CO³ POSITION PAPER:

FRAMEWORK FOR COLLABORATION

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COLLABORATION CONCEPTS FOR CO-MODALITY’ (CO³)

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EXECUTIVE SUMMARY:

CO³ POSITION ABOUT OPERATIONAL AND LEGAL FRAMEWORK FOR COLLABORATION

CO³
The EU-funded project ‘Collaboration Concepts for Co-modality’, or ‘CO³’ in short, is a project that aims to develop, professionalize and disseminate information on the business strategy of logistics collaboration in Europe. The goal of the project is to deliver a concrete contribution to increasing load factors, reducing empty movements and stimulate co-modality, through collaboration between industry partners, thereby reducing transport externalities such as greenhouse gas emissions and costs. The project will coordinate studies and expert group exchanges and build on existing methodologies to develop legal and operational frameworks for collaboration via freight flow bundling in Europe. Furthermore, the project consortium of knowledge institutes and industry partners will come up with joint business models for logistics collaboration. The developed tools, technologies and business models will be applied and validated in the market via case studies. Finally, the CO³ consortium will promote and facilitate matchmaking and knowledge-sharing through conferences and practical workshops to transfer knowledge and increase the market acceptance of collaboration.

As a starting point for the CO³ project, this paper provides an overview of the most relevant aspects for horizontal collaboration projects, based primarily on academic literature but furbished by insights from practitioners and industry experts. It discusses all relevant dimensions of horizontal collaboration, empirical opportunities and impediments, a description of the development process, roles and responsibilities of the key actors, and available tools and technologies. In this summary, the key messages of the position paper are briefly explained.

HORIZONTAL COLLABORATION AND CO-MODALITY
The CO³ project aims at supporting co-modality projects that are made possible by the increased economies of scale created by means of horizontal collaboration between companies, being either logistics service providers or shippers. Individually these companies might not have the scale to make the shift from road to rail, inland navigation or short sea shipping, but the idea is that by bundling companies can accumulate enough transport volume to fill a train, ship or barge, thereby reducing cost and decreasing total emissions of the transport industry in Europe.

CURRENT ROAD TRANSPORT EFFICIENCY
The main factors driving inefficiency in the road transport industry in Europe are the high percentage of empty running and the low load factors. The first one is mainly due to geographical trade imbalances and the lack of scale at carrier companies described in the previous subsection. The low load factors are mainly due to order fragmentation at shippers following just in time production and working capital reduction policies. In addition, planning capabilities at both shippers and logistics service providers could be improved to better utilizing
available transport capacity. By closely cooperating logistics shippers and service providers can reduce their inefficiency, something that is very much called for. In the period of 2001-2010 between 18.0% and 20.4% of freight kilometers driven in the European Union (27 countries) are conducted by empty vehicles. Another disturbing fact is that the average loading rate of the other remaining, i.e. loaded vehicles is only about 56% in terms of weight. Together these two observations result in an overall efficiency score of European road transport of around 45%. The total cost burden of road freight transport inefficiency is enormous. It increases from around € 120 billion in 2001 to around € 160 billion in 2010, having a peak of € 170 billion in 2008.

**FAIR GAIN SHARING**

When creating these consortia of companies working together, quite some aspects play a role. For example, a consortium is only economically viable if enough synergy exists among it. Furthermore, there is the aspect of trust, fair gain sharing and competition. Usually it is easier to collaborate with companies outside one’s own industry than with direct competitors, although obviously the overlap and synergy with competitors is promising by its nature. The dangers of mistrust and legal aspects however make that it seems more reasonable to sacrifice a little synergy for the sake of feasibility of a long lasting partnership. Whether between competitors or non-competitors, a fair gain sharing mechanism is essential. Therefore, fair gain sharing is one of the key messages of CO3.

**STRUCTURED DEVELOPMENT PROCESS**

The CO3 project aims to develop, describe and implement the ideal setup of a logistics collaboration project. This should be generic enough to fit most practical cases. It explicitly does not ambition to guide all individual cases in their development process towards true collaboration. That is impossible because there are just too many possible routes towards this, which depend on the specifics of the companies involved, the pace of development, impact etc. It is however very important to stick to a structured development process, for example including all legal contracts required. This structured development process is another key message of CO3.

**TRUSTEE IS NEEDED**

It was argued in this paper that there is a need for a specialized entity to setup, manage and develop a collaboration. If such a neutral, transparent and trusted party is not present, there is a severe risk that not all parties will efficiently work together in the long run on a fair give and take basis. Typically, there are two separate types of collaboration support activities carried out by a trustee. We categorize these types as ‘offline’ and ‘online’ activities. The main keywords for both the online and the offline functions of a trustee are neutrality, transparency and safeguarded confidentiality of data provided. These can never be compromised in any of the tasks performed by the trustee. In addition, the trustee will take responsibility for the legal foundations of the collaboration, making sure that for example the necessary contracts are in place, the collaboration satisfies competition law and the shared data remain strictly confidential. Given the importance of a trustee, the final key message of CO3 states that in a well-designed horizontal collaboration project, a neutral trustee must be in place to avoid anti-trust and establish a sustainable collaboration between the parties.
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INTRODUCTION

THE CO3 PROJECT

The EU-funded project ‘Collaboration Concepts for Co-modality’, or CO3 in short, is a project that aims to develop, professionalize and disseminate information on the business strategy of logistics collaboration in Europe. The goal of the project is to deliver a concrete contribution to increasing load factors, reducing empty movements and stimulate co-modality, through collaboration between industry partners, thereby reducing transport externalities such as greenhouse gas emissions and costs. The project will coordinate studies and expert group exchanges and build on existing methodologies to develop legal and operational frameworks for collaboration via freight flow bundling in Europe. Furthermore, the project consortium of knowledge institutes and industry partners will come up with joint business models for logistics collaboration. The developed tools, technologies and business models will be applied and validated in the market via pilot studies. Finally, the CO3 consortium will promote and facilitate matchmaking and knowledge-sharing through conferences and practical workshops to transfer knowledge and increase the market acceptance of collaboration.

STATE OF THE ART IN COLLABORATION

This position paper aims at describing the current state of the art in logistics collaboration, both from an academic and from a practical perspective. Over the last years, quite some literature has been developed on the topic, which in fact is waiting for broader application in practice. It is the view of the CO3 consortium that there is still a missing link between academia and practice when logistics collaboration is concerned. By developing a clear toolbox of for example development processes, optimization technologies, legal contracts, main opportunities and impediments to be encountered, this missing link can be solved. The main goal of this position paper therefore is to identify all such tools, frameworks, etc. that are necessary for a successful logistics collaboration project. These can then be used to sharpen the ideal business models for collaboration and to assist in concrete projects, thereby bridging the gap between academia and practice.

Results have been gathered by surveying academic and business literature on the topic of collaboration, attending various workshops and presentations on the topic, and interviewing key decision makers in the logistics industry. The result is this paper, which is an attempt to provide a comprehensive overview of the state of the art in logistics collaboration. The remainder of this paper is organized as follows. In the current section 1, the background of the collaboration and the logistics industry in Europe is sketched and the topic of horizontal collaboration is introduced. Then, section 2 provides an overview of the main typologies for horizontal collaboration available in literature. After that, the main opportunities and impediments found
in literature and encountered in practice are summarized. Section 4 deals with the development process for a collaboration project and argues that a structured approach to developing horizontal collaboration projects strongly improves the probability of long term success of the project. Next to be discussed are the roles and responsibilities of the various stakeholders in horizontal collaboration. The tools and technologies available for support are in focus in section 6. Section 7 concludes and provides suggestions for further research.

**CHALLENGES FOR SHIPPERS**

In the current situation of economic downturn and focus on cost reductions, the transport and logistics industry is evolving from a necessary, though low priority function to an important part of business that can enable companies to attain a competitive edge over their competitors. Because profit margins are shrinking especially in the transport-intensive commodity producing sectors, efficient logistics management can in fact be the decisive factor for a company’s success, since competition will take place on the basis of costs, service and timeliness. Despite the increased focus on logistics functions of shipping companies, there are still plenty of developments that are forcing shippers to improve their logistics capabilities. An overview is given in Table 1.

<table>
<thead>
<tr>
<th>Capability</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Compression</td>
<td>Reduced transport times can decrease the required level of inventory, especially safety and pipeline inventory. This time compression can be achieved by acquainting suppliers and Logistics Service Providers (LSPs) with relevant information as fast and accurate as possible.</td>
</tr>
<tr>
<td>Reliability</td>
<td>Supply chain partners depend on reliable deliveries for their own production and sales efforts (Morash and Clinton, 1997). Customer dissatisfaction, overstocking at retailers and not communicated promotional actions are sources of unreliability of the logistics process and are symptomatic for suboptimal supply chains (cf. LeBlanc, 2006).</td>
</tr>
<tr>
<td>Standardisation</td>
<td>For example the advent of EDI and standard Enterprise Resource Planning (ERP) software has caused a strong integration and automation of many of the business practices associated with the production and distribution operations of companies. This facilitates information exchange and improves visibility and planning at the operational and tactical level of operation.</td>
</tr>
<tr>
<td>Just-in-Time</td>
<td>A Just-in-Time (JIT) inventory strategy can be implemented to improve a company’s profitability by reducing in-process inventory and its associated costs. Stock levels are kept low so that savings can be attained on both warehousing and inventory costs. For a successful JIT implementation, the presence of high quality information systems containing reliable data is vital.</td>
</tr>
<tr>
<td>Flexibility</td>
<td>In today’s constantly changing market places, the flexibility of a company to fulfil its customers’ requirements is often an important capability. Having the logistics skills to support last minute changes in order specifications is therefore a necessary condition for a company’s success. Here, ‘flexibility’ is an umbrella term for responsiveness, agility, and adaptivity.</td>
</tr>
<tr>
<td>Customisation</td>
<td>Companies must be able to offer their customers tailored services, rather than a rigid standard package. This customisation might occur in both product and distribution characteristics. For example, a producer of soda drinks must be able to supply one customer by shipping large volumes to its distribution centre, while for another customer Vendor Managed Inventory (VMI) on store level is asked for.</td>
</tr>
</tbody>
</table>
In order to improve the efficiency of logistics processes, shippers have to make logistics an integral part of their business process. Only if the internal departments of procurement, sales and manufacturing are in harmony with logistics, merchandise can be delivered to customers in the right amount, at the right time, to the right place, in perfect condition and against the lowest price. Companies that are successful in their supply chains are those that have developed the capabilities listed in Table 1. It has to be noted however that some of these capabilities have become almost a standard over the last years, which is not always good news from a holistic supply chain point of view. For example, just-in-time production tends to result in small and difficult to predict transport orders, making it very difficult for LSPs to work efficiently, as we will discuss in the next section. In many supply chains, the strongest negotiation power lies with the shippers. This result in what is sometimes referred to as the ‘tyranny of the buyer’: very high service levels are negotiated by the shippers, simply because they are able to negotiate them, not because they necessarily need them. As a side effect of collaboration, these market imperfections will become clear as service levels of various shippers will need to be aligned and agreed upon with LSPs.

CHALLENGES FOR LOGISTICS SERVICE PROVIDERS

Whereas shippers must have the adaptive logistics organization that facilitates the increasing customer needs as described in the previous section, Logistics Service Providers (LSPs) must be able to actually execute the tasks that arise from these new logistics requirements. However, it is fair to say that LSPs are having severe difficulties with these newly posed demands. The shorter lead-times, narrower time windows and smaller quantities demanded by shippers have caused lower load factors, increased empty running, worsened profitability, and, as a final result, an increase in the number of bankruptcies. The situation is worst for those LSPs that are active in the more traditional forms of logistics services, such as storage and basic distribution. The most prominent reason for the bad financial performance of LSPs is that they usually cannot transfer the increased operating costs to their customers. The reason for this lies in the fact that the fragmented LSP sector is unable to take a stand against their large (often multinational) and thus powerful customers. This unbalanced market power creates the vicious circle for LSPs displayed in Figure 1. LSPs are characterized by low profit margins, a strong fragmentation and price competition. As a result, they do not have the time and monetary resources to develop new skills or undertake new projects to discern themselves from competitors and to better serve customers. Consequently, the sector remains traditional in the sense that no innovation or proactive initiatives are undertaken to structurally improve the level of service. Therefore, the logistics services will remain commodity-like and competition will be focused on the lowest price, instead of superior quality. This induces even thinner profit margins and stronger competition, starting another iteration of the vicious circle.
The challenge for LSPs is of course to break out of this vicious circle for example by implementing innovative software, logistics concepts or business models that strengthen their bargaining position with respect to their customers. In other words, they have to become the customer’s partner instead of merely its supplier. Such collaboration between shippers and LSPs is in line with the development of LSPs from traditional carrier companies to fully-fledged partners that help shippers to structurally improve their logistics performance in an innovative way. These more modern LSPs have better capabilities to respond to changes in the market place, one important of which is discussed here below: the transit from supply chains to supply networks.

