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ABSTRACT

Experimentations and innovations flourish in France that involve a container barge transport (CBT) as the main leg for urban distribution of goods. Based on the study of existing chains, the paper shows how coordination issues are actually managed by CBT stakeholders. With the help of Transaction Costs Economics, the paper shows that coordination and pooling issues lead CBT stakeholders to adopt hierarchical or hybrid governance structures to build regular inland shipping line. Based on this result, several examples are used to identify the economic and organizational conditions of river logistics in urban area.

KEYWORDS

Urban river logistics; coordination; governance structure; transaction costs economics

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Urban freight transport is becoming nowadays a more and more complex matter. Mainly achieved through road haulage, urban freight transport suffers from increasing traffic jams that raise significantly its – private and social – costs (Henscher and Pucket, 2005). Public authorities and private companies are looking for alternate solutions (Debah, 2010). In France, stakeholders are turning to inland river transport, as this underused mode of transport can easily reach French main cities' heart with less CO2 emissions (TL & Associés, 2006). Experimentations and innovations flourish that involve a container barge transport (CBT) as the main leg for urban distribution of goods (Kreutzberger, 2003; Wiegmans, 2005; Wiegmans and Konings, 2007; EICB/BVB, 2009; Gort, 2009; Van Hassel and Vanelslander, 2011), as can be illustrated in France with companies such as Point P, Auchan or Franprix. But many obstacles remain impeding the development of this kind of solution in urban areas. In particular, transaction costs are supported by agents willing to use it (Brooks *et al.*, 2012). Indeed, the complexity of barging logistics raises coordination issues and transaction costs (Fischman and Lendjel, 2012) that affect the decision making process of both shippers and carriers.

In continuation of previous works (Panayides, 2002 ; De Langen *et al.*, 2006 ; Van der Horst and De Langen, 2008 ; Franc and Van der Horst, 2010; Fischman and Lendjel, 2011), a neo-institutional approach (Williamson, 1996) of CBT was chosen to understand how these issues are dealt with. Transaction cost economics is a useful tool to tackle with coordination problems, to explain actual governance structures (market, hybrid, hierarchy) and strategies of firms to control this transaction chain. Few studies address the conditions of development of

urban river logistics in France, despite the growing concern of environmental and congestion costs. The paper aims to show that coordination issues raised by urban river logistics can only be supported by integrated or quasi-integrated governance structures, as observed for freight forwarders (Saeed, 2013).

Thus, section 1 starts with the characteristics (nature, perimeter, main features) of the transaction of CBT. Section 2 deals with observed governance structures of CBT chains in France. According to Williamson (1996) remediableness criterion, the observed governance structure of a given transaction is presumed efficient and aligned to its attributes. We point out that the need for control explains the features of the observed structures on the Seine and Rhone rivers. Taking into account the existing governance structures of CBT chains, the last section (Section 3) discusses the organizational and transactional conditions that should meet any urban river logistics in French main cities.

1. Definition and perimeter of the CBT transaction chain

According to Williamson, 'transaction occurs when a good or service is transferred across a technologically separable interface' (Williamson, 1996, p. 58). Here, the transaction at stake (CBT) is to transfer a service of transport, so that a container can be moved from one port to another during a given time. A container is a standardized intermodal unit load device (usually 20 or 40 feet long) designed to carry all different goods on the same vector and to be used repeatedly. The advantage of the container is to standardize all handling operations and transport. Thus, it reduces the unit cost of transportation and handling thanks to economies of scale and scope, but also thanks to diminishing transaction costs, since the transaction itself becomes standardized. With these lower costs, volume and frequency of transactions may increase. The standardization of the container supports the positive effects (aggregation economics) of market governance (Lendjel and Fischman, 2011).

The container revolutionized the way we think about transportation because, somehow, goods are not moved anymore, but their container, whether empty or full. It helps to de-specify the assets involved because it is no longer necessary to have ships and handling equipment dedicated to each product category. This revolution led to the industrialization of the transaction chain, especially in the river link. At the organizational level, this means the commissioning of a liner service, with a given routing schedule of a fleet (fleet size, vessel size, fleet mix), a given number of port calls with a given frequency of departures, etc. (Notteboom, 2006). Hence, unlike tramping, the high frequency and the regularity of transactions across the CBT chain supports hierarchical types of governance structures, especially when highly specific assets are involved.

The provision of a container is a sub-transaction prior to the transaction of CBT. Yet, even though it is essential, this sub-transaction remains peripheral since the container is a loading unit of maritime origin. CBT can, therefore, be considered as a sub-transaction of the container transport's transaction. If the master link in the transaction chain is maritime, inland waterway transport then appears as a "terrestrial" extension of a maritime transport[1]. Then, the freight forwarder or the shipping company have usually the commercial function to fill containers, to position them at the customer's warehouse or even to organize their stuffing/stripping in the case of grouping. A specific extraction from the ECHO[2] national survey database (realized by the INRETS in 2004) shows that 100% of the 23 CBT shipments

[1] Note that it could be part of the transaction's perimeter when CBT becomes independent of the maritime chain as it is on the Rhine (Zurbach, 2005).

[2] ECHO ("Envois - CