Background
In 1993, eight competing medium-sized Dutch producers of sweets and candy came to an agreement of intensive cooperation designed to increase the efficiency of their delivery processes. The cooperation was called “Zoetwaren Distributie Nederland” and was moderated by Prof. Jos Vermunt. Together, the companies supplied around 250 drop-off points (e.g. retail distribution centers), the majority of which received goods from more than one of the eight producers on a daily basis. A Logistics Service Provider was hired by the group to consolidate and deliver the shipments to their customers. Although the prime goal of the cooperation was to cut transportation costs, at the same time customer service was increased because the consolidated shipments reduced the number of deliveries, which in turn reduced unloading and handling costs. Moreover, customers were able to access a broader product assortment more easily.

Today, initiatives such as the above are occurring more frequently than ever. The economic downturn of 2008-2010, shortening of product life cycles, fierce competition in global markets and the heightened expectations of customers have generally caused companies’ profit margins to shrink. As a result there exists a strong incentive to decrease costs of non-value adding activities, such as basic distribution and warehousing. In addition, from the point of view of the service providers, the accumulating number of mergers and acquisitions provides an impetus for companies to re-optimize their logistics processes. All in all, the logistics market is undergoing a fundamental reorganization. Among others, this opens up the possibility to start innovative (horizontal) partnerships.

Cooperative logistics
When redesigning logistics processes, one of the most fundamental choices that companies face is whether to i) outsource, ii) keep logistics in-house, or iii) seek cooperation with like companies to exploit synergies (Razzaque and Sheng, 1998). Since today’s demanding customers expect their goods to be delivered to the right place, at the right time, in the right amount, in perfect condition and all at the lowest
price, companies often experience difficulty in satisfying these demands individually or by means of dyadic outsourcing relationships with service providers. This has resulted in the third option of closely cooperating with other companies becoming more and more viable.

Cooperation can occur in many ways. Commonly, a cooperative supply chain is characterised by its structure: vertical, horizontal, and lateral (Simatupang and Sridharan, 2002). Firstly, Supply chain management is the classic term describing vertical cooperation, a topic that boasts an abundant amount of formal literature. Supply chain management is aimed at installing beneficial partnerships and seamless linkages between multiple parties operating at different levels of the supply chain to avoid unnecessary logistics costs, or ‘waste’. The key drivers of such costs savings are inventory and transportation reductions, logistics facilities or equipment rationalization, and better information usage. Examples of vertical cooperation are Vendor Managed Inventory (VMI), Efficient Customer Response (ECR), and Collaborative, Planning, Forecasting, and Replenishment (CPFR). Secondly, the European Union (2001) defines horizontal cooperation as “concerted practices between companies operating at the same level(s) in the market”. These can be either competing or unrelated companies that share private information, facilities or resources to reduce costs or improve service. Some examples of horizontal cooperation in logistics are Manufacturers Consolidation Centres (MCCs), joint route planning, and purchasing groups. Finally, Simatupang and Sridharan (2002) define a lateral cooperation as a cooperation aimed at gaining more flexibility by combining and sharing capabilities in both vertical and horizontal manners. The goal of lateral cooperations is to synchronize shippers and LSPs of multiple companies in an effective logistics network.

Whereas much has been written about both vertical cooperation in supply chains and lateral cooperation in supply networks, both the literature and practical
evidence on horizontal cooperation in transport and logistics is still in its infancy, especially where operational consequences are concerned. However, this type of cooperation is becoming more and more relevant in practice. Empirical research (Cruijssen et al., 2006a) has indicated that generally LSPs consider horizontal cooperation to be an interesting approach to decrease cost, improve service or protect market positions amongst others. The same result, possibly even stronger, can be expected for shippers. As a result, more and more horizontal cooperation initiatives are developing. In Belgium and the Netherlands, the European logistics centre of gravity, we are aware of over 50 formally articulated horizontal logistics partnerships.

ArgusI and logistics cooperation projects
ArgusI counts the development and support of horizontal logistics partnerships to one of its core services. In our projects, we use both our broad experience in horizontal cooperation projects (around 20 initiatives supported) and our theoretical knowledge on the topic. In 2006, Frans Cruijssen successfully defended his PhD thesis (cum laude) entitled “Horizontal Cooperation in Transport and Logistics”. Some projects that ArgusI has supported are concerned with shared outbound palletized transport, joint conditioned transport, collaborative warehouse, joint benchmarking, mergers.

In our collaboration projects, we follow a proven methodology that aims at fulfilling our clients’ needs in a rigorous and transparent manner. The first important question is always whether there exists enough potential for collaboration. We check this by mapping processes and flows of the potential collaborating companies, see the pictures below for an example of the presentation of transport flows.
Once a suitable set of companies has been found and set up, the next step is to start up a pilot project in which the collaboration can be tested. The correct setup of these steps is highly case dependent and is therefore different in every project. A topic that is critical for every cooperation is the fair distribution of risks, costs and benefits among the participants. This question is too often underestimated, and many promising partnerships have clashed on discussions about gain sharing. To tackle this issue, ArgusI consistently promotes the use of cooperative game theory instead of the more popular rules of thumb, such as:

- Proportional to the total load shipped
- Proportional to the number of customers served
- Proportional to the transportation costs before the cooperation
- Proportional to distance traveled for each shipper’s orders
- Proportional to the number of orders

Because these rules are easy and transparent and since each embodies a construct that arguably represents the importance of an individual player to the group, they are likely to appeal to practitioners initially. However, when using a single construct, the others are obviously disregarded. In the long run, some participants will inevitably get frustrated since their true share in the group’s success is undervalued. For example, if gain sharing takes place according to the number of drop points, a certain customer firm with many end consumers in a small geographical region will
get a large share of the benefits, while his de facto contribution to the attained synergy is negligible when the other participants serve only few drop points in this area.

ArgusI’s proposal is to employ solution procedures from cooperative game theory instead. Cooperative game theory models the negotiation process within a group of cooperating agents and allocates the generated savings. This field has proved capable of solving fairness issues in many fields. Some logistics related examples are: (Vertical) Supply Chain Coordination (cf. Cachon and Lariviere (2005)), Hub-and-Spoke network formation (cf. Matsubayashi et al. (2005)), Outsourcing (cf. Elitzur and Wensley (1997)), and Inventory pooling (cf. Anupinidi et al. (2001); Bartholdi and Kemahlioglu-Ziya (2004); Sošić (2005)). Other sectors where game theoretical methods have been successfully applied in practice include among others: Automotive (cf. Cachon and Lariviere (1999)), Retail (cf. Sayman et al. (2002)), Telecommunication (cf. van den Nouweland et al. (1996)), Aviation (cf. Adler (2001)), and Health Care (cf. Ford et al. (2004)). Cooperating companies in these sectors benefit from game theoretical methods that objectively take into account each player’s impact within the group as a whole and produce compromise allocations that distribute the benefits of cooperation based on clear cut fairness properties. Different fairness properties are represented by well-known allocation rules such as the Shapley value (Shapley (1953)), the nucleolus (Schmeidler (1969)) and the tau-value (Tijs (1981)).

As an example, in our project for the Healthcare Logistics Forum, we tested a number of rules of thumb versus the cooperative game theory models of the Shapley value, the nucleolus and the compromise value, in the context of a joint warehouse
location study. The joint network infrastructure brought significant cost reductions up to 60% to the individual network configuration of the cooperating companies. These monetary savings were to be allocated to the participating companies. The following figure represents the results of the various gain sharing methods.

It shows from the figure that the three game theoretical concepts on the left are in good agreement. The rules of thumb on the other hand see to go anywhere. Using one of these rules of thumb obviously benefits some companies, where other will be dissatisfied. This is a big risk for the stability of the cooperation.

For more information on horizontal cooperation, game theoretical models and projects supported by ArgusI, please contact Frans Cruijssen.