FROM CHAINS TO NETWORKS

Mason et al. (2007) state that in their drive to be ever more efficient and competitive, companies have focused on their internal organization and processes, mostly through intensified vertical collaboration with supply chain partners. As pressure to become ever more competitive continues, companies are now looking beyond the boundaries of their own organizations and even beyond their own supply chain. The result of this is that supply chains that traditionally were virtually separate, are now starting to overlap, for example by jointly using transport capacities, warehouses, collaborative planning and forecasting, etc. This strongly increases both the number and the complexity of relations in a networked system of supply chains. With structured collaboration, it is possible to more fully exploit the conceptualization of supply chains as supply networks. A discussion of the development of supply networks and the role that collaboration plays here, can be found in the report of the Consumer goods forum and Cap Gemini (2011). An illustration of this can be found in Figure 2.
Another challenge for LSPs is the strong fragmentation in the industry, which is discussed in the next section.

**FRAGMENTATION OF THE EUROPEAN ROAD TRANSPORT INDUSTRY**

The total road transport industry in the European Union is enormous. Although not readily available from the Eurostat database, the European Union (2010) in cooperation with Eurostat estimates it to 302 billion euro.

However, this industry is heavily fragmented. The 10 biggest European LSPs do not serve more than 15% of the total market. A very large share of the trucking companies in the European union even operate five trucks or less, resulting in a highly fragmented industry structure, intense competition and small profit margins. For example, in the Netherlands there were 142,715 trucks and pulling units by 1 January 2011, operated by around 12,000 companies (CBS, 2012; NIWO, 2012). This means that the Dutch road transport industry is populated by a small number of big players and a whole range of very small carrier companies. This causes transport inefficiency, which is the topic of the next section.
INEFFICIENCY

The main factors driving inefficiency in the road transport industry in Europe are the high percentage of empty running and the low load factors. The first one is mainly due to geographical trade imbalances and the lack of scale at carrier companies described in the previous subsection. The low load factors are mainly due to order fragmentation at shippers following just in time production and working capital reduction policies. In addition, planning capabilities at both shippers and logistics service providers could be improved to better utilizing available transport capacity. Especially the fragmentation is a big problem: Krajewska et al. (2008) state that with the increasing globalization of the economy, large international logistics service providers are more competitive than small companies due to their extensive market power structure.

A solution for medium- and small-sized carriers lies in establishing coalitions in order to extend their resource portfolios and to reinforce their market position (Krajewska and Kopfer, 2006). Collaboration can be a powerful approach when it is used to improve operational planning. By cooperating carriers can reduce their 'hidden costs' for inefficiency (Ergun et al, 2007).

An example of such a hidden cost is asset repositioning. To execute shipments from different shippers a carrier often has to reposition its fleet. Shippers have no insight in how the interaction between the various shipments affects a carrier’s asset repositioning costs. In other words, no single participant in the logistics system controls the asset repositioning costs (Ergun et al., 2007).

Asset repositioning and low factors are expensive. Eurostat data (2012) show that in the period of 2001-2010 between 18.0% and 20.4% of freight kilometers driven in the European Union (27 countries) are conducted by empty vehicles. Another disturbing fact is that the average loading rate of the other reaming, i.e. loaded vehicles is only about 56% in terms of weight (European Environment Agency, 2010). Together these two observations result in an overall efficiency score of European road transport of around 45%. Figure 3 provides an overview of road freight transport (in)efficiency in the European union over the period 201-2010. It shows that the total cost burden of road freight transport inefficiency is enormous. It increases from around € 120 billion in 2001 to around € 160 billion in 2010, having a peak of € 170 billion in 2008. Admittedly, there are some side remarks to be made to this number, for example it disregards cubic capacity restrictions, see McKinnon (2010) for a discussion. Still however, this number is a clear call for action.
The growth of road transport combined with the low efficiency requires an adequate response from the market to prevent an increase in congestion on the European roads and an increase in the environmental impact.

**Environmental Impact**

The transport sector is greatly responsible for the increase in energy consumption and for emissions of pollutants and greenhouse gases. For example in France, transport accounts for 29% of total CO$_2$ emissions in 2010 (passenger and freight transport combined). For freight transport, road is by far the leading culprit, accounting for almost 80% of the energy consumed by all means of transport combined (Ademe, 2012). More details on the measurement of environmental impact of the transport industry in Europe can be found in McKinnon (2010).

This situation is not sustainable, especially not with the strong focus on environmental care and emission reduction, for example following the Stern report (2006) and the film ‘An Inconvenient Truth’ by Al Gore. As a reaction, voluntary agreements have been signed between the European Commission and for example automobile manufacturers to significantly reduce vehicles’ unit consumption (and therefore related emissions of carbon dioxide). Moreover, every four or five years new European standards (Euro 3, Euro 4) lower the emissions thresholds of the leading pollutants.

Yet all these efforts are simply not enough. The decrease in vehicles’ unit consumption and emissions is offset by a sharp increase in road traffic. Therefore, regardless of future prospects in the technological arena, action must also be taken to manage the growth of freight. Policy makers in Europe and around the world realize this and have proposed a number of focus areas to reduce the environmental footprint of the road transport industry. These will be introduced in the next subsection.
POLICY FOCUS AREAS ADVISED BY WORLD ECONOMIC FORUM

In 2009, the World Economic Forum published an important report called ‘Supply chain decarbonization – The role of logistics and transport in reducing supply chain carbon emissions’. In this report a number of prioritized strategies for reducing the environmental impact of the transport industry were posed. Regulation is called for as the desire to reduce carbon and other emissions is not yet intrinsic to the industry. In Table 2, we provide the most prominent recommendations by the World Economic Forum report.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Explanation</th>
<th>Potential abatement (Mt CO2e)</th>
<th>Feasibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Clean vehicle technology</td>
<td>Introduce clean and environmentally efficient technologies</td>
<td>175</td>
<td>High</td>
</tr>
<tr>
<td>2 Slowing down product flow</td>
<td>Decrease transport speed and increase load fill</td>
<td>171</td>
<td>High</td>
</tr>
<tr>
<td>3 Localized sourcing of agricultural produce</td>
<td>Optimize the location of agriculture</td>
<td>178</td>
<td>Medium</td>
</tr>
<tr>
<td>4 Optimization of logistics networks</td>
<td>Improve network planning through transformation projects</td>
<td>124</td>
<td>High</td>
</tr>
<tr>
<td>5 Increased energy efficiency of buildings</td>
<td>Minimize emissions from operating activities</td>
<td>93</td>
<td>High</td>
</tr>
<tr>
<td>6 Improved packaging design</td>
<td>Reduce weight and volume of packaging</td>
<td>132</td>
<td>High</td>
</tr>
<tr>
<td>7 Enable low carbon production</td>
<td>Optimize manufacturing location</td>
<td>152</td>
<td>Medium</td>
</tr>
<tr>
<td>8 Training and communications</td>
<td>Provide training to road transport contractors and building operators</td>
<td>117</td>
<td>Medium</td>
</tr>
<tr>
<td>9 Freight modal shift</td>
<td>Transfer freight from air and long-haul road freight to ocean, road and rail freight</td>
<td>115</td>
<td>Medium</td>
</tr>
<tr>
<td>10 Reverse logistics / recycling</td>
<td>Improve percentage of total supply chain waste which is</td>
<td>94</td>
<td>Medium</td>
</tr>
<tr>
<td>11 Near-shoring / relocalization</td>
<td>Transfer long-haul air and ocean freight to road and rail freight</td>
<td>5</td>
<td>Medium</td>
</tr>
<tr>
<td>12 Increased home delivery</td>
<td>Rely on alternate transport services to deliver goods home</td>
<td>17</td>
<td>Medium</td>
</tr>
<tr>
<td>13 Reduction in congestion</td>
<td>Introduce traffic management techniques</td>
<td>26</td>
<td>Low</td>
</tr>
</tbody>
</table>

TABLE 2 EMISION ABATEMENT STRATEGIES (WORLD ECONOMIC FORUM, 2009)
In their report, the World Economic Forum strongly encourages collaboration among shippers and carriers, for example by investing in data exchanges to increase visibility of co-loading and other collaboration opportunities. The proposed policy measures are graphically presented in Figure 4.

One of the most promising strategies in Table 2 in terms of possible abatement of CO₂ is modal shift. This will be discussed in more detail in the next section.

**Modal split**

It was already mentioned in the section on the environmental impact of transport that road transport is still by far the dominant mode of transport in the European Union. Figure 5 supports this observation. Despite the growing emphasis on reducing the environmental footprint of the economy in general and the transport industry in particular, still we do not seem to succeed in switching to more environmentally friendly modes of transport such as rail and inland waterways.
This is a discouraging observation, especially since the emissions from road transport have been steadily increasing in the European Union since 1990, as can be seen from Figure 6.

Given the bigger scale of operations that is required for operating the more environmentally efficient modes of transport, it is not always possible for individual companies to easily switch to these alternative modes. One solution to this, which is also advocated by the World Economic Forum (2009) is to have small companies collaborate with each other and consolidate flows so that modal shift becomes a broad and economically viable measure. Collaboration, and more specifically horizontal collaboration, is the main topic of this paper and will be introduced in the next subsection.
DEFINITION OF HORIZONTAL LOGISTICS COLLABORATION

Barratt (2004) provides a useful definition of the various types of collaboration that can take place in supply chains. These are summarized in Figure 7. Apart from internal optimization processes, he identifies vertical collaboration upstream with suppliers and downstream with customers. In addition, it is possible to engage in horizontal collaboration, either with competitors or with non-related other organizations that conduct similar activities in another supply chain.

Several definitions for horizontal collaboration or similar practices can be found in literature. For instance, Lambert et al (1999) define a Partnership as “a tailored business relationship based on mutual trust, openness, shared risk, and shared rewards that yields a competitive advantage, resulting in business performance greater than would be achieved by the firms individually.” A different definition, which includes the horizontal aspect of collaboration, is given by the European Union (2001) which defines Horizontal Collaboration as concerted practices between companies operating at the same level(s) in the market. Lastly, Cruijsen (2006) defines horizontal collaboration in transport and logistics as “active collaboration between two or more firms that operate on the same level of the supply chain and perform a comparable logistics function on the landside.” Based on empirical data in Flanders, Cruijsen et al. (2010b) show that collaborating companies operate more efficiently than non-collaborating companies.

Ritter et al. (2004) investigates a combination of horizontal and vertical forms of collaboration, which is sometimes referred to as lateral collaboration. It aims to gain more flexibility by combining and sharing capabilities in both vertical and horizontal manners (Simatupang and Sridharan, 2002). This kind of thinking is being exploited by new logistics players who envisage
that collaboration will be a key to creating superior value adding solutions in many supply chains. Throughout the CO3 project, the focus is on horizontal collaboration projects with a lateral component via a so-called trustee. This key new logistics function is discussed in detail in the section on roles and responsibilities.

Combined horizontal and vertical collaboration via a trustee is not fully the same as lateral collaboration as it does not require direct and networked points of contact between various shippers, logistics service providers and combinations of those. For simplicity therefore, we speak of horizontal collaboration in this paper. The next section further introduces the topic.
HORIZONTAL COLLABORATION

Horizontal logistics collaborations come in many shapes in practice. To learn from the experiences and note which setups succeed and which ones tend to not succeed, a typology for horizontal collaboration is required. In literature, a number of structured descriptions of (horizontal) collaboration projects can be found. In this section we describe the most relevant ones. These are based on the dimensions listed in Table 3. In the subsections below we discuss each of the dimensions in some detail.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Based on</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intensity of the collaboration</td>
<td>Lambert et al. (1999)</td>
</tr>
<tr>
<td>Direction of consolidation</td>
<td>Industry consultation</td>
</tr>
<tr>
<td>Scope and Intensity</td>
<td>Zinn and Parasuraman (1997)</td>
</tr>
<tr>
<td>Scope, competition, combined assets and objectives</td>
<td>Cruijssen (2006)</td>
</tr>
<tr>
<td>Shippers and/or carriers</td>
<td>Industry consultation</td>
</tr>
<tr>
<td>Number of partners</td>
<td>Industry consultation</td>
</tr>
</tbody>
</table>

TABLE 3 DIMENSIONS FOR TYPOLOGY OF HORIZONTAL COLLABORATION

INTENSITY OF COLLABORATION

Lambert et al. (1999) identify three types of collaboration depending on the level of integration of partners (see Figure 8). Although this categorization was initially designed for vertical supply chain relationships, it can straightforwardly be translated to accommodate horizontal collaboration. This spectrum is completed on the left-hand side by Arm’s length collaboration, and on the right-hand side by Horizontal integration, which are not considered to be genuine horizontal collaboration in the context of this paper. However, it can be stated that horizontal integration, or a merger, is in fact an extreme case of horizontal collaboration.
In an arm’s length collaboration, communication is of an incidental nature and companies may collaborate over a short period of time, involving only a limited number of exchanges. There is no strong sense of joint commitment or joint operations. An example in the logistics industry is if one LSP subcontracts a comparable LSP in the event of a capacity shortage. This horizontal subcontracting is discussed in detail by Spiegel (1993).

One can only speak of real collaboration if “there is a tailored relationship based on mutual trust, openness, shared risk and shared rewards that yields a competitive advantage, resulting in business performance greater than would be achieved by firms individually” (Lambert et al., 1999). As illustrated in Figure 8, horizontal collaboration can be subdivided into three types. A Type I collaboration consists of mutually recognized partners that coordinate their activities and planning, though to a limited degree. The time horizon is short-term and the collaboration involves only a single activity or division of each partner company. Type II is a collaboration in which the participants not merely coordinate, but also integrate part of their business planning. The horizon is of a long though finite length and multiple divisions or functions of the companies are involved. In Type III collaborations, the participants have integrated their operations to a significant level and each company regards the other(s) as an extension of itself. Typically, there is no fixed end date for such a collaboration. Type III collaborations are often referred to in literature as ‘strategic alliances’. Whereas the Type I and II collaborations are characterized by the absence of a formal contract, a horizontal strategic alliance is defined as a long-term (generally three years or more) explicit contractual agreement pertaining to an exchange and/or combination of some, but not all, of a firm’s resources with one or more competitors (Burgers et al., 1993). Strategic alliances have attracted considerable academic interest, see Todeva and Knoke (2005) for a review. They identify thirteen types of strategic alliances based on the level of integration and governance formalization, ranging from market relations (lowest level) to hierarchical relations (highest level, such as mergers and acquisitions). Table 4 describes the three types identified by Lambert et al. (1999).

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
</table>
| Type I       | The organizations involved recognize each other as partners and, on a limited basis, coordinate activities and planning. The partnership usually has a short-term focus and involves one division or functional area within each organization. | Data exchange  
Joint distribution or line haul  
Backloading  
Purchasing/tendering group  
Maintenance group |
| Type II      | The organizations involved progress beyond coordination of activities to integration of activities. Although not expected to last "forever," the partnership has a long-term horizon. Multiple divisions and functions within the firm are involved in the partnership. | Synchronized planning  
Multimodal collaboration  
Warehouse/cross dock sharing |
| Type III     | The organizations share a significant level of integration. Each party views the other as an extension of their own firm. | Network integration  
Joint investments |
Typically no “end date” for the partnership exists.

TABLE 4: TYPES OF RELATIONSHIPS (LAMBERT ET AL., 1999)

In the context of this paper we consider all three types identified by Lambert et al. (1999) true examples of horizontal collaboration. We do focus however of initiatives that can potentially make a strong contribution to the efficiency goals in Europe discussed in the introduction to this paper. This almost necessarily will involve structural changes to networks of shippers and/or logistics service providers. Therefore, the focus will be on the type II and type III collaborations.

DIRECTION OF CONSOLIDATION

In their Future Supply Chain project, Cap Gemini and the Consumer Goods Forum argue that traditional bilateral supply chain relations are developing into new multi-lateral supply network relations. This was also discussed in the introduction of this paper. As such, a new integrated supply chain model is taking shape that takes into account sustainability, reduced energy consumption, better traceability and reduced traffic congestion, as well as traditional measures like on-shelf availability, cost reduction and financial performance. This poses stronger challenges for network actors in the form of multi-modal transport sharing; multi-retailer and multi-manufacturer distribution sharing. This is illustrated in Figure 9.

![Figure 9: Multi-modal Transport Sharing Initiative: AS-IS vs. TO-BE (Consumer Goods Forum, 2011)](image)

When looking from the transport view, the development depicted in Figure 9 can only be supported by reducing the number of relations in the overall supply network by means of transport bundling. From a high level, this is possible by doing either of the following three transport bundling strategies, which are illustrated in Figure 10. First, less than truckload (LTL) flows can be combined into one better utilized milkrun. Secondly, two LTL or preferable two full truckload (FTL) routes travelling in opposite directions can be glued together to reduce empty repositioning kilometers. And finally, LTL or FTL shipments travelling in the same direction can be combined into one long haul on a vehicle with a bigger capacity. Typically, this third form is concerned with a modal shift from road to either rail, inland waterways or shortsea shipping.
McKinsey (2010) present a segmentation of horizontal partnership by means of the governance or leadership that is observed within the collaboration. The types they identify are convened collaborations, primus inter pares collaborations and inter pares collaborations. Table 5 provides the pros and contras of each of these three setups.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| **Convened collaboration** | - No disclosure of confidential information to competitors (3PL acts as neutral intermediary)  
- Less effort for shipper in organizing and carrying out collaboration (clear governance of convener)  
- No laborious partner search |
| - Clear alignment on who is in charge to make collaboration successful  
- Potentially large gains for smaller shippers |
| **Primus inter pares collaboration** | - Potentially limited transparency on direct cost efficiency gains (closed book)  
- Additional financing of 3PL margin  
- Little opportunity to influence the collaboration model/governance |
| - Little opportunity for smaller shippers to influence the collaboration model  
- Potentially limited transparency on improvements and no guarantee for "small" shipper to capture the full benefit  
- High dependency on "primus" |
for all smaller shippers to make collaboration work
- Disclosure of potentially confident information to partners
- Calls for relatively high expertise on bundling and implementation of collaborations
- Buildup of proper governance requires substantial resources

TABLE 5 LEADERSHIP COLLABORATION TYPOLOGY (MCKINSEY, 2010)

SCOPE AND INTENSITY

Zinn and Parasuraman (1997) state that “strategic alliances are at the forefront of current management practice” and that “in these alliances, buyers, sellers, and third-party service providers in the distribution channel engage in business relationships designed to reduce the joint cost of two or more firms”. Furthermore, they mention that “extant logistics literature lacks any general conceptual classification to guide potential strategic-alliance partners as to the nature and range of services that should be incorporated into the alliance”. To remedy this they propose a typology that classifies logistics-based strategic alliances along two dimensions, 1) scope (broad versus narrow), and 2) intensity (high versus low). This typology can be found below in Figure 11.

FIGURE 11: TYPOLOGY OF LOGISTICS-BASED STRATEGIC ALLIANCES (ZINN AND PARASURAMAN, 1997)

In this typology scope is defined as “the range of services to be included in the alliance” and intensity as “the extent of direct involvement between partners” (Zinn and Parasuramen, 1997). Using this typology a logistics-based strategic alliance can be categorized, with increasing
commitment, as 1) limited collaboration, 2) focused collaboration, 3) extensive collaboration, and 4) integrated collaboration.

SCOPE, COMPETITION, COMBINED ASSETS AND OBJECTIVES

Another typology of horizontal collaboration is given by Cruijssen (2006) and is designed especially for horizontal collaboration in practice. It classifies horizontal collaboration in practice using four different dimensions, being 1) Decision level (operational, tactical or strategic), 2) Competition (competitive or non-competitive), 3) Combined Assets (orders, logistics facilities, rolling stock, market power, supporting processes, and/or expertise), and 4) Objectives (cost reduction, growth, innovation, quick response, and/or social relevance). Below we discuss the elements of this typology and present it graphically in Figure 12.

OPERATIONAL/TACTICAL/STRATEGIC
Operational collaboration relates to the daily operations within the logistics company. It is mainly practical in nature and can be described as “joint execution” or “sharing operational information”. Tactical collaboration relates to achieving mid-term objectives and involves more intensive planning and more substantial investments. Tactical collaboration can be described as “joint organizing”, “servicing a market together” and “sharing logistic resources”. Strategic collaboration is aimed at achieving long-term company objectives. It is characterized by intensive planning and is closely related to the mission statement, core activities and core competences of the company. In most cases of horizontal collaboration we observe in practice, strategic collaboration cannot be achieved without preceding collaboration at the tactical level. Similarly, tactical collaboration seems to require a well-established collaboration at the operational level.

COMPETITORS/NON-COMPETITORS
The second dimension concerns competition. Horizontal logistics collaboration can either be competitive or non-competitive. Non-competitive horizontal collaboration occurs when collaborators that are not active in the same market work together. If the partners are servicing the same industries, they are direct competitors and the collaboration is referred to as competitive horizontal collaboration.

In competitive horizontal collaborations, Hingley et al. (2011) show that specific barriers are created by power plays among competitors, thereby inhibiting horizontal collaboration regardless of cost or other benefits. They found that fierce competition among major grocery chains means that most are unwilling to even participate in studies of their systems, since the results could benefit their competitors. Also, many legal barriers can be avoided if a complementary partner is selected from a different industry. Therefore, when the synergies are comparable, non-competitive collaboration can be preferred over competitive collaboration.
**COMBINED ASSETS**

All collaboration projects are based on the sharing of some kind of assets. The following six groups of assets that can be combined to the benefit of all participants: 1) orders, 2) logistics facilities, 4) vehicle fleet, 5) market power, 6) supporting processes and 7) expertise. The extent to which partnerships are aimed at combining these assets is the basis of the third dimension of the classification.

**OBJECTIVES**

The last dimension for horizontal collaboration in the typology of Cruijssen (2006) is based on the objectives of horizontal collaboration, see Table 6. Over the last years since 2006, a number of additional objectives have emerged in the transport industry, notably supply chain security, supply chain robustness, and reduced carbon footprints. It would we useful to extend the typology of Cruijssen (2006) with these and possibly more elements.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost reduction</td>
<td>The most frequent objective of horizontal collaboration is cost reduction, either in core or non-core activities. Most short-term collaboration initiatives from practice have cost reduction as their primary goal.</td>
</tr>
<tr>
<td>Growth</td>
<td>Through collaboration, especially logistics service providers can establish financial growth (increased turnover or profit) or geographically extend their coverage by combining the networks of all partners. Moreover, the bundled forces make it possible to tender on large contracts that are normally only reserved for the bigger players.</td>
</tr>
<tr>
<td>Innovation</td>
<td>Innovative service concepts, the introduction of new systems and technology (e.g., RF tags) and inter-organizational learning can increase the quality of the services offered by cooperating LSPs. The new concepts or technology will in many cases be too labor- or capital intensive to be introduced by a single company.</td>
</tr>
<tr>
<td>Information and quick response</td>
<td>In an economy that is enabled by information flows, obtaining the most accurate and real time information offers the key to a worldwide competitive advantage. Technological progress in information and communication technology supports cheap and efficient communication between the partners in a network. Besides through best-in-class ICT capabilities, response times can also be shortened by introducing innovative cooperative logistics concepts or by benefiting from partners’ distribution or storage networks. For example, courier companies may exchange orders to cut lead times to levels that would be impossible to achieve individually.</td>
</tr>
<tr>
<td>Social relevance</td>
<td>Horizontal collaboration can be an effective way to achieve a higher capacity utilization by exchanging loads and equipment between the geographically dispersed partners. Load exchanges, central planning, shared distribution centers etc. all increase the efficiency of road transport and are a potential remedy for the increased transport demand. Through horizontal collaboration, the increase in ton-kilometers can be kept under control, even when modal shift is impossible.</td>
</tr>
</tbody>
</table>

**TABLE 6 OBJECTIVES OF HORIZONTAL COLLABORATION**
The four dimensions developed in this section allow the construction of a classification aimed at situating different forms of horizontal collaboration and supporting potential partners in choosing a form of collaboration based on their specific needs. This classification is summarized in Figure 12. For a detailed description of each of these concepts, we refer to Verstrepen (2005). They have rated the dimensions for every horizontal collaboration initiative based on interviews with industry experts and their own insights. These assessments are intended to serve as a starting point to set up a partnership, which needs to be complemented by personal and situation-specific needs of the parties involved.

FIGURE 12: TYPOLOGY OF HORIZONTAL COLLABORATION FORMS IN PRACTICE (VERSTREPEN ET AL., 2005)

CARRIER AND/OR SHIPPER

Collaboration can take place between shippers, between carriers or between multiple carriers and multiple shippers. Most literature though has focused on active collaboration between carriers. Collaboration between shippers is a more recent phenomenon, but quickly gaining momentum. In a sense, as Agarwal et al. (2009) argue, LTL carrier operations might even be considered as an implicit collaboration among shippers. In collaboration terms however, shippers are taking active control to consolidate their flows and offer them to LSPs in a bundled manner.

FIGURE 13: COLLABORATION BETWEEN SHIPPERS AND/OR LSPS

The three generic setups for collaboration between either carriers or shippers are depicted in Figure 13. First, collaboration can take place between shippers exclusively. An example of this is a purchasing group where the transport flows of multiple shippers are outsourced to one single
carrier company. Secondly, LSPs can join forces to make use of each others’ networks to improve efficiency and avoid empty running. This is the most frequently studied case in literature (see for example Cruijssen et al., 2007b).

The best setup however is the case where a group of both LSPs and shippers work actively together. Although arguably more difficult to organize and maintain, such a collaboration offers most opportunities to improve efficiency. Transport orders of shippers can be synchronized over time, based on the best available transport option within the set of LSPs. The pre-existing networks and (multimodal) fleet of the LSPs are different and will have different cost structures. As a result, the price charged for a transport lane of a specific shipper will vary across the LSPs, because the value of that lanes differs for each of LSPs, depending on how it matches with each one’s existing workload (cf. Agarwal et al., 2009). In a network collaboration setting, both the individual shippers and the collaborative group as a whole have more than one option to choose from for their transport requirements. To make this choice however, we need a new function that oversees the complete network of shippers and LSPs. We call this function a trustee, and will elaborate on it later in this paper.

**NUMBER OF PARTNERS**

The last defining dimension for horizontal collaboration is the number of parties that are involved. As a general rule of thumb, adding more partners will increase the operational synergy, for example in terms of the number of ton-kilometers that can be avoided. Simultaneously however, the coordination costs will increase if the number of partners increases. It is still an open research problem what the optimal number of partners is or how this can even be tested or evaluated. The biggest consortium in the context of horizontal collaboration as we understand it in this paper, has been described by Frisk (2010). Concerning the number of partners they state that it is very unusual that as many as eight companies together analyze the potential savings of co-operating within transport planning.

As the number of partners grows, also the number of potential contact points increases. This introduces also the ideas behind reducing the number of active contact points so that they can be better managed and the segmentation of relationships to determine different levels of collaborative action (Ritter et al., 2004). This can be established by means of a trustee.

**DISCUSSION**

In this section we have introduced a number of typologies for horizontal collaboration available in literature. These typologies are based on many dimensions, each having its own importance: direction of consolidation, leadership, level of intensity, scope, competition, combined assets and objectives, collaboration of shippers and/or carriers, and the number of partners.
The overview in this section offers the most important aspects of horizontal collaboration. These can be used in creating order in the sometimes still diffuse world of logistics collaboration. In the next section we continue with a discussion of one specific element of the typology, i.e. the goals or opportunities of horizontal collaboration. In the same section also the impediments for successful long term implementation are discussed.
OPPORTUNITIES AND IMPEDIMENTS

Important aspects of horizontal collaborations are the opportunities that they are aimed at and the impediments that have to be passed before the collaboration develops into a success. In this chapter we discuss two empirical studies on these opportunities and impediments. The first study was conducted by Cruijssen et al. (2007a) and was based on survey in Belgium. Secondly, the results of the survey by Eye for Transport (2010) are presented that are based on views of a wide range of knowledgeable practitioners from the logistics industry.

OPPORTUNITIES

Bartlett and Ghoshal (2004) mention three high-level ways in which companies can benefit from cooperation. They can do so by 1) pooling their resources and concentrating on core-activities, by 2) sharing and leveraging the specific strengths and capabilities of the other participating firms, and by 3) trading different or complementary resources to achieve mutual gains and eliminate the high cost of duplication. For a complete overview of the potential opportunities of horizontal cooperation, we refer to Cruijssen et al. (2007a, 2007b). The seven specific propositions formulated based on this overview are subdivided in three groups: Costs and productivity, Customer Service and Market position. They are summarized in Table 7.

<table>
<thead>
<tr>
<th>Code</th>
<th>Proposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>O1</td>
<td>Horizontal collaboration increases the company’s productivity for core activities, e.g. decrease in empty hauling, better usage of storage facilities etc.</td>
</tr>
<tr>
<td>O2</td>
<td>Horizontal collaboration reduces the costs of non-core activities, e.g. organizing safety trainings, joint fuel facilities, etc.</td>
</tr>
<tr>
<td>O3</td>
<td>Horizontal collaboration reduces purchasing costs, e.g. trucks, onboard computers, fuel etc.</td>
</tr>
<tr>
<td>O4</td>
<td>LSPs can specialise while at the same time broadening their services.</td>
</tr>
<tr>
<td>O5</td>
<td>LSPs can offer better quality of service at lower costs, e.g. in terms of speed, frequency of deliveries, geographical coverage, reliability of delivery times etc.</td>
</tr>
<tr>
<td>O6</td>
<td>Horizontal collaboration enables individual LSPs to tender with large shippers on larger contracts.</td>
</tr>
<tr>
<td>O7</td>
<td>Horizontal collaboration helps to protect the company’s market share.</td>
</tr>
</tbody>
</table>

TABLE 7: PROPOSITIONS ON OPPORTUNITIES OF HORIZONTAL COLLABORATION (CRUIJSSEN ET AL., 2007A)

The BelFirst database, containing the annual reports of 250,000 companies in Belgium, was used to construct a representative sample of around 1,500 LSPs, with NaceBel main activity codes: Freight transport by road, Inland water transport, Cargo handling and storage, Freight forwarding and Courier activities other than national post activities. 154 companies responded
and evaluated each proposition by choosing one of the following options: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, (5) strongly agree. The results are displayed in Table 8.

<table>
<thead>
<tr>
<th>Code</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>No. of Obs. (1-5)</th>
<th>Missing (%)</th>
<th>Strongly disagree/ Disagree (%)</th>
<th>Neutral (%)</th>
<th>Strongly agree/ Agree (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>O1</td>
<td>4.17</td>
<td>0.99</td>
<td>152</td>
<td>6.2</td>
<td>4.9</td>
<td>13.0</td>
<td>75.9</td>
</tr>
<tr>
<td>O2</td>
<td>3.65</td>
<td>1.00</td>
<td>152</td>
<td>6.2</td>
<td>8.0</td>
<td>33.3</td>
<td>52.5</td>
</tr>
<tr>
<td>O3</td>
<td>3.42</td>
<td>1.13</td>
<td>152</td>
<td>6.2</td>
<td>16.7</td>
<td>35.2</td>
<td>42.0</td>
</tr>
<tr>
<td>O4</td>
<td>3.74</td>
<td>1.08</td>
<td>152</td>
<td>6.2</td>
<td>9.9</td>
<td>25.3</td>
<td>58.6</td>
</tr>
<tr>
<td>O5</td>
<td>3.56</td>
<td>1.10</td>
<td>151</td>
<td>6.8</td>
<td>10.5</td>
<td>34.0</td>
<td>48.8</td>
</tr>
<tr>
<td>O6</td>
<td>3.60</td>
<td>1.12</td>
<td>152</td>
<td>6.2</td>
<td>13.6</td>
<td>29.0</td>
<td>51.2</td>
</tr>
<tr>
<td>O7</td>
<td>3.24</td>
<td>1.08</td>
<td>152</td>
<td>6.2</td>
<td>19.1</td>
<td>41.4</td>
<td>33.3</td>
</tr>
</tbody>
</table>

**TABLE 8: EVALUATIONS OF PROPOSITIONS ON OPPORTUNITIES (CRUIJSSEN ET AL., 2007A)**

The numbers in Table 8 indicate that the most supported opportunity of collaboration is the possible increase in a company’s productivity on its core activities (O1). More than 75% of the respondents of the survey agrees with proposition O1, while less than 5% disagrees. The in-depth interviews revealed that decreases in empty mileage, better usage of storage facilities and increased load factors are the most common examples.

A large share of the respondents is neutral about the proposition that horizontal collaboration helps to protect market share (O7). Collaboration between LSPs is only encouraged by shippers if it brings the shippers significant cost reductions and as long as it does not jeopardize their negotiating position. This, together with the neutral evaluation of proposition O7, suggests that horizontal collaboration in logistics should be regarded as a means to increase productivity, rather than as a reaction to requests from the demand side.

A comparable study was conducted by Eye for transport (2010). This survey used “responses solicited by targeted e-mail lists, select trade association memberships, various related-industry databases and other targeted methods. The majority of respondents were key figures, representing major companies.” A list of opportunities of horizontal collaboration was provided to the respondents to be rated in a similar way as in Cruijssen et al. (2007a). The results are presented in Figure 14.
The results are well in line with the Cruijssen et al. (2007a). The most important opportunity is a reduction of operational cost, here split into two categories, transport and distribution. Maybe the most striking observation is that respondents do not consider modal shift enabling an opportunity for horizontal collaboration.

**Impediments**

When compared to the possible opportunities, literature pays little attention to the impediments for logistics cooperation (Zineldin and Bredenlöw, 2003). A typical risk is for example opportunistic behavior of the partners i.e., actions by a partner that do not comply with the spirit of the cooperation (Das and Teng, 1998). A more elaborate list of impediments can be found in Table 9 based on Cruijssen et al. (2007b). It gives the specific propositions that were tested in the questionnaire relating to impediments in four areas: Partner selection, Determining and dividing the gains, Unequal negotiation positions of partners, and Information and Communication Technology. Table 10 then provides the results.

<table>
<thead>
<tr>
<th>Code</th>
<th>Proposition</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1</td>
<td>It is hard to find commensurable LSPs with whom it is possible to collaborate for (non-)core activities.</td>
</tr>
<tr>
<td>I2</td>
<td>It is hard to find a reliable party that can coordinate the collaboration in such a way that all participants are satisfied.</td>
</tr>
</tbody>
</table>

**Determining and Dividing the Gains**
It is hard for the partners to determine the benefits or operational savings of horizontal collaboration beforehand.

Partners find it hard to ensure a fair allocation of the shared workload in advance.

A fair allocation of benefits to all the partners is essential for a successful collaboration.

Unequal Negotiation Positions of Partners

When an LSP collaborates with commensurable companies, it becomes harder to distinguish itself.

Over time smaller companies in the collaboration may lose customers or get pushed out of the market completely.

When benefits cannot be shared in a perceived fair way, the larger players will always benefit most.

Information and Communication Technology (ICT)

Collaboration is greatly hampered by the required indispensable ICT-investments.

According to the respondents the most severe impediments for collaboration are the problems of finding a reliable party that can coordinate the collaboration in such a way that all participants are satisfied (I2) and the construction of fair allocation mechanisms for the attained savings (I5). Both these topics will be further discussed in the tools and technology section. The impediment that received the least support concerns the required ICT-investments (I9). The in-depth interviews affirmed that ICT costs are only an issue for collaborations of a medium size and intensity. The administrative burden of handling the transactions of the collaboration may be too large to handle by phone or fax, but cannot justify investments in an Electronic Data Interchange (EDI) system or a sophisticated web-based exchange system because the collaboration lacks the critical mass.

The study by Eye for Transport (2010) paints a somewhat different image. The most important impediment found there is the fear of sharing information with competitors, see Figure 15. Following that, there is a group of impediments that have to do with finding trustworthy partners to collaborate with. Indeed these are important aspects that will also be treated in the tools and technology section later in this paper. They can be approached by getting a comprehensive legal and contractual framework in place and by have a clear approach for partner selection.
Besides these two empirical studies, there are a number of authors that provide a list of opportunities and/or impediments for horizontal collaborations based on analysis and industry feedback, but without testing it on a wide scale with a questionnaire. For example, 't Hooft et al. (2010) put forward that the main obstacles on the road towards horizontal logistics collaboration or bundling are a lack of:

- A solid economic framework
- Guidelines for partner analysis and selection
- Project methodology / roadmap
- First movers willing to take the risk
- A legal framework and standard contracts
- Proper supporting technologies and information systems
- Management KPI’s / transparent reporting
- An impartial referee
- Accepted mechanisms for fair gain sharing
- Government measures and incentives
- A holistic vision combining all the above

In the next section we will discuss a practical framework for developing horizontal collaboration projects, in an attempt to solve (part of) the last impediment, the lack of a holistic vision combining all efforts to get to a horizontal collaboration. After that, the tools and technology section describes practical ways to quantify various open issues about collaboration, thereby
providing a viable approach to surmount some of the most prominently mentioned impediments, such as gain sharing, partner selection, and (the lack of) a legal framework.
DEVELOPMENT PROCESS

Despite the quite obvious cost and service improvement opportunities, still not many horizontal collaboration projects can be observed in practice. That is not an accident. Horizontal collaborations are intrinsically more difficult to manage than the classical vertical collaborations, since they lack the usual authoritative power of one of the parties in the value chain. Issues such as trust, mutual understanding, long term visions giving and taking etc are keywords for horizontal collaboration and are quite fragile by nature. Even projects with very positive business case will fail if they are not founded on a strong enough level of trust among the partners or if it is not managed completely correctly.

Even in a trustworthy relationship, the risk of opportunism remains real (Tomkins, 2001). Possibly due to the complexity and uncertainty in building horizontal partnerships, the set-up of cooperative relationships seldom occurs in a structured way, nor do they live a long life. This section provides support to companies wishing to collaborate horizontally with a conceptual framework for setting up and maintaining horizontal collaboration. In addition, this conceptual framework offers a four-step approach leading towards horizontal collaboration. A go/no go decision between each of the phases will determine whether the step to the next stage can be safely taken. The four subsequent stages are: Strategic positioning, Design, Implementation and Moderation. The subsections below discuss each stage, as it was developed by (Verstrepen et al., 2005). It is one of the goals of the CO3 project, notably WP3 on the business models, to further work out this model.

**FIGURE 16A STAGE-WISE APPROACH TOWARDS HORIZONTAL COLLABORATION**

**STRATEGIC POSITIONING**

At the stage of ‘Strategic Positioning’, a company becomes aware of the need to collaborate and starts to explore his basic objectives. This phase is not characterized by an unambiguous starting
point but is rather a process of gradually increasing awareness and trust (Lane and Backmann, 1998). Together, the four dimensions of the classification from Cruijssen (2006) define the collaboration, so the phase of strategic positioning fills in these four dimensions. After having gone through the phase of strategic positioning, a company knows what it can expect from collaboration (motives), how it can benefit from the partnership (objectives), whether it wants to collaborate with direct competitors or not (competition) and whether the collaboration will take place at the strategic, tactical or operational level (intensity). When strategic positioning is completed, and when it has resulted in an intent to collaborate with two or more other LSPs, the collaboration can evolve towards the second phase: the design phase.

**DESIGN**

In this phase there are four important hurdles to take: 1) identify the right partner(s), 2) negotiate about the business and financial conditions of the collaboration, 3) define strategy and vision of the collaboration, and 4) choose the shape of the collaboration. Table 11 discusses these hurdles.

<table>
<thead>
<tr>
<th>Design hurdles</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partner selection</td>
<td>Collaboration between competing companies is interesting from an organizational point of view when their strengths and weaknesses are complementary (the two services increase each other’s quality, e.g., an intermodal group offers both cheap but slow service via rail/water and fast but expensive service via road) or supplementary (making a certain service ‘bigger’, e.g. a partnership between road transporters to build a pan-European network). Both the hard, measurable aspects (related to business economics and strategic fit) and soft, company cultural aspects (related to trust and cultural fit) need to be considered. In order to limit the danger of dominance, it is advisable to choose partners of approximately the same size and market power.</td>
</tr>
<tr>
<td>Financial condition</td>
<td>Horizontal logistics collaboration can only function properly when a mechanism is in place that permits the parties involved to share both the costs and the benefits and the activities in a balanced way. The negotiation process should result in a win-win situation. Fierce negotiations with little value to be shared cannot support the collaboration for a longer period. A positive attitude during the negotiations will have an important impact on the negotiation strategy and the monetary valuation of the contribution and benefits of the collaboration. For a detailed discussion of gain sharing, please refer to the tools and technology section.</td>
</tr>
<tr>
<td>Strategy and vision</td>
<td>Developing and implementing a clear strategy and vision is of vital importance for a sound cooperative relationship. This strategy at least contains a general description of the horizon of the collaboration, the objectives and the reach of the partners.</td>
</tr>
<tr>
<td>Shape of collaboration</td>
<td>Once the cooperating parties are convinced that all conditions for collaboration have been fulfilled, they can start to select the appropriate format for the collaboration. Based on the drivers and objectives identified, the most appropriate format of the collaboration can be selected.</td>
</tr>
</tbody>
</table>
IMPLEMENTATION

The third phase of the development process is the implementation of the collaboration project. At this point, two tasks have to be fulfilled: a contract needs to be set up, and the ICT landscapes need to be mapped so that they can be adjusted and integrated. For the contractual point, we refer to the description of legal aspects in the tools and technology section. Industry interviews indicated that ICT is mainly a problem for horizontal collaborations of medium intensity. Light forms of horizontal collaboration do not require specific ICT investments, while high intensity initiatives have enough financial room to absorb the required ICT investments (Cruijssen et al., 2005).

MODERATION

The final stage of the successful creation of a horizontal partnership lies in moderating the collaboration. Again, two features can be distinguished: the management and control of the processes and the strategy towards growth of the partnership.

For efficient management and control processes, the parties involved need to agree on a set of appropriate Key Performance Indicators (KPIs). These KPIs need to be monitored and a management feedback mechanism should enable their periodic follow-up. The KPIs give an indication of the success and therefore also of the viability of the relationship. Because of their ability to affect mutual trust, tensions and conflicts can have a bad influence on the durability of the collaboration. It is almost impossible to exclude conflicts of collaboration completely, but it is possible to protect the partners against them or to reduce their frequency by implementing certain rules and control mechanisms. This can be accomplished for example by organizing regular face-to-face meetings, preparing written minutes of all meetings and agreements between the cooperating parties, making sure that a trustee (see roles and responsibilities) is in place.

Mostly, the full advantages of horizontal collaboration will only be realized after a number of attempts. It is advisable that inexperienced companies start with a ‘light’ form of horizontal collaboration that they can extend gradually when they get to know their partner(s) better and some successes and confidence have been achieved. If results have been positive for a longer period of time, the management and staff of the cooperating companies will get to know each other better and the level of trust will increase. The increased commitment of all partners facilitates putting more resources at the disposal of the collaboration.

CRITICAL SUCCESS FACTORS
Van der Ham et al. (2005) also provide a development process for shippers' collaboration. In this guidebook they also presented a roadmap to get from an improvement concept to an actual realization. This roadmap can be found below in Figure 17. It describes the project from idea, to collaboration plan, to feasibility study, to pilot, to collaboration on a daily basis.

![Diagram of the development process](image)

**FIGURE 17 HIGH LEVEL PROCESS MAP (VAN DER HAM, 2005)**

In addition, Van der Ham (2005) identified the following critical success factors:

- Look beyond cost reductions
- Carefully select the flows to be consolidated
- Try to find non-competitors as partners
- Make sure there is a fair gain sharing mechanism
- Start with a small group of partners
- Define clear rules of engagement
- Align the information flows
- Focus on mutual benefits and incentives
- Invest in the personal fit between key players at the partnering companies
- Allow the partnership some time to develop
We will look at these elements more closely in the section on the supporting tools and technologies for collaboration.

**DISCUSSION**

Multiple frameworks and development process maps for collaboration exist in literature. Two of these were introduced in this section. The CO3 project will work on defining the most practical and usable one. Key is that a collaboration project develops along a well-structured process. Experience shows that successful collaboration is not a matter of chance but rather of careful organization. In the next section we visit the roles and responsibilities of the active players in logistics collaboration.
ROLES AND RESPONSIBILITIES

Collaboration by definition takes place between various entities, all of which will have a specific role and responsibility in a supply chain or the logistics industry in general, or in a collaboration in particular. Here we discuss the main actor types and the role they play in a collaboration project. They are: shippers, logistics service providers, 4PLs, trustees, governments, industry organizations and knowledge institutes.

SHIPPER

A shipper (or consignor, exporter, or seller, who may be the same or different parties) is the company that is responsible for initiating a shipment, and who may also bear the freight cost in the end. Typically, these players have most power and control in the supply chain and are looking for ways to improve their cost levels, service capabilities or environmental footprint.

LOGISTIC SERVICE PROVIDER/3PL

According to Chopra and Meindl (2010) Logistics service providers or 3PLs perform "one or more of the logistics activities relating to the flow of product, information, and funds that could be performed by the firm itself". Examples of services that these providers offer, other than the traditional carrier companies are the tendering of transport orders, contract management, customer returns, consolidation etc. Although 3PL providers normally arrange the fulfillment of transport orders given to them by shippers, they do not necessarily own their own fleet. Based on Hingley et al. (2011), it can be said that LSPs are typically reluctant to actively contribute to and build on horizontal collaboration between shippers.

4PL

An LSP is called a 4PL provider when it provides coordination services but does not execute any of the activities themselves. However, a 4PL provider is more than that. Anderson Consulting (now Accenture) defined a 4PL as “an integrator that assembles the resources, capabilities and technology of its own organization and other organizations to design, build and run comprehensive supply chain solutions”. Christopher (1998) defines a 4PL role via four key functions:
1. Systems architecture and integration skills.
2. A supply chain control room.
3. The ability to capture and utilize information and knowledge across the network.

For a discussion of a 4PL application in the UK grocery supply chain, we refer to Hingley et al. (2011). They developed the chart in Figure 18 that proposes the most suitable type of logistics service providers to manage a collaboration project based on two dimensions being the complexity and the intensity of the collaboration. They state that as the collaborative complexity increases, a relational 3PL arrangement may be most appropriate. If there is high intensity, a 4PL arrangement may be appropriate such that the provider operates the collaboration on an arm’s-length basis for the customer. In a project with a complex collaboration setup and intensity, a specialist or consultant is required. This role can be taken up by a trustee, which will be discussed hereafter.

![Figure 18: A Collaboration Typology (Hingley et al., 2011)](Image)

**FIGURE 18 A COLLABORATION TYPOLOGY (HINGLEY ET AL., 2011)**

**TRUSTEE**

In academic literature, it is still an open question what type of organization in a collaboration should collect sensitive information about supply, demand and costs and perform the collaborative planning. Frisk et al. (2010) state that they believe that there needs to be an independent organization to carry out and suggest wood bartering. We refer to such a function as a trustee, or alternatively, a Transport Network Manager, as Pedersen (2012) calls it. Closely linked to the idea of a trustee is the concept of a logistics control tower. In this paper we treat these two phenomena as being one and the same, in other words: the logistics control tower is operated by a trustee.

A trustee is a fairly new concept in logistics and not much can be found in literature about the specific role of a trustee in horizontal collaboration. Nonetheless, a trustee can be very beneficial and important when setting up collaboration. For example in the startup phase providing...
information to the other participants could be undesirable, especially when participating companies are competitors. A trustee can solve this issue. In this situation, all the information would be sent to the trustee, which can then determine whether there is a positive business case or not. In this way the company specific information of the participating companies is not available to all the other participants, but only to the trustee. In the context of horizontal collaboration in transport and logistics, the trustee function (usually executed by a specialized consultant, but this can also be a lawyer, an industry group or a trade association) is responsible for collecting and analyzing data and for the management of the collaboration between a number of different shippers, logistic service providers and/or horizontal communities.

**Offline and Online Support**

Typically, there are two separate types of collaboration support activities carried out by a trustee. We categorize these types as ‘offline’ and ‘online’ activities. The offline function requires the trustee to play an external, supporting role and as such will not take part in the day-to-day operations, activities or processes of the collaboration. The online function in turn requires a trustee to be a pivotal actor in the horizontal community and to be responsible for the harmonious organization of daily processes, activities and operations. These two separate tasks may require that the trustee function is actually divided over two separate legal entities. This also makes it possible to employ two different business models for the two trustee functions. It is regarded logical that the offline services are charged on a consultancy basis, while the online services can be paid for by transferring for example a percentage of the synergy savings to the trustee.

The main keywords for both the online and the offline functions of a trustee are neutrality, transparency and safeguarded confidentiality of data provided. These can never be compromised in any of the tasks performed by the trustee. In particular, these three elements distinguishes a trustee from a 4PL. The main concrete tasks of a trustee are listed in Table 12, categorized in the online and offline functions.

<table>
<thead>
<tr>
<th>Online functions</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triple bottom line</td>
<td>A trustee should manage the collaboration from the perspective of the company-specific objectives of the partners, and make sure that a close eye is kept on the balance between the cost focus, service improvements and emission levels, i.e. the <em>triple bottom line</em>.</td>
</tr>
<tr>
<td>Loads combination</td>
<td>The success of collaboration is partly attributed to being able to efficiently handle the small but frequent loads required for lean production, thus supporting reduced inventory levels especially at customers. From a supply chain efficiency perspective a trustee should be able to fully support a company’s drive to reduce inventory and work to a tighter just in time system shipping regular small quantities on fairly tight lead times (Mason et al., 2007). The trustee must keep these small shipments cost effective by combining them into bigger consolidated shipments.</td>
</tr>
<tr>
<td>Prioritization</td>
<td>The trustee should be completely neutral in its handling and prioritization of jobs coming from the various partners. It must do so according to decision rules that were formulated in the setup phase of</td>
</tr>
</tbody>
</table>
the collaboration, and ideally are formalized in the contract.

### Synchronization
The trustee is responsible for maximization the possibilities of order synchronization. It must act a signaling function that makes shippers aware that cost reduction through bundling can be achieved if some of their shipments are somewhat delayed or released earlier.

### Contact person
The trustee is always available as a contact person for all collaborators, both for logistics service providers and shippers. It also provides a neutral platform and safe location for meetings, brainstorm and discussions.

### Interfaces
The trustee is responsible for the definition and implementation of interfaces between the IT systems of the various partners.

### Maximize gain
On a high level, the trustee is responsible to creating the maximum gains from the collaboration in whatever way allowed by the partners, for example by bundling or avoiding transport flows.

### Matching
The trustee makes sure that LSPs are selected that correctly match the transport needs of participating shippers.

### Improvement
The trustee is the mandated to continuously improve the community by making suggestions based on the realized consolidation results and their experiences in the partnership.

