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COLLABORATIVE TRANSPORTATION SHARING: FROM THEORY TO PRACTICE VIA A CASE STUDY FROM FRANCE

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Collaborative transportation sharing: from theory to practice via a case study from France

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INTRODUCTION

The freight transportation industry is a major source of employment and supports the economic development of the country. However, freight transportation has many negative aspects including congestion and environmental disturbance, which negatively affect quality of life, particularly in urban areas. Both the new trends in retail and commerce organization and the technological innovation in supply chain management and distribution planning have led decision makers to consider collaborative strategies to reduce overall cost and pollution emissions, and improve social management of the supply process (see papers concerned with sustainable development and transport and logistics management). In freight distribution, the most popular collaborative strategy is that of logistics sharing. This can take place at the transport level, but also in warehousing, inventory and other operations. These strategies are based on collaborative decision making and information sharing. They usually take the form of agreements and partnerships. The main aspects of collaborative logistics in production and supply management have been recently reviewed, however logistics sharing in freight distribution remains a less explored subject in the literature, but commonly observed in several real-life cases.

The aim of this chapter is to define the main concepts related to logistics sharing agreements and to present a conceptual schema representing the most important organisational aspects. We will focus on socio-economic and legislative aspects by making an analysis of feedback of several freight distribution experiences and introducing the main concepts of collaboration applied to this field. First of all we will present the main concepts of logistics sharing, based on the main definitions of collaborative logistics. After a brief presentation of the main background issues, the most important organisational aspects of this type of approach will be presented. Then, the socio-economic and legislative aspects of collaborative logistics sharing will be described. To illustrate the presented concepts and schemas, we propose an analysis of several experimental cases from the literature, and a case study from the French press distribution sector; a distribution company that started a collaborative logistics sharing project at the end of 2008.

BACKGROUND ISSUES

In the last years, several strategies and logistics models have been developed in order to increase the supply chain effectiveness. Collaboration is one of the most promising areas of study in supply chain management (Lambert et al., 1996; Barrat, 2004; Min et al., 2005; Simatupang and Sridharan, 2005; Lambert, 2008). In supply chain management, collaboration can take place at several stages of the chain and with different levels of interaction. These different levels of interaction can be classified as follows, by Crainic and Laporte (1997) for freight transportation and by Baglin et al. (2009) for collaborative logistics:

- *Transactional collaboration*: Logistics and transportation need consistent administrative practices and document exchanges. The first stage of collaboration consists of the common coordination and standardization of administrative practices and exchange techniques, requiring information and communication systems.
- *Informational collaboration*: This level of collaboration concerns mutual exchange of information such as sales forecasts, stock levels and delivery dates. It is important to note, that confidentiality and the process of competition can hinder collaboration.
- *Decisional collaboration*: This category concerns the different collaboration possibilities in planning and management decisions within logistics and transportation. These decisions can belong to different planning stages:
 - *Operational planning*: This planning stage is related to daily operations that can be coordinated or shared, like freight transportation or cross-docking.
 - *Tactical planning*: The middle-term planning stage involves several tactical decisions, like sales forecasts, shipping operational decisions, stock and production management and quality control. At this level, sharing decisions can establish a relation of trust between the collaborators.
 - *Strategic planning*: The highest collaboration stage is related to long term planning decisions such as network design, facility location, finance and production planning.

Although in a narrow sense the word “sharing” refers to the joint or the alternating use of inherently finite resources, both material and immaterial, it can also refer to the process of dividing and distributing. In logistics, the main shared resources are information, infrastructure, management/planning tools, vehicles and human resources. In transportation and logistics sharing, operational decisions are in general individually made. Tactical and strategic decisions can be made by different actors or groups. We can define three types of transportation and logistics sharing approaches:

- *Non-collaborative sharing*: the shared resources are managed by their users independently. There is no collaboration between these users.
- *Collaborative sharing with hierarchical decision making*: the shared resources are commonly managed by their users but the main decision processes are hierarchic.
- *Collaborative sharing with non-hierarchical decision making*: this type of sharing differs from the above in the fact that the different users take part into the decision processes.

In the first and the second types of sharing, strategic decisions are taken by a single decision maker. In the third type, these decisions are made by the members of a collaborative group of actors under a partnership contract or other type of agreement. In this chapter, we focus on the third type of sharing approach. Collaborative sharing can be defined as the joint use of material and immaterial logistics resources, and a good management of the collaborative actions is necessary to ensure the continuity of this type of sharing approach. When two or more actors decide to collaborate in a sharing approach, we can call them sharing partners. Although sharing can be formalized by agreements that are not formal written partnership contracts, we observe several analogies between logistics partnerships and collaborative logistics sharing approaches (Lambert, 2008). The relations between partners are complex, and several papers have defined the main principles of collaboration in partnerships (Newbourne, 1997; Lambert et al., 1996; Cooper et al., 1997). Lambert et al. (1996), define the main principles a logistics partnership and the differences between other forms of inter-enterprise relationships, as well as a first model to analyze their feasibility from a management point of view. Other works define the factors that accelerate collaboration, most of them related to production and warehousing (Lambert et al., 2004; Lambert, 2008), and involve in general multiple participants.

In collaborative logistics sharing, the involved actors in the approach can be considered as a reasoning community (Evangelou and Karacapilidis, 2007; Yearwood and Stranieri, 2009), in other words, a group or community of individuals that engage in dialogue with each other in order to reason toward action. As such the term is broader than communities of practice, communities of action or communities of purpose. Members of a reasoning community may or may not belong to the same organisation, hold the same values, aim for the same outcomes or have anything in common, except the need to reason toward a solution of the same or similar problem. From these statements, we can define a Logistics Sharing Community (LSC), as the group of stakeholders involved in collaborative transportation sharing with non-hierarchical decision making and as the extension of the logistics partnership principles to a larger group of reasoning. An LSC can also be considered as a small reasoning community (Yearwood and Stranieri, 2006), where their members are well identified and defined, and have different objectives. They can also have different points of view and decision values at different planning stages. A reasoning community engages in a process that involves three main components (Yearwood and Stranieri, 2009):

- In the *individual reasoning* phase each individual seeks evidence, organises it and ultimately forms claims that represent his or her preferred position or beliefs.
- The *communication of reasoning* phase describes the transmission of all aspects of individual and coalesced reasoning to others.
- Finally, in the *coalescing of reasoning* phase a form that represents the reasoning processes acceptable to the entire community is obtained. A coalescing of reasoning does not mean that an agreement about a solution is reached. Rather, coalescing of reasoning reflects the state where each individual's reasoning is understood and accepted as valid by the community even if there is such a divergence of views that agreement is impossible.

