_H^R = Number of hubs in a network R
D^R = Set of drains in a network R	T^R = Set of tariffs in a network R
n_D^R = Number of drains in a network R	

Symbols for calculation of emissions	
u = Capacity utilization of a truck [%]	ε_e = CO_2 emissions of an empty truck [g/km]
u_i = Partial capacity utilization for load i [%]	ε_f = CO_2 emissions of a full truck [g/km]