### Offline function

<table>
<thead>
<tr>
<th><strong>Explanation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Critical mass</strong></td>
</tr>
<tr>
<td><strong>Stability and fairness</strong></td>
</tr>
<tr>
<td><strong>Legal compliance</strong></td>
</tr>
<tr>
<td><strong>Entry and exit</strong></td>
</tr>
<tr>
<td><strong>Conflict resolution</strong></td>
</tr>
<tr>
<td><strong>Satisfaction</strong></td>
</tr>
<tr>
<td><strong>Confidentiality</strong></td>
</tr>
</tbody>
</table>

### Table 12

<table>
<thead>
<tr>
<th><strong>Function</strong></th>
<th><strong>Explanation</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Critical mass</strong></td>
<td>The trustee is always on a quest for the best transport flows and capacities to further extend and improve the collaboration. This involves new partner selection and the increase of the flows managed by the collaboration within the current group of participating companies.</td>
</tr>
<tr>
<td><strong>Stability and fairness</strong></td>
<td>The trustee safeguards stability of the collaboration by ensuring correct gain sharing.</td>
</tr>
<tr>
<td><strong>Legal compliance</strong></td>
<td>Trustee makes sure that the collaboration is fully legally compliant.</td>
</tr>
<tr>
<td><strong>Entry and exit</strong></td>
<td>By putting in place clear guidelines on for example volume bandwidths and entry rules, the trustee makes sure that the collaboration is flexible enough to cope with changes in the composition of its partners.</td>
</tr>
<tr>
<td><strong>Conflict resolution</strong></td>
<td>In cases of conflict, the trustee will be the first to act as a referee. For information on the conflict resolution function we refer to Wallenburg and Raue (2011).</td>
</tr>
<tr>
<td><strong>Satisfaction</strong></td>
<td>Though difficult to formalize, the trustee makes sure that all partners are satisfied with the course of the collaboration.</td>
</tr>
<tr>
<td><strong>Confidentiality</strong></td>
<td>The trustee prevents potential partners from having to share market related data directly with each other, which may be against national or EU competition law (see legal section under tools and technology).</td>
</tr>
</tbody>
</table>

With the trustee role we introduce a new type of collaboration, in between horizontal and lateral collaboration. It combines horizontal collaboration among multiple logistics service providers to reduce cost, optimize load factors and avoid empty running, with horizontal collaboration
between shippers that synchronize transport orders, allow flexibility in delivery windows or lead times and accept that transport is sometimes carried out by different logistics service providers. Because of the complexity of this combined collaboration, a trustee is needed to manage the relations and make sure that maximum benefit is achieved. And in fact a stable collaboration managed by a well-functioning trustee can make a significant contribution to improving efficiency levels and reducing the environmental footprint of road transport in Europe.

GOVERNMENTS

Governments have articulated policy goals such as reducing the number of ton-kilometers on roads, a reduction of emissions, less congestion, etc. Since these goals typically coincide with the goals of a collaborative transport project, governments can support collaborations for example by subsidizing the first development phases or by funding research and awareness programs. In the European Union, these can be municipal, regional, national or European measures.

INDUSTRY ORGANIZATIONS

Industry organizations can play a useful role in creating awareness among their specific industry members. Especially in the early phases of a collaboration project they can help to get the right companies and people around the table.

KNOWLEDGE INSTITUTES

Since horizontal collaboration is still a very young research field and practical evidence is quite scarce, knowledge about the topic has not yet been fully internalized in the logistics industry. Knowledge institutes can play an important role in helping collaborations that are starting up and in analyzing the results of early pilot studies to make them available to other academics and practitioners via conferences, publications, workshops etc.

Over the last years, a number of research programs and institutes have emerged that conduct research on logistics collaboration. Table 13 provides some example initiatives on this topic in Europe.
<table>
<thead>
<tr>
<th>Institute</th>
<th>Country</th>
<th>Brief description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dinalog</td>
<td>NL</td>
<td>The Dutch Institute for Advanced Logistics (Dinalog) was established to unroll the Research and Development Program for Logistics and Supply Chain Management. Dinalog will be the (physical and virtual) place where the private sector will collaborate with Centers of Excellence (the Universities) and where Post-Experience Education will be organized.</td>
</tr>
<tr>
<td>Swedish Logistics Forum</td>
<td>SE</td>
<td>The Logistics Forum is an advisory body serving both the Government and the Minister for Communications. It is composed of representatives for such sectors as goods owners, transport companies, universities and researchers.</td>
</tr>
<tr>
<td>Elupeg</td>
<td>GB</td>
<td>ELUPEG seeks to promote and facilitate horizontal collaboration by bringing together non-competing and even competing companies, massive improvements in asset utilization, carbon reductions, customer service and cost reductions are possible</td>
</tr>
<tr>
<td>CO3</td>
<td>Europe</td>
<td>The project aims to establish a business strategy to optimize logistics and transport operations by increasing load factors, reducing empty movements and stimulating co-modality through horizontal collaboration between industry partners.</td>
</tr>
</tbody>
</table>

**TABLE 13 KNOWLEDGE INSTITUTES FOCUSSING ON LOGISTICS COLLABORATION**

**DISCUSSION**

Figure 19 gives a graphical illustration of how the various roles discussed in this section work together to manage and operate a horizontal collaboration. The operational logistics tasks are performed by logistics service providers, shippers and 4PLs. The collaboration is then being managed by a trustee to make sure that it flourishes and is sustainable in the long run. Finally, knowledge institutes, industry organizations and governments play their role by actively supporting horizontal collaboration as a way to improve overall transport and logistics efficiency and to attain (policy) goals for the industry.
Having discussed the roles and responsibilities for collaboration in this section, we now turn to an overview of the available tools and technologies for supporting these initiatives.
TOOLS AND TECHNOLOGY

In order to make collaboration projects a success, a number of questions always need answering. On a high level, one can say that there are ‘hard’ and ‘soft’ questions to be answered. Firstly, an example of a hard question is: “How many yearly ton-kilometers can be avoided if shippers A, B and C bundle their distribution flows to region X?” Such a question can be answered by using appropriate operations research tools, capable of solving large scale and possibly NP hard optimization problems. Second, there are soft questions like: “How to make sure that the expectations that the participants in a collaborative transport project are the same or at least consistent with each other over time?” These questions must be answered by developing frameworks and processes for horizontal collaboration that are based on careful industry consultation and experiences from test projects. This section discusses the most important topics that a company has to consider when entering a horizontal logistics partnership, along with the tools and technologies that are available for each topic.

Agarwal et al. (2009) propose the following key generic questions that are to be answered for a horizontal collaboration:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business case</td>
<td>How does one assess the maximum potential benefit from collaborating?</td>
</tr>
<tr>
<td>Development</td>
<td>How should a membership mechanism be formed and what are the desired properties that such a mechanism should possess?</td>
</tr>
<tr>
<td>Gain sharing</td>
<td>How should the benefits achieved by collaborating be allocated among the members in a ‘fair’ way?</td>
</tr>
<tr>
<td>Entry and exit</td>
<td>How can potential new partners be evaluated and how do new products or services offered by the incumbent partners affect the collaboration?</td>
</tr>
</tbody>
</table>

**TABLE 14 KEY COLLABORATION QUESTIONS FOLLOWING AGARWAL ET AL. (2009)**

In addition to this, industry consultation has indicated that also the following questions are relevant for supporting collaboration projects in a good manner:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness</td>
<td>How can we raise enough awareness in the market so that promising new partners are attracted and the group of collaborators is well-functioning?</td>
</tr>
<tr>
<td>Data</td>
<td>Which data are needed to assess opportunities and make a business case for entering a collaboration?</td>
</tr>
<tr>
<td>Legal</td>
<td>What are the legal aspects needed to take into consideration?</td>
</tr>
<tr>
<td>Implementation</td>
<td>What are the operational implications of implementing a collaboration project?</td>
</tr>
<tr>
<td>Partner selection</td>
<td>How to make sure that a company finds a suitable partner to collaborate with?</td>
</tr>
</tbody>
</table>

**TABLE 15 ADDITIONAL COLLABORATION QUESTIONS BASED ON INDUSTRY CONSULTATION**
These main questions all require a generic and standardized approach. As far as currently available, the available standards, tools and frameworks are described one by one below.

**BUSINESS CASE**

A business case for collaboration will only be positive if enough *synergy* exists within a group of collaborating companies. Synergy can be defined as the difference between the total stand alone cost and the total cost of the collaboration. A sound business case naturally provides a good starting point for a project. The goal of the business case development phase is to develop a qualitative plan into a quantitative project proposal. This typically is being done by applying various operations research techniques. Dependent on the type of collaboration project, for example Strategic Network Design problems, Vehicle Routing problems, Collaborative Fleet scheduling problems, Inventory optimization, etc. can be formulated and solved by software tools available on the market. Such an analysis can then result in statements like the one in Frisk et al. (2010): “The result of the analysis shows that there is a lot of money to save, up to 14.2% of the transport cost. The transport cost for these companies is about 60 million Euros and the potential saving relates to more than 8 million Euros. Additionally, the environmental effects of better co-operation between the companies are very positive with about a 20% reduction of emissions from the trucks.”

From a business case calculation point of view typically there is no need to design separate optimization tools. In most cases, the business case for collaboration of N partners can be calculated by solving the a similar optimization problem N+1 times. N times for each of the individual partners and once for the group of collaborators together. The difference between the result of this latter calculation and the sum of the individual cases is the synergy, and defines the business case.

**DEVELOPMENT MECHANISM**

The next important tool is a clear framework for developing a collaboration from scratch to lasting success. Starting from a positive business case, the collaboration has to be formalized and intensified step by step. For a description of this process, we refer to the earlier section in this paper on the Development Process.
GAIN SHARING

One of the most important tasks in a logistics collaboration is to allocate the synergy estimated in the business case to the participating companies in the collaboration. Both industry consultation and academics show that having a gain sharing mechanism in place that is fair, also perceived by the partners as being fair, is crucial for the success of the collaboration. The importance of a fair distribution of expected and unexpected costs is stressed in Gibson et al. (2002). Mistrust about the fairness of the applied allocation rule for savings has caused many horizontal logistics collaboration initiatives between shippers, and/or LSPs to marginalize or disintegrate. For example, in Cruijssen et al. (2005) a survey on opportunities and impediments for horizontal collaboration is described. Respondents were asked to evaluate each opportunity and impediment by choosing one of the following options: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, (5) strongly agree. The statement that a fair gain sharing mechanism is essential for success was endorsed most, with an average score of 4.11.

Therefore, there is a clear need for a well-defined, fair and understandable formula that collaborators can apply in practical projects. As Agarwal et al. (2009) state, this formula should be attractive both centrally, i.e. for the group, and individually, i.e. for every single participating company. This is not straightforward as individual decision makers, though often working towards a common objective, will always be guided by their own self interest in the end.

PROPORTIONAL RULES

In practical cases of collaboration among LSPs and/or shippers, many allocation rules can be observed. Most often these are simple rules of thumb that distribute savings proportionally to a single indicator of either size or contribution to the synergy. Some examples are:

- Proportional to the total load shipped
- Proportional to the number of customers served
- Proportional to the logistics costs before the collaboration
- Proportional to the distance travelled for each shipper’s orders
- Proportional to the number of orders
- Proportional to the number of drop-off points
- Proportional to the turnover of the collaborators
- Equal split
- Etc.

Because these rules are easy and transparent and since each embodies a construct that arguably represents, the importance of an individual partner 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 become 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 of each participant, a certain partner who delivers a large number of
drop points in a small geographical region will get a large share of the benefits, while his de facto contribution to the attained synergy is negligible if the other participants serve only few drop points in this area (Cruijssen et al., 2010a).

This shortcoming of proportional rules is also shown by Ozener (2008), when they state that the often-used proportional allocation rules have several drawbacks, particularly in terms of stability. For example, proportional methods may allocate a subgroup of participants more than the subgroup’s individual cost. The reason for this is that a proportional cost allocation ignores the synergies between transport needs of the shippers. With computational experiments on real-world instances they reveal that these excess charges correspond to 25% of the subgroup’s individual cost on average. Therefore, using such a cost allocation method may in the end result in a break-up of the collaboration.

Instead, to ensure a fair gain sharing mechanism, the marginal contributions of each LSP to the total gain have to be accurately quantified. These can then be allocated by means of concepts from cooperative game theory (Cruijssen, 2006), which is discussed hereafter. Also, some lessons can be learned from other transport modes, for example for a discussion on revenue sharing in the airline industry, we refer to Hu et al. (2010).

**GAME THEORETICAL RULES**

Instead of using practical rules of thumb, we propose to employ solution procedures from cooperative game theory. Cooperative game theory is a branch of mathematics that studies the negotiation process within a group of cooperating agents (in this case shippers) and allocates the generated savings. This field has proved capable of solving fairness issues in many fields. Myerson (1991) defined game theory as “the study of mathematical models of conflict and collaboration between intelligent and rational decision-makers. Game theory provides general mathematical techniques for analyzing situations in which two or more individuals make decisions that will influence one another’s welfare”.