In classical logistics research, most of the literature deals with individual reasoning, even when dealing with collaborative approaches. We will propose in the following sections two models, taking into account the logistics principles and applying them to a reasoning community in order to define the main organisational and socio-economic aspects of a logistics sharing community.

ORGANISATIONAL ASPECTS

Collaboration happens through information and knowledge management (Laudon and Laudon, 2007; Evangelou and Karacapilidis, 2007; Lambert, 2008; Baglin et al., 2009). For this reason, we can assert that collaborative transportation sharing needs an efficient shared information system to ensure a high standard of performance. We propose an organisational model to represent the organisational aspects of logistics sharing, based on that of Laudon and Laudon (2007) for the conception of a shared information system. These ideas are summarised in the following chart:

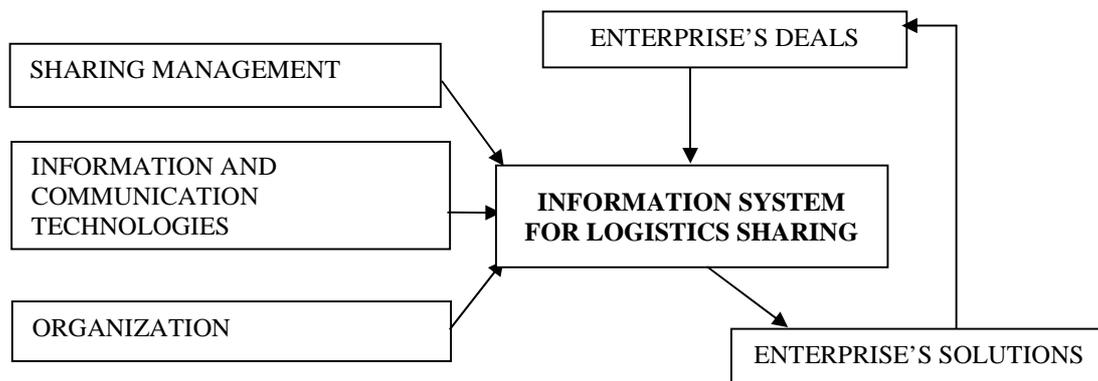


Figure 1: Flowchart for the conception, design and management of an information system for logistics sharing (adapted from Laudon and Laudon, 2007)

This conceptual model, initially proposed for individual decision making situations, is composed of five modules. The sharing management module contains all the elements of the management of sharing services and collaboration. In this case, a focus will be made on the elaboration of new business models based on the collaboration; as well as on the location of new customers. The information technologies module contains the Information and Communication Technologies (ICT) that are used in the proposed sharing solution. Here, we find all the internal and external tools. For instance internal tools include personal computers, but also professional softwares and Intranets. External tools include traceability tools like bar codes or Radio Frequency Identification. The organisation module lists all of the actors involved in the sharing solution, in both internal and external contexts. These three modules are related to tactical and operational decisions. The enterprise's deals and solutions are related to strategic planning. The deals of each enterprise concern the decreasing of costs and value creation for all stakeholders. The solutions are connected with the reduction of cycle time or the improvement of customer service, for example. All the modules are more precisely described above, starting by those utilising strategic planning then focusing on the tactical ones.

Enterprise's deals module

The enterprise's deals module presents both the project's expectations and the risks that are studied in that project's preliminary developments. Considering the technologies, tools and their usage levels, several choices must be made in order to set up the best solution of logistic sharing services. In order to make these choices, it is important to formulate questions related to the goals and the risks of the project, and to find the appropriate answers. Accordingly, it is important to make a deep analysis of the possible risks that the project may encounter. From the work of Seiersen (2006), we can list the main categories of risks related to a collaborative transportation sharing project:

- The risks related to the project accounting itself, more precisely to the different type of resources that can be affected by the project, in financial, economical, technical, technological or human terms. In general, each member of a LSC knows its implications in financial and accounting terms, and these decisions are individually taken.
- The risks related to the organization of the project and its continuity. Two types of risks can be identified in this category: the risks related to the logistics organisation; for operational decisions, which are in general individually made, and those of the LSC tactical and strategic actions, where misunderstandings and other obstacles to collaboration have to be seen as potential risks. It is important to note that the reorganisation of a project (including changes on the LSC status) can be considered only when the project is operative and stable.
- The technological risks; in general, the technologies present problems related to functionality, robustness and compatibility, among others. Before choosing a technology, it is important to think about these questions.
- The risks related to policies, processes and current practices. The development and usage of new logistics solutions can need an important change in the way people think and act to make them operative. Continuous social analysis during all conception and development phases are crucial to the stability and success of very innovative solutions. These social analyses need to be made on both the LSC members and the external actors involved in the different stages of the project.
- The risks related to the impact of the systems in the current and future operations, at both human and technical levels. In this category, the collaboration rules and the respect of them have to be considered.
- The dependence risks; If the information system is based on several technologies, the risks related to the dysfunction of these technologies have to be considered. When a technological tool presents a dysfunction, the system can be less efficient, or can stop because of it. These risks have to be studied in a preliminary phase of a project.

Enterprise's solutions module

The enterprise's solutions are the main objectives of the project and the evaluation of its performance (Laudon and Laudon, 2007). Although at the end of the 20th century the notion of performance has been basically related to economic indicators, the notion of sustainability is nowadays a central element in transportation and logistics planning and management (Morana and Gonzalez-Feliu, 2009). Sustainable development can be represented as the junction of three spheres: the first one deals with the economic aspects, the second one contains the social and the

societal elements, and the third is related to the environment. The economic analysis is different, since it is necessary to reach each member to reach economic sustainability to ensure that of the entire LSC (i.e., if one member does not reach the economic balance in order to reach that of the group, it will quit the community).

Some recent French research (Marais and Reynaud, 2007) proposes a ranking table for the different components of Sustainable Development actions, based on an exhaustive literature review analysis. The authors propose 5 central subjects: Strategy, Enterprise's policy, organisation, systems and key competencies. We can also refer to the main environmental and social norms and recommendations, as for example the AFNOR ISO 14000 environmental norms, the SA 8000, OHSAS 18001 and AA 1000 social norms or the SD21000 norm for sustainable development (Morana and Gonzalez-Feliu, 2009). Sustainability Balanced Scorecards (Hockerts et al., 2002) can be considered as sustainability performance indicators. However, in order to take into account the group reasoning component of an LSC, collaborative decision making (Raghu et al., 2001; Beroggi, 2005) has to be valued more highly than individual decision making while analysing the social sphere of sustainable development. For example, collaborative multicriteria analysis (Evangelou and Karacapilidis, 2007) can be used to develop decision support systems that model the different expectations and key objectives of the LSC, considering those of each member of the community. Moreover, the durability of collaborative transportation sharing approaches can be modelled using group reasoning decision support systems.

Organisation module – Types of actors in supply chains related to sharing

Reasoning occurs in a social context and usually involves numerous participants with differing views (Yearwood and Stranieri, 2009). Over the length of a supply chain, several actors interact in order to complete all the tasks necessary to produce and distribute a product to a retailer. In this section, we will introduce the main categories of actors in logistics and their potential domains of sharing, focusing on the logistics of distribution. We will outline the categories of actors in the freight transportation field that can be directly concerned to LSC so to group reasoning.

First of all, we can describe the “loaders” (Ambrosini and Routhier, 2004), who are the actors that send or receive the freight. We can find in this category the producers of the various raw products and components as well as the final product manufacturers, the logistics providers, the distribution and gross commerce enterprises, then the retailers. These actors can be considered as “senders”, if they act at the origin of the transport, and “receivers” if they are at its destination. Another important category is the “transporters”. The transporters can be the “loaders” that make self-transport operations, or the third-party transportation companies (Ambrosini and Routhier, 2004). These companies can be workers that have only one vehicle, small and medium enterprises or big companies and multinational groups, as well as postal and courier operators and logistics providers. A third category is that of the platform management companies (Patier et al., 2007). The heterogeneity of the LSC and the different goals and the degrees of implication for each member have to be considered while modelling the community decision process.

Yet other actors participating indirectly to transportation sharing, like public administrations, highway companies, customs operators, are not considered in this classification for two reasons: the first is that their possible implication as logistics sharing partners are much less important

with respect to the three main categories and the second is that they are external actors to the LSC, although they can have influence to several decisions related to this community's strategic and tactical actions.

Sharing management module – Sharing approaches in freight distribution

In supply chain management, we observe sharing approaches in different processes, involving both production and distribution sub-chains. More precisely, focusing on distribution, we can distinguish two main domains of application: the complementary activities to transportation, as for example warehousing or supplying, and the transportation itself. We will describe briefly the organisational models of sharing in both fields.

The Efficient Consumer's Response (ECR) is a concept developed in the grocery distribution context. It is defined as a cooperative approach whose goal is the total satisfaction of the consumer by an improvement on the economic performance of the different actors within the supply chain. The ECR optimises the retailer's supply and improves the promotional actions and the freight availability by the use of ICT and logistics information systems, as well as the usage of activity based management tools. The Vendor Management Inventory (VMI) can be considered the next step in respect the ECR. In this collaborative approach, the supplier is co-responsible for the warehouses' re-supplying using the sales forecasts. This involves using collaborative actions. This approach implies a commitment of the distribution company to give real time information to the producer, who will be able to make a re-supply proposal and then make his demand predictions in order to adapt his production phases and his resources to these demand predictions. A new form of VMI, which can be called "shared VMI", has been developed in the UK and France, and involves several producers, who agree to work with the same distribution company and share information with this company (Simonot and Roure, 2007). At the infrastructure level, shared platforms and infrastructures are very common. However, most of them are only physically shared, and the actors that operate in these platforms do not collaborate. Another model of shared platform is the "collaborative warehouse", where several producers and distribution companies share a physical space and logistics information to improve the global performance of the overall distribution processes (GCI and Capgemini, 2008). This idea can also be found in consolidation platforms, like classical cross-docks, regional platforms, urban consolidation centres or urban logistics spaces.

In freight transportation, collaboration between two operators is an action that is usually informal and not documented. These actions are taken to increase the loading rate of a vehicle, or to make a "friend" company deliver to a customer that the contracted operator is not able to get to (Patier, 2004; Morana and Gonzalez-Feliu, 2009). In frequent collaboration cases, the approaches can be formalized by agreements. Another form of collaboration is the networks of transportation companies. Most of these networks involve small and medium companies. A network is presented as an association, although some of them assume the form of a cooperative company (Simonot and Roure, 2007). A more collaborative sharing approach is the open e-marketplace. This approach is based on an electronic information exchange system, where the transportation offer actors meet the transportation demand ones. The offer comes from transport companies, and the

demand can come from “loaders” or from transporters that do not have enough quantity of goods to transport in a particular area.

Information technologies’ module

Information is a central key of sharing. Without information sharing, the other levels of sharing cannot take place. In transport management, the role of ICT has been recently overviewed (Fabbe-Costes, 2007). Two types of information technologies are identified by the author: the transportation management modules, related to transportation planning, and the information exchange tools, that allow transportation to be integrated into the supply chain.

In logistics planning, decisions on the transportation network settings have a direct impact on the service quality but also on their costs. It is then important to adapt the transportation network to the economic, geographic, organisational and quality constraints (Crainic and Laporte, 1997; Wieberneit, 2008). In tactical and operational freight distribution planning, these questions are related to warehousing, transportation management, vehicle assignment and crew scheduling. The two last points derive from the two first, and take place after them. In research, both inventory and vehicle routing and scheduling problems are very popular, and several algorithms for multi-stage transportation systems have been proposed in recent surveys (Dullaert et al., 2007; Gonzalez-Feliu, 2009). Moreover, a periodic survey on operative software for vehicle routing management can be found in (Hall and Partyka, 2008).

In transportation planning and management, ICT play a crucial role, and are usually combined with optimisation modules in order to improve the performance of the different operations. A special attention has to be given to the main technologies which allow the freight transport operations to be included in the global supply chain of a product. Fabbe-Costes (2007) individuates three categories of IS, i.e. document exchange systems, communication systems and traceability systems. The document exchange systems ensure data exchange among actors and record several transactions, following several mediums, like the written transportation documents, the Electronic Data Interchange (EDI), or the web-EDI. Then, the communication systems ensure the enterprise flow’s work. Finally, the traceability systems are developed to find and follow freight movement. In this field, several standards are used, in general related to Radio Frequency Identification (RFID) or to classical reading systems (bar codes).

Information Systems	Technologies and Tools
<i>Document exchange systems</i>	Fax; Electronic Data Interchange tools (web-based or intranet-based); Internet
<i>Communication systems</i>	Onboard radio; onboard/portable terminals; Fixed phone; Mobile phone; Internet; Multifunction portable terminals
<i>Traceability Systems</i>	Identification/codification (bar codes, RFID); Electronic readings; Waymarks; Vocal systems; Recorders; Memory systems

Table 1: Information systems and technologies in supply chain (Fabbe-Costes, 2007)

COLLABORATIVE SHARING APPROACHES FOCUS

We have outlined the main organisational aspects in collaborative transportation sharing. These approaches need the collaboration of different actors, each of them having their own strategies, targets and processes. It should be noted that the works of Laudon and Laudon (2001) follow an enterprise's perspective, not those of a reasoning community. To introduce the different socio-economic and legislative factors that are related to collaborative sharing, we propose a conceptual model for sharing analysis based on those of Lambert et al. (2004) and Lambert (2008), including several elements of group reasoning to logistics partnership models.

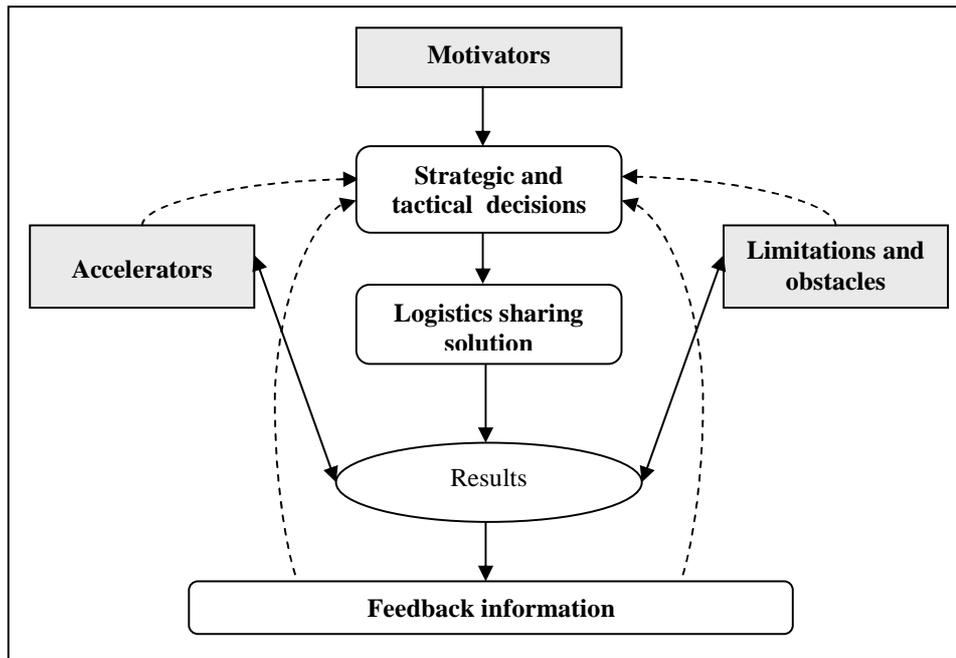


Figure 2: Conceptual model for sharing analysis in freight distribution planning and system design

In order to illustrate the model, we have done a comparative analysis of 18 logistics sharing communities, at different levels. The data used for this analysis has been obtained from various sources. Most of the feedback experiences have been identified in research reports and other scientific documents (Patier, 2004; Simonot and Roure, 2007; TL&Associés and LET, 2009; Semet et al., 2009). We have extracted the information about sharing approaches filling in the missing elements with information found in technical documents and professional logistics articles. Four cases are obtained from only technical and professional information, with no direct relation to a scientific study, and nine have been done by face-to-face interviews with logistics and sustainable development managers involved in the project. This has provided information about the capacities and the adaptability competencies of each member of the corresponding LSC, and the motivations and decision processes in the analysis and development of logistics sharing solutions.

Num.	Type	Description	State
E1	Transportation	Two concurrent logistics services companies made a	Demand

	agreement	transportation sharing agreement to avoid empty returns	changed
E2	Production platform sharing	Three concurrent automotive industry groups made almost identical models with the same patterns in the same factory	Strategies changed
E3	Shared warehouse and distribution	Two concurrent tyre brands built a particular shared warehouse to optimise the distribution operations by using the same transport operator	Operative
E4	Shared VMI	Shared VMI between a cleaning products international group and a healthcare industry international group	Operative
E5	Shared VMI	Shared VMI among non competing food industry companies	Operative
E6	Classical VMI	A grocery distribution group developed a VMI approach with several furnishers and collaborators	Operative
E7	Collaborative warehouse	First case of collaborative warehouses in the food industry (two non competing companies)	Simulation
E8	Transportation agreement	Two non competing fresh food industry small enterprises developed a mutual transportation and representation strategy, sharing vehicles and salespeople	Operative
E9	Transportation agreement	Three competing fresh food transportation companies collaborated to increase their vehicle's loading rates, developing several sharing approaches	Changed. Partners' fusion
E10	Network	Network of small and medium French transportation enterprises	Operative
E11	Network	Network of LTL transportation enterprises in France	Operative
E12	Consortium	Last mile distribution system based on a urban consolidation centre and a consortium of transportation companies	Operative
E13	Consortium	Collaborative last-mile transportation sharing approach for small and medium transportation companies	Partner's search
E14	Agreement	Printing and logistic chain solutions for two competing newspaper publishing companies in The Netherlands	Operative
E15	Agreement	A newspaper distribution company made collaboration agreements with book editors to increase their loading rates	Operative
E16	Network	Closed e-marketplace (network with membership fees and entry conditions) for overseas transportation	Operative
E17	Open marketplace	Open e-marketplace for national road transportation	Non efficient
E18	Classical VMI	A chain of supermarkets developed an inventory management system close to a classical VMI with several furnishers	Operative

Table 2: Description of the 18 cases

In terms of sharing management (see details in above paragraph), we have considered four VMI cases (E4, E5, E6, E18), three different transportation sharing agreements (E1, E8, E9), five transportation networks and consortiums (E10, E11, E12, E13, E16), four cases of shared logistics platforms with mutual usage of distribution systems to retailers (E2, E3, E7, E15), one open e-marketplace (E17) and two non-transportation based collaboration agreements (E14, E15). We present first the main categories of motivators, then, we study both the facilitators and limitations. Finally, the economic and environmental performance feedbacks are presented.

Motivators

The motivators are the factors that incite the development of a sharing approach. These factors are defined from the socio-economic and legislative context of the practices. More exactly, we can distinguish the following groups of motivators:

1. *Economic, environmental and value motivators.* Although the economic efficiency is the strongest motivators found in the experiences reported, other elements are also considered, usually related to the prestige of the partners. Therefore, collaboration among transportation operators is chosen as a cost optimisation approach when the favourable conditions are met. The two main reasons of vehicle sharing are related to the increase of the loading rates (E1 to E11, E14 to E18). Urban logistics measures are related to environmental aspects, from which CO₂ reduction is more important than the other environmental aims (E6, E7, E8, E12, E13, E15). Also quality is considered as important, but is in general seen as a feedback indicator that motivates new developments for logistics sharing services. For example, the main results of exploratory collaborations (E5 and E9) led to the research of new partners to start bigger partnership-based sharing services. In the same way, the transportation networks and consortiums (E10 to E13) have followed evolutions inciting collaboration among their partners.
2. *Legislative motivators.* Normative and jurisprudence aspects of sharing are related to public administrations. Nowadays, the most important facilitators in this category are the different local laws that help the development of sharing approaches in urban and regional freight transportation (Dablanc, 2008). We observe two types of policies: restrictions to non-sharing approaches and incentives to sharing approaches. We can find in these categories the access permits of Genova (Italy) and Amsterdam (The Netherlands), restrictions based on minimum loading factors of the vehicles or their CO₂ emissions in Padova and Bologna (Italy) or the reduction of restrictions to sharing-promoting transportation systems in Ferrara (Italy). More restrictive policies are those of the Principality of Monaco or Vicenza (Italy), where only one operator is allowed to access the limited traffic zone, imposing transportation sharing to the other actors in urban logistics. These questions are observed on four cases (E8, E12, E13 and E15).
3. *Relation motivators.* When actors have already collaborated, because of common interests (this is the case of the small transportation operators that led to E10 and E11, as well as some of the participating operators of E12 and E15) or because they belong to the same supply chain, so they are complementary (E4 to E6, E8, E15 and E18), transportation sharing is more naturally taken into account than in cases where those conditions are not met. Moreover, non-concurrent or complementary enterprises are more concerned to these types of approaches in absence of legislative or financial motivators.
4. *Financial motivators.* They are related to subventions and financial help that can come from public, private or mixed entities. Several approaches have emerged from research and innovation projects financed (totally or partially) by public entities (E4, E7, E12, E13).

Facilitators

The facilitators are the conditions and situations that have a positive impact on the daily operations of a sharing approach. They are similar to those of collaboration and logistics partnerships (Lambert et al., 2004; Lambert, 2008). These factors are not only related to the logistics organisation but also to the evolution of the strategic planning relations between sharing partners. A history of relations between two actors can facilitate a durable partnership. For example, most transportation networks are born from a small group of “friendly” companies, who have collaborated or started cordial relations (E10, E11, E12, E16). Shared VMI approaches are related to grocery distribution, and have a central distribution company that organises the supply system for their collaborators. In general, a project where partners already had good relations has positive results in terms of collaboration management.

The boundary between the motivators and the facilitators is not always clear. However, we can distinguish these two categories by the fact that the motivators have an impact on the strategic decisions before the project is operative, and the facilitators have impacts which are observed at the operational level for a given sharing approach.

Limitations and obstacles

Closely related to the facilitators, the limitations and obstacles are those factors that can become an impediment to the successful development of a logistics sharing approach. and in preceding studies they have not been defined explicitly. We can find several types of limitations and obstacles, which can be grouped into the following categories:

1. *Legislation.* Restrictive legislation to sharing approaches is legislation that is related to freight compatibility, i.e. the norms and laws that forbid the loading of a vehicle with products of different sorts (for example dangerous goods, fresh food, waste, raw materials, etc.) or to competition laws that can limit the development of sharing approaches (E8, E9, E15).
2. *Organisation.* In this category we find the physical and organisational conditions for freight compatibility, like dimensions, freight, type of packaging, loading unit and loading operations main characteristics. Another organisational factor is the acceptability of the sharing approach, which also has to be taken into account when defining the main characteristics of the collaboration for logistics sharing (E3, E7, E8, E15).
3. *Confidentiality.* The main issues related to confidentiality that can become an obstacle to logistics sharing are when two competing actors decide to collaborate in a distribution system that implies sharing some of their logistics resources. Since information is the base of good collaboration, if one or more partners manage confidential information that they don't want to share for competition reasons, the efficiency of the sharing approach can decrease considerably. These issues are seen in most of the initiatives involving competing enterprises that do not have the support of public entities (E1, E3).
4. *Responsibility.* The factors related to the transportation operation's responsibility are strictly derived from the contract between the different actors of these operations. If the collaborations for logistics sharing follow a contract or a chart where the questions of responsibility are well defined, these questions will not constitute an obstacle to sharing. On the other hand, if these questions are not clearly specified in a contractual document,

legal disputes related to responsibility can easily occur or the quality of service decreases because of these questions (E17).

Case study: the press distribution in France

From the detailed experiences, we observe that sharing approaches are mainly developed as an answer to economic performance questions, and are related to motivating contexts. Only a few of them show that environmental performance is an important evaluation factor. Open marketplaces do not present very positive results, because of the responsibility transfer aspects. We observe that most of the detailed experiences present an important information sharing system, but only the transportation networks and some agreements involve more than one transportation operator. Only four of them present an important platform sharing approach based on collaboration. These results are related to facilitators and limitations. Sharing approaches among complementary actors seem to be easier to implement than those that involve competing companies. However, these approaches come about due to economic factors that incite their development and effectiveness.

Another important question is the evolution of the sharing approach. In networks and agreements involving two or more transportation operators, if sharing is giving very good results, we observe two types of evolutions. One is the reinforcement of the network or the creation of strong partnerships. The second possible evolution is the union of the sharing partners into a group to optimize their overall resources and give a better service to their customers. We present the main results of a case study research for the biggest press distribution company in France. This is a qualitative study. We will present the main results of the organisational model, whose methodology and extended results can be found in a recent study (Morana and Gonzalez-Feliu, 2009), and complete the study by an analysis of the logistics sharing approach using the conceptual model presented above.

The press distribution in France: general context

The press distribution sector is experiencing decreasing trends in sales and distribution flows, because of internet information sources and the free press. These factors have a repercussion in the distribution system. In France, there are only two distribution companies for classical press, i.e., written press excluding free journals, which are not real competitors (the competition exists at the editor level, but not in terms of distribution costs). Moreover, they are already collaborating in non-Parisian areas. The specifics of the metropolitan region of Paris, which represents approximately 1/4 of the total population of France (overseas territories not included), justify the usage of separate distribution systems for each of the two distribution companies. The distribution system is based on intermediary platforms for storage and consolidation. Moreover, two different types of products are managed: daily press, which has very tight time constraints, and magazines, which can be managed with less restrictive time limitations. Another important characteristic of press distribution is the variability of magazines' quantities to distribute, which make the transportation demand difficult to estimate. Therefore, the last mile distribution system is rigid and based on small transportation operators, to ensure a personal contact with selling points, that can need to give a key to the vehicle driver because of the distribution period (from 2:00 a.m. to 6:00 a.m.) and the risks of having the freight stolen.

Company's overview

The case study deals with the Presstalis group, an action-based company that delivers 80% of the traditional press distribution in France. The main activities of the company deal with the logistics planning and organisation for all the distribution and reverse supply chains of the written press, excluding the free press distribution, whose supply chains differs from those of the traditional written press. The company's key information is summarised in the following table:

Key information	
2008 Turnover	2560 M €
2007 Turnover	2677 M €
3000 employees in 2008	
2.5 millions customers per day	
Presstalis distributed products sells (end 2008)	
-	Global sales : 1235 million units (2560 million euros)
-	Unsold rate/ (49.9% value)
-	Sales in overseas France = 1.1 % of the global sales
-	Export sales (100 countries) = 8.9% of the global sales

Table 3: Summary of Presstalis' key information.

In 1994, because of a constant decrease of the traditional press in France, Presstalis started to consider a set of strategies projecting in a ten year horizon to modernise their company and increase the efficiency of its distribution system. From this perspective, Presstalis invested in a new collaborative transportation sharing solution project, constituting a mixed group including logistics operators, software developing companies, research centres and consultants, with a double aim (1) to optimise their 'land logistics' (press depots and warehouses) and (2) to find new products to distribute, in a transportation sharing perspective. The case study presents the preliminary phase of the project, as well as its current state.

Organisational model results. Qualitative analyses on 9 months (January-September 2009)

We will present the most significant results of the qualitative analysis made on the basis of a directive interview plus two site visits, and concluded by a small interview at the end of the period (September 2009) with those responsible for the project in order to have feedback on the recent developments, like the partner research phase and the last organisational advances in the collaborative logistics sharing platform.

The logistics chain of Presstalis (*sharing management module*) is similar to that of the other French press distribution groups, and can be divided into two macro-echelons: the inbound distribution (from the publishers' printing platforms to the press depots), and the outbound distribution (from the depots to the retailing activities selling the distributed products). Presstalis had in 2009 about 172 press depots and 30000 selling points. The inbound distribution presents a more flexible transportation demand than the outbound distribution; inbound flows are contracted

each day and well optimised, because consolidation and rationalisation is possible. However, this is not possible for the outbound flows, because of the retailer's constraints and Presstalis quality control settings.

One of the goals of the shared platform is to reduce the number of storage and consolidation platforms that will in turn reduce the number of echelons in each category of distribution flows; by including other categories of products in the outbound distribution. Doing this, Presstalis can find two questions to answer: the first is in respect of the constraints specific to the written press distribution, and the second is the security of the products that can cohabit with the written press. These two questions are crucial to find the categories of products that can be compatible with written press distribution. A first study identified several categories, like books, catalogues, stationery products, collectibles, CDs, and DVDs, and a deeper compatibility study started in September 2009. The chosen system is based on bilateral partnerships first, with the aim of constituting a small transportation consortium and finding regular customers that ensure the minimum freight volumes to justify a sharing approach like this. More specifically, the chosen system is a hybrid model that mixes a VMI solution with a consortium of transporters. The VMI solution has already been defined, and the consortium of transporters is in a development phase. Presstalis can be compared to a logistics operator without vehicles under direct ownership. For this reason, the initial consortium will include the current Presstalis transportation operators and two other parcel operators that are specialised in urban distribution.