Cooperative game theory focuses on cooperative behavior by analyzing and simulating the negotiation process within a group of shippers in establishing a contract or joint plan of activities, including an allocation of collaboratively generated revenues or collaboratively avoided cost. In particular, the possible levels of collaboration and the revenues of each possible coalition (a subgroup of the shippers’ consortium) are taken into account so as to allow for a better comparison of each shipper’s role and impact within the group as a whole. In this way, shippers in a coalition can settle on a compromise allocation in an objectively justifiable way, moderated by a trustee (see Section on roles and responsibilities).

Before we can discuss some game theoretical gain sharing mechanisms, we shortly introduce some basic terminology from cooperative game theory.

Let $N$ be a finite set of shippers and denote by $2^N$ the collection of all subsets of $N$. Elements of $2^N$ are called coalitions, $N$ is referred to as the grand coalition. The cost savings that a coalition $S$ can jointly generate without the shippers in $N \setminus S$ is called the value of coalition $S$. The values of all coalitions $S$ are captured in the so-called characteristic function $\nu: 2^N \to \mathbb{R}$. The marginal contribution of a shipper $i$ to a coalition $S$ in which he does not yet participate is defined as
\( v(S \cup \{i\}) - v(S) \). The marginal contribution is in fact the basis for every game theoretical gain sharing mechanism. We will discuss four of them below.

**SHAPLEY VALUE**

The Shapley value (Shapley (1953)) is a well-known solution concept that constructs a vector \( \Phi(N, v) \) that allocates the value \( v(N) \) of the grand coalition based on the values \( v(S) \) of all coalitions \( S \). The Shapley value can be explained as follows. Consider the creation of a coalition \( S \) to which \( i \) does not belong. First, a set size \( |S| \) is chosen at random out of \( \{0,1,2,\ldots,|N|-1\} \), each having a probability \( \frac{1}{|N|} \) to be drawn. Then a subset of \( N \setminus \{i\} \) of size \( |S| \) is chosen, each with a probability \( \frac{|S|!(|N|-1-|S|)!}{(|N|-1)!} \). After \( S \) has been drawn, shipper \( i \) is allocated his so-called *marginal contribution* \( v(S \cup \{i\}) - v(S) \). Then, the Shapley value is the expected payoff for shipper \( i \) in this random procedure, as indicated in the following formula:

\[
\Phi_i(N, v) = \sum_{S \subseteq N \setminus \{i\}, |S| = |S|} \frac{|S|!(|N|-1-|S|)!}{|N|!} \left[ v(S \cup \{i\}) - v(S) \right], \text{ for all } i \in N.
\]

The Shapley value possesses a number of important and objective fairness properties. Below we will briefly discuss five of these properties that are useful in the context of horizontal logistics collaboration:

1) **Efficiency.** This property value ensures that the total value of the grand coalition is distributed among the partners, i.e., no value is lost.

2) **Symmetry.** Two partners that create the same additional value to any coalition receive the same share of the total value.

3) **Dummy.** Partners that do not contribute anything to any coalition except their individual value indeed receive exactly their individual value as a final share of the total value.

4) **Strong monotonicity.** This guarantees that if all of the partner’s marginal contributions increase, his payoff will increase.

5) **Individual rationality.** A partner will be better off in the collaboration than alone.

It has been proven that the Shapley value is the unique solution concept that satisfies all these five properties (Shapley, 1953). Since these properties make perfect sense from a practical perspective, this renders the Shapley value a very attractive mechanism in practice. Although not yet widespread in the supply chain industry, the Shapley value has been applied in other industries where sharing is an issue, such as in 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).

**Nucleolus**

The Nucleolus was developed by Schmeidler (1969). It is based on the goal to minimize the maximum dissatisfaction over all coalitions \( S \). For every coalition \( S \) it calculates its dissatisfaction, which is defined as \( v(S) \) minus the final allocations to the individual players via the allocation rule, in this case the nucleolus. These dissatisfaction values for every coalition \( S \) are put into a so-called excess vector. The nucleolus is exactly that allocation rule that lexicographically minimizes the dissatisfactions in the excess vector.

The nucleolus satisfies the properties of efficiency, individually rationality, symmetry and dummy. Moreover, if a stable allocation exists (i.e., no coalition has an incentive to leave the grand coalition\(^1\)), the nucleolus will give a stable allocation. This is not necessarily true for the Shapley value.

The nucleolus is more difficult to compute than the Shapley value. In fact, the first step of finding the nucleolus is to find a vector that minimizes the maximum of the excesses over all \( S \) in such a way that the efficiency property is satisfied. This problem of minimizing the maximum of a collection of linear functions subject to a linear constraint can be converted to a linear programming problem and can thus be solved by dedicated software. For larger groups of collaborators though, this calculation becomes very time-intensive.

**Separable and Non-separable Costs (SNS)**

In Tijs and Driessen (1986), cost allocation methods are presented, based on the notion that the total cost to be allocated is divided into two parts: the separable and the non-separable costs.

Methods based on this idea first allocate to each participant his separable cost, then distribute the non-separable cost among the participants according to given weights. The separable cost of partner \( i \) is equal to cost level of the whole group minus the cost level of the whole group, excluding partner \( i \). This is sometimes also referred to as the marginal cost of partner \( i \). The non-separable cost that remains to be distributed is then the cost of whole group minus the sum of all separable costs of the individual participants (Frisk et al., 2010). The distribution of the non-separable cost can take place in various ways using different weights for the participants.

This rule will satisfy the efficiency and symmetry property. If carefully chosen, the allocation rule will also satisfy the individual rationality and dummy property. As such, it is a useful approximation of the Shapley value with the virtue that it is can be calculated much easier: it doesn’t suffer from the combinatorial explosion of the number coalitional values that need to be calculated for determining the Shapley value allocation.

---

\(^1\) For reasons of simplicity, a discussion of the core of cooperative game is avoided here.
**EQUAL PROFIT METHOD (EPM)**

The equal profit method is developed by Frisk et al. (2010) to cover for some disadvantages in the allocation models discussed above that are based on their experience with the acceptance of these rules by companies in practice. They found that companies were mostly interested in the relative savings they incurred individually compared to their baseline cost, i.e. without collaboration. The developed Equal Profit Method aims to minimize the maximum difference in pairwise relative savings. These differences are calculated for each of the N(N-1) distinct pairs of participants, and minimized by choosing the most suitable allocation, while satisfying also the stability constraint if possible.

This rule will work quite well for groups of comparable partners, but it is very sensible to free-riding. A dummy player will get assigned the same relative savings as the partner that brings in the most synergetic flows.

**DISCUSSION**

In this section, five possible rules for gain sharing have been discussed. Table 16 shows the formal properties of these rules and our subjective assessment of the ease of implementation. From this table we conclude that proportional rules and the Nucleolus have important drawbacks, for the nucleolus this is its complexity, which makes it difficult to have practitioners understand and trust it. This drawback could become smaller in the future, when the concept of collaboration is more established and trustees are really trusted in their advice for gain sharing, also when they apply the nucleolus.

From the table we conclude that the Shapley value and the SNS methods are in fact preferential. The Shapley value should be used for smaller, coherent groups. The SNS method is very suitable for collaborations of changing partners.

<table>
<thead>
<tr>
<th></th>
<th>Proportional</th>
<th>Shapley</th>
<th>Nucleolus</th>
<th>SNS</th>
<th>EPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monotonicity</td>
<td>✗</td>
<td>✚</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Dummy</td>
<td>✗</td>
<td>✚</td>
<td></td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Efficiency</td>
<td>✚</td>
<td>✚</td>
<td>✚</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Individual rationality</td>
<td>✗</td>
<td>✚</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Ease of implementation</td>
<td>✗/✘</td>
<td>✗/✘</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
</tbody>
</table>

**TABLE 16 PROPERTIES OF GAIN SHARING MECHANISMS**

Krajewska et al. (2008) rightly state that the specific features to be eventually included in the gain sharing scheme will also depend on the distribution of negotiation power among freight carriers, on their level of interdependency and willingness to make compromises, and on the market within which they operate. In other words, a gain sharing formula like the ones in Table 16 will most likely not be implemented without any changes in a practical context. However, for reasons of fairness and stability of the collaboration, we do stress the importance of using a formal allocation rule at least as the starting point of gain sharing negotiations.
ENTRY AND EXIT

A collaboration consortium is dynamic almost by definition. Unlike in vertical supply chain collaborations, there is no strict commercial governance structure of buyers and sellers. In contrast every partner will make a trade-off every once in a while whether it will stay in the consortium or not. A well-constructed gain sharing mechanism can ensure stability of the consortium, but only if there is every participant provides enough synergy to the group. If for example participant X has a changed customer base or has observed other changes in its logistics operation, it is for example possible that the group can attain a bigger synergy without X than with X. In such a case the group will wish to ask company X to leave. In another case, it is possible that participation in the project is not profitable for company X itself anymore. Also in that case, X will most likely leave the collaboration.

Next to companies leaving the collaboration, it is also possible that other companies apply for participation in the consortium. In some cases, it can even be a clear strategy of a consortium to try and expand the group in order to increase the level of synergy. In such a case, a mechanism should be in place to manage such entry processes.

From a high level there are two consequences of both entry and exit for a horizontal collaboration. Firstly, there must be a legal structure in place to accommodate new entries and companies leaving the project. The underlying contract should articulate how entry and exit will take place. In some cases, parties may for example agree on a veto-system for new entries. However, in such a situation, care must be taken that no infringement of competition law arises from this. Legal aspects of collaboration are discussed in more detail later in this section. Next to the legal aspect, entry and exit will usually also have an impact on operational synergy. Most commonly, when a participant leaves this will negatively affect synergy levels and when a sensible entry takes place, synergy will rise. These effects, whether positive or negative, must be managed by a well-functioning trustee according to agreed rules and conditions. For a discussion on the synergy effects of entry and exit in collaboration we refer to Cruijsen et al. (2010a). Furthermore, legal aspects of entry and exit in collaboration are the topic of a dedicated position paper that will be produced in WP2 of the CO3 project.

AWARENESS

The next topic to discuss is awareness. Collaboration is a highly 'human' topic: even a positive business case might not always be enough ground for managers to actually engage in a project. Experience in many pilot studies has shown that awareness of and intuition on the improvement opportunities of collaboration is sometimes more important that the exact synergy number. Maybe the most helpful way of giving this intuition is by creating a geographical map with an illustration of the possibilities of combinations between companies. For example, Figure 20 illustrates the customer locations of two companies considering to start a collaboration. Although such a picture does not provide any additional information over a well-constructed business case calculation, it had the capability of becoming symbolic for the project and sticking
in the decision makers minds and as such provides a more solid ground for the collaboration, especially in the development phase.

![Figure 20: Example of a Synergy Awareness Chart](image)

**DATA**

Collaborations can only start and can only be managed by a trustee, on the basis of trustworthy data. It is important that the same data is available from every participating company. Which specific data is required depends on the case at hand, but typical examples are:

- Pickup/delivery addresses
- Shipment overview for representative period
- Product logistics characteristics
- Delivery schedules and frequencies
- Transport contracts
- Prices and current cost levels
- (Minimum) service levels
- Etc.
LEGAL ASPECTS

Industry feedback from within the CO3 project has indicated that a solid legal basis for collaboration is crucial. Therefore, a comprehensive legal framework will have to be developed. In this paper we present a first starting point by introducing two important topics, i.e. the underlying contracts and the role of competition law.

CONTRACTS

The table below summarizes the most important documents to be incorporated in this legal framework, i.e. a standard/model contract, general terms and conditions for collaboration, a service level agreement, a non-disclosure agreement and a letter of intent.

| Standard contract | There are three contacts to be developed. The legal framework includes three model agreements: 1. one between all shippers, 2. one between the shippers and the trustee, 3. one between the shippers and the logistic service providers. Contains the core obligations that the contract partners agree on, such as service and payments. It defines the connection also with the other legal documents. Contract can be very elaborate or very short, depending on the level of detail of the terms and conditions that are in place. In the contract, all operational and organizational aspects discussed in Section X should be included, e.g. gain sharing, way of handling increasing or decreasing volumes, entry and exit, etc. |
| Terms and conditions | Terms and conditions are a fixed part of the legal agreement. They contain terms that hold for all partners that are possible participants to the project. The more elaborate the terms and conditions, the simpler the final contract can be. This is certainly advisable to avoid lengthy individual contract negotiations. In the contract, per partner amendments to the terms and conditions can be made when necessary. |
| Service level agreement | This offers the starting points for the daily execution of the consolidated flows. Legal significance only in conjunction with the contract. Focuses on problem solving, target numbers, etc. Typically a technical document, so compiled by logistics experts. If service level agreements are in place over a longer period of time, some elements of it can be included in the contract document. |
**Non-disclosure agreement**

The obligation to treat information of the participants confidentially.

Can be one-sided or two-sided.

Usually this is the first document to be signed, already in the negotiation phase.

Its term can be longer than the contract duration.

**Letter of intent**

Contains the formal intent of potential participants to enter negotiations with the goal to close a contract.

Usually, a letter of intent does not hold any legal guarantees, but it communicates commitment of the parties.

Binding fragments in the letter of intent are also possible, if there is a need for that. For example to arrange a financial settlement on exclusiveness. These fragments will in this case later be transferred to the contract.

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**COMPETITION LAW**

Sharing of information between direct competitors can be problematic from a legal perspective if there is a danger of either collusion or market protection. Collusion happens when competitors together are able to concert their competitive practices (or to control who deviates) and as such limit competition in the market place at the expense of the end customer. Market protection is a situation where the group of collaborating companies would prohibit other competing companies to take part in the partnership, thereby causing them a competitive disadvantage.

Whether in practice there is indeed illegal collaboration strongly depends on the circumstances. It is hard to give generic rules of what is allowed and what is not. Obviously, there is a tradeoff between the positive element from collaboration that efficiency rises and the impact of transport on the environment will become less as a result, and the negative element of the threat of a reduction of competition at the expense of the end customer. In specific cases, a court might order a proportionality check to see if the same advantages could not have been reached with less restrictive measures by the partners. Although generic rules do not yet exist, a number of rule of thumb can be formulated, see Table 18.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparency</td>
<td>The more transparent the market in which the collaboration takes place, the more difficult the collaboration will be under competition law.</td>
</tr>
<tr>
<td>Consortium size</td>
<td>The fewer and bigger the participants, the more difficult the collaboration will be under competition law.</td>
</tr>
<tr>
<td>Stability</td>
<td>The more stable and predictable the collaboration is, the more difficult it will be under competition law.</td>
</tr>
<tr>
<td>Strategicness of data</td>
<td>Strategic data, such as prices, cost levels, customer bases, costs, marketing plans etc., are very sensitive under competition law.</td>
</tr>
</tbody>
</table>
Recentness of data

More recent data are always more sensitive than older data. Information about future plans are very tricky to share under competition law.

Market share

The larger the market share of the group of collaborators, the more difficult the collaboration will be under competition law.

Frequency of information exchange

The more frequent a data exchange is, the more difficult the collaboration will be under competition law.

Openness

The more difficult it is to acquire the same data in the open space, the more difficult the collaboration will be under competition law.

Anonimization

It is always safer to aggregate data and make it anonymous when possible. Exchange of individual data will lead to problems more quickly. The harder it is to track data back to information of a competitor, the safer the collaboration is from a competition law point of view.

<table>
<thead>
<tr>
<th>TABLE 18 RULES OF THUMB FOR COMPETITION LAW OBEDIENCE UNDER HORIZONTAL COLLABORATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>The point of competition law is also stressed by Frisk et al. (2010) when they state that one aspect of how the collaboration should be carried out concerns the law governing restrictive practices. They also observe that exact ruling seems to be a rather grey zone, but the current interpretation by many companies is that collaboration between companies is allowed as long as it does not interfere with the overall market.</td>
</tr>
<tr>
<td>Given the fact that the legal side of collaboration is still a grey area, there is a clear need for a coherent legal framework. Furthermore, in order to support international cross border horizontal collaboration projects, it is necessary to verify whether the model legal framework is in accordance with national law and regulations of the involved jurisdictions.</td>
</tr>
<tr>
<td>OPERATIONAL ELEMENTS</td>
</tr>
<tr>
<td>Like any other change to a logistics organization, also collaboration will have an impact on operational aspects of the company. And even in some cases they can be a necessary condition or a prohibiting factor for collaboration success. A detailed discussion of all the operational elements that can play a role is beyond the scope of this paper, but some examples are:</td>
</tr>
<tr>
<td>‐ Detailed product characteristics</td>
</tr>
<tr>
<td>‐ Time windows and other client specific agreements</td>
</tr>
<tr>
<td>‐ Change management</td>
</tr>
<tr>
<td>‐ Information technology aspects</td>
</tr>
<tr>
<td>‐ Communication plan</td>
</tr>
<tr>
<td>‐ Precise pilot project definition</td>
</tr>
<tr>
<td>‐ Loading instructions</td>
</tr>
<tr>
<td>‐ Etc.</td>
</tr>
</tbody>
</table>
MATCHMAKING AND PARTNER SELECTION

Obviously, one of the most important decisions to make when considering collaboration concerns the selection of partners with whom to work together. The survey by Eye for Transport (2010) mentioned earlier provided a number of methods for finding partners to collaborate with, see Figure 21.

The figure shows that the most common ways to search for partners are to ask Logistics Service Providers or 4PLs to find and select those companies. Alternatively, industry organizations can assist. McKinsey (2010) also discusses the topic of partner selection and provides the following considerations (see Table 19).

<table>
<thead>
<tr>
<th>Consideration</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply chain segment</td>
<td>What part of the supply chain needs to be covered, e.g. inbound, outbound, distribution, reverse?</td>
</tr>
<tr>
<td>Supply chain needs</td>
<td>What requirements in terms of speed, reliability and flexibility?</td>
</tr>
<tr>
<td>Geographic overlap</td>
<td>What distribution/warehousing footprint?</td>
</tr>
<tr>
<td>KPI</td>
<td>Shared success measures across financial, operational, and consumer-based dimensions?</td>
</tr>
<tr>
<td>People</td>
<td>Common agenda and joint willingness to make it happen?</td>
</tr>
<tr>
<td>Industry conduct</td>
<td>Possibility/feasibility to collaborate with competitors.</td>
</tr>
<tr>
<td>Objective</td>
<td>What benefits/capabilities needs the partner to bring, e.g. volume, skill, market access, financing, influence etc.?</td>
</tr>
</tbody>
</table>
Most of the considerations identified by McKinsey (2010) are of a qualitative nature. The geographical overlap consideration though can also be approached from a more quantitative angle. If enough data is available for a group of potential collaborators, for example the members of a certain industry organization, an overview such as the one in Figure 22 can be constructed, indicating the combinations of companies whose client locations show the strongest overlap.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>100%</td>
<td>9%</td>
<td>99%</td>
<td>91%</td>
<td>41%</td>
<td>74%</td>
<td>89%</td>
<td>99%</td>
<td>55%</td>
<td>7%</td>
<td>24%</td>
</tr>
<tr>
<td>Company B</td>
<td>92%</td>
<td>100%</td>
<td>99%</td>
<td>72%</td>
<td>28%</td>
<td>100%</td>
<td>87%</td>
<td>76%</td>
<td>92%</td>
<td>38%</td>
<td>30%</td>
</tr>
<tr>
<td>Company C</td>
<td>97%</td>
<td>12%</td>
<td>100%</td>
<td>94%</td>
<td>74%</td>
<td>86%</td>
<td>96%</td>
<td>95%</td>
<td>37%</td>
<td>7%</td>
<td>42%</td>
</tr>
<tr>
<td>Company D</td>
<td>93%</td>
<td>39%</td>
<td>96%</td>
<td>100%</td>
<td>49%</td>
<td>83%</td>
<td>88%</td>
<td>82%</td>
<td>65%</td>
<td>14%</td>
<td>27%</td>
</tr>
<tr>
<td>Company E</td>
<td>66%</td>
<td>0%</td>
<td>96%</td>
<td>27%</td>
<td>100%</td>
<td>67%</td>
<td>98%</td>
<td>95%</td>
<td>92%</td>
<td>0%</td>
<td>66%</td>
</tr>
<tr>
<td>Company F</td>
<td>96%</td>
<td>22%</td>
<td>83%</td>
<td>92%</td>
<td>61%</td>
<td>100%</td>
<td>94%</td>
<td>88%</td>
<td>53%</td>
<td>20%</td>
<td>30%</td>
</tr>
<tr>
<td>Company G</td>
<td>89%</td>
<td>7%</td>
<td>89%</td>
<td>85%</td>
<td>55%</td>
<td>66%</td>
<td>100%</td>
<td>87%</td>
<td>44%</td>
<td>15%</td>
<td>59%</td>
</tr>
<tr>
<td>Company H</td>
<td>98%</td>
<td>3%</td>
<td>98%</td>
<td>90%</td>
<td>59%</td>
<td>75%</td>
<td>98%</td>
<td>100%</td>
<td>59%</td>
<td>15%</td>
<td>37%</td>
</tr>
<tr>
<td>Company I</td>
<td>100%</td>
<td>79%</td>
<td>98%</td>
<td>92%</td>
<td>45%</td>
<td>96%</td>
<td>94%</td>
<td>87%</td>
<td>100%</td>
<td>32%</td>
<td>26%</td>
</tr>
<tr>
<td>Company J</td>
<td>100%</td>
<td>49%</td>
<td>84%</td>
<td>97%</td>
<td>16%</td>
<td>97%</td>
<td>100%</td>
<td>100%</td>
<td>81%</td>
<td>100%</td>
<td>30%</td>
</tr>
<tr>
<td>Company K</td>
<td>89%</td>
<td>23%</td>
<td>89%</td>
<td>92%</td>
<td>50%</td>
<td>86%</td>
<td>99%</td>
<td>89%</td>
<td>45%</td>
<td>30%</td>
<td>100%</td>
</tr>
</tbody>
</table>

This finishes the discussion on supporting tools and technologies for collaboration. In the next concluding section we formulate the main conclusions.
CONCLUSION

This paper has provided an overview of the relevant aspects for horizontal collaboration projects, based primarily on academic literature but furbished by insights from practitioners and industry experts. It will be used as the starting document for the CO3 project in which pilot studies, business models and tools and technologies will be developed for horizontal collaborations.

The CO3 project aims at finding, developing and managing co-modality projects that are made possible by horizontal collaboration between at least three companies, being either logistics service providers or shippers. Individually these companies might not have the scale to make the shift from road to rail, inland navigation or short sea shipping, but the idea is that by bundling companies can accumulate enough transport volume to fill a train or ship, thereby reducing cost and decreasing total emissions of the transport industry in Europe.

In this concluding section we summarize the paper by formulating three headlines for CO3 and by defining directions for further research.

KEY MESSAGES

When creating these consortia of companies working together, quite some aspects play a role. For example, a consortium is only economically viable if enough synergy exists among it. Furthermore, there is the aspect of trust, fair gain sharing and competition. Usually it is easier to collaborate with companies outside one’s own industry than with direct competitors, although obviously the overlap and synergy with competitors is promising by its nature. The dangers of mistrust and legal aspects however make that it seems more reasonable to sacrifice a little synergy for the sake of feasibility of a long lasting partnership. Whether between competitors or non-competitors, a fair gain sharing mechanism is essential. Therefore, fair gain sharing is the first key message of CO3.

The CO3 project aims to develop, describe and implement the ideal setup of a logistics collaboration project. This should be generic enough to fit most practical cases. It explicitly does not ambition to guide all individual cases in their development process towards true collaboration. That is impossible because there are just too many possible routes towards this, which depend on the specifics of the companies involved, the pace of development, impact etc. It is however very important to stick to a structured development process, for example including all legal contracts required. This structured development process is the second key message of CO3.

It was argued in this paper that there is a need for a specialized entity to setup, manage and develop a collaboration. If such a neutral, transparent and trusted party is not present, there is a severe risk that not all parties will efficiently work together in the long run on a fair give and take basis. Typically, there are two separate types of collaboration support activities carried out
by a trustee. We categorize these types as ‘offline’ and ‘online’ activities. The main keywords for both the online and the offline functions of a trustee are neutrality, transparency and safeguarded confidentiality of data provided. These can never be compromised in any of the tasks performed by the trustee. Given the importance of a trustee, the third key message of CO3 states that in a true horizontal collaboration project, a neutral trustee must be in place.

RECOMMENDATIONS FOR FURTHER RESEARCH

Since horizontal collaboration is still a very young research field and practical evidence is quite scarce, knowledge about the topic has not yet fully internalized in the logistics industry. Luckily, academic literature on this important topic is starting to build up and early practical evidence is also being gathered. There are still quite some open questions to be answered and some of these questions will maybe only become apparent when collaboration will launch at a more intense rate. However, a number of questions can already be formulated and invite the academic and practice logistics community to provide an answer. Firstly, in the light of gain sharing, how should a consortium cope with sharing upfront investments that do not directly have a synergetic effect? This topic has been discussed by Cruijssen et al. (2010c), but certainly needs further elaboration. Secondly, there is the issue of the many typologies for horizontal collaboration that exist, and are described in this paper. It would be very worthwhile to have a single comprehensive framework or typology in which most collaboration projects can be positioned and describes their relevant attributes. Thirdly, it is an open question what the optimal number of partners in a consortium and for a given type of collaboration is. Finally, the development process for a horizontal collaboration project should be adjusted and expanded to incorporate the trustee role.

Acknowledgement

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LITERATURE