Currently, Presstalis does not have very expansive technological information systems. This choice derives from the outbound distribution system's rigidity as well as from the low value of the written press products. Indeed, the network design and transportation planning tools for the last mile are commercial software programs. The transportation plans are established for a given period (in general, 6 months), and do not change unless under unexpected or urgent constraints, as for example the presence of special events or the addition of a new publishing company. The inbound distribution system is more flexible, and a personalised software, developed by an internal service, was chosen. These transportation plans are established every day and can be easily modified. The company is equipped with standard communication technologies (mobile phone for the terminal-vehicle communication, e-mail and fax for the transportation plans exchanges), because no more complex systems are required for non high-value products, which is the case of the written press. Moreover, the standard barcode system is used for freight traceability, as well as for managing the pickup and delivery transactions. The current technologies used by Presstalis can become an obstacle to the introduction of other products; if more strict follow-up constrained freight is transported, barcodes are not enough to ensure a correct follow-up, and RFID solutions will have to replace the current traceability systems, leading to changes that need a large monetary contribution. Depots are managed manually and few automation systems are used. Moreover, the EDI standard is not considered, since the transportation operators for the inbound distribution accept the commands made by fax and the outbound distribution system is based on medium and long term agreements with a rigid routing plan for each transportation operator. However, a SAP technology is in a pre-implementation phase to improve the warehousing performance, and is partnered with Presstalis' warehouses and their own and associated press depots.

The organisation module defines the different actors in Presstalis' LSC. We observe two types of members: Presstalis' internal actors, who are those related to the echelons of both distribution systems and their sub-contractors, i.e., their contracted transporters, the logistics platforms managers and employees, the press depots operators, Presstalis' partners, and their current collaborators. These actors are not enough to maintain an efficient sharing system (the loading rates are still too low to reach Presstalis' performance targets), so new collaborators will have to be found. Four transportation operators have given a tentative agreement to implement a sharing system based on a consortium, and new potential customers are being looked at. These operators are environmentally-friendly last mile transporters, who deal with potentially compatible products with respect to Presstalis' distribution system. Since their goals are similar, agreements can be stated, but not all the freight will be shared. In the partner research phase, also the juridical and regulation aspects of sharing are studied. The public administration systems are also an important party because lawful standards depend on these entities, and their implication can have non negligible impacts to the acceptability of potential LSC members to enter the reasoning community. Finally, the potential customers, i.e., the "loaders" and logistics operators that can contribute to the community by bringing transportation demand, will be sought after the basic version of the sharing virtual platform is tested.

Sharing is considered a good solution because of the system rigidity during the press distribution period, and the possibility to deliver other products after the last selling point has been visited. The risks of this approach have to be considered, and a proposed sharing distribution system has to be developed. To do this, the main tactical decisions have to be spelled out, then, using the analysis model, the main strategic decisions can be defined. Moreover, considering that the project is in a development phase (the completion is less than 1/3 of the total respectful of the initial planning), the performance evaluation indicators are starting to be defined. Two main groups of indicators will be taken into account: first, the economic sustainability of the proposed solution will be tested, then, in order to evaluate its environmental performance, a comparison between different situations will lead to an analysis on the effects of the proposed solution on CO₂ reduction. The other pollutants and the noise nuisances will not be initially estimated.

Logistics sharing analysis

After presenting the main organisational aspects, a first analysis of the logistics sharing is proposed to link the logistics organisational model to group reasoning theory. Based on this analysis, a conceptual model is deduced. If we focus on the collaborative logistics sharing motivators, we observe that the context of the press distribution had an important influence on the decision to consider collaborative sharing. The rigidity of the current system and the economic and environmental factors motivated the development of a sharing approach (the economic efficiency has to be increased to maintain the current distribution costs or reduce them, and the environmental efficiency is important to improve the company's popularity and quality), and to find the potential collaborators for a collaborative sharing platform. A high-quality internal organisation and a good relation with partners is necessary to ensure system operability. For these reasons, a preliminary study of the partners has been made. The chosen partners are enterprises that were already important collaborators with the distribution company or had similar and non contradictory aims in a potential sharing approach. These collaborators have in general similar interests, but a dialogue and debating phase is necessary before a "principle of agreement" can be

established. Moreover, these actors must be able to collaborate in the different planning horizons. The sharing approach design has been developed by the press distribution company and the partners have been chosen on the basis of their adaptability and compatibility with respect to this system. In this way, the main limitations and obstacles are able to be avoided. However, some legislation questions, specific to competition rights and to responsibility transfers, are under deliberation and analysis because they are considered the main obstacles to the system. These limitations are also considered in the risk analysis.

The first results are good but not enough to ensure a better control over transport demands. However, they show that the developed approach can be efficient and could be extended to a bigger consortium. The main results are used to redefine some details of the main strategies and to focus on questions not initially taken into account, such as specific legislative questions, and the potential of other freight categories such as packaged non-fresh food, small electronic products, software and tobacco derivatives, among others, to be considered.

A crucial question has however, to be solved: the management of the logistics sharing virtual platform, and in consequence that of the LSC. The community manager needs to mediate between the parties, without having a predominant or a discriminative attitude toward one or more members. This figure, that is starting to be defined, can have a significant influence on the other members, and constitute both a facilitator and an obstacle.

In order to summarise the proposed results, we propose a conceptual model that summarises and connects the organisational model and the sharing analysis factors in the context of a sharing community. It can be illustrated in the following chart:

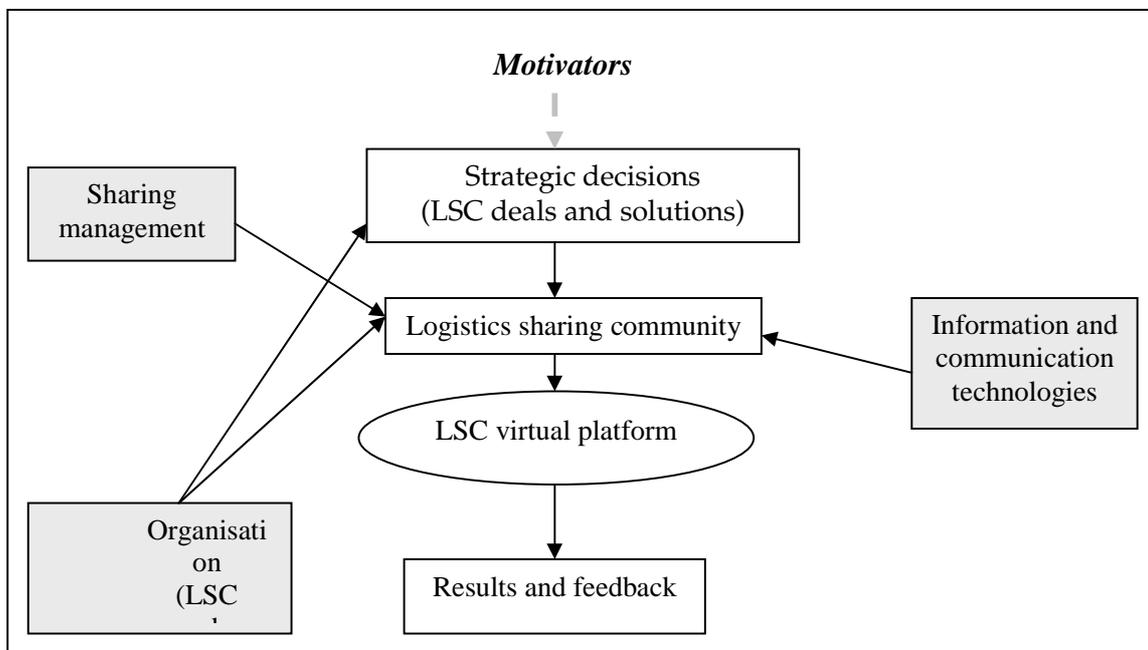


Figure 3: Logistics sharing community decision processes. The shadowed blocs indicate that they can affect the LSC as a facilitator or an obstacle

The relations are similar to those of the organisational model based on the work of Laudon and Laudon (2007), but have taken into account the differences in the decision processes between a reasoning community and an individual decision maker. In addition to the former organisational model, this one introduces the socio-economic elements and proposes a first relation schema between the logistics concepts and the collaborative decision making notions.

Strategic decisions are influenced by the motivators as we have seen above. The main difference between this model and that of Laudon and Laudon (2007) is that strategic decisions follow three phases: first, individual strategic decisions are made, followed by a contribution of each member to the community strategic decision process; finally, after a collaborative discussion process, group decisions can be stated.

The three shadowed blocs (organisation, sharing management and information and communication technologies) constitute both the tactical decisions and the main facilitators and obstacles to collaborative transportation sharing. The two last modules are quite similar to those explained in the organisational aspects' conceptual analysis. From the case study (Eisenhardt, 1989), we can reformulate the organisation module as follows. First, the different actors of the sharing approach have to be identified, and their relation to the LSC defined (members, collaborators, regulators, etc.) in order to define the reasoning community dealing with sharing management and planning and the extended reasoning group, including the involved authorities (legislation and regulation). These actors have already been defined as well as their contributions by either facilitating or slowing down the collaboration among members of the community. Each actor's individual decisions will have an impact on the argumentation phase of the group decision stage. From these decisions and the derived actions, the main facilitators and obstacles to group reasoning can be identified. The impacts of these factors have a repercussion on the logistics sharing community decisions and on the ability to reach agreements and equilibriums. Then, indirectly, they have an impact on the performance of the sharing approach as well as on tactical and strategic decisions.

As we have seen, collaborative transportation sharing involves different actors and cannot be analysed using only the enterprise's perspective, like in classical supply chain management. The introduction of group reasoning and collaborative decision making can constitute an important research direction in logistics, more precisely by developing collaborative decision support systems for logistics sharing communities.

CONCLUSIONS, STAKES AND FUTURE DEVELOPMENTS

Logistics sharing is becoming a popular approach to reduce the distribution costs of a product. However, the subject has not been deeply studied in the literature. In this chapter, we presented the main concepts of logistics sharing in the freight distribution sector, focusing on collaborating transportation-based sharing approaches. We presented both an organisational model for the development of a sharing-based information systems and an analysis model for its strategic decisions, defining the categories of factors that can have an impact on them.

A collaborative sharing approach must pass through an efficient information sharing system. In this perspective, several aspects have to be considered in the different planning horizons. The

tactical decisions deal with technologies and planning tools, with sharing management and with the possible actors of the sharing-based supply chain, both at internal and external levels. The strategic decisions consider the possible tactical choices to define the main objectives and define the sharing solutions to develop, considering also the risks of these choices.

The factors that influence strategic decisions can be grouped into three categories. First of all, the motivators, i.e. the reasons that incite the actors to collaborate in logistics sharing solutions. Then, the facilitators and the limitations and obstacles, which have an impact on the evolution of a conceived sharing service.

Several requirements can be deduced from the presented models and examples of logistics sharing approaches. The first is to consider the transportation field explicitly in the supply chain management methods, providing multidisciplinary research that includes system engineering, information science, economy, management, sociology and decision sciences, among others. In this sense, group decision theory becomes a field of investigation that can produce interesting results for logistics sharing management decision support. The second requirement, for the logistics strategic decision makers of enterprises, is to make a preliminary analysis of the factors having an impact on the main decisions in order to choose the best approach to meet their goals. Third, for managers, to identify the external factors facilitating and limiting the logistics sharing solution in order to better assure its performance. Finally, the public decision makers have to consider the legislation that can have a positive or negative impact on the development of collaborative sharing services for freight distribution in respect of the market and the competition rules of the current macroeconomic context.

However, this field is yet to be studied thoroughly and this work remains exploratory, aiming to establish standards and patterns to support logistics sharing decision making. New variables will appear with the development of sharing management and planning. Moreover, a measurement scale will be implemented to facilitate the evaluation and the strategic decision support. An extrapolation of the proposed models from (and to) other fields has to be considered to generalise and enhance them to other applications of sharing and collaboration. Finally, collaborative decision making methods, like collaborative multicriteria analysis, and group reasoning approaches, like argumentation models, can be applied to logistics sharing communities to build specific decision support systems for these collaborative approaches in logistics and transportation.

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Collaborative transportation, case study, sustainable development, reasoning communities, decision analysis, information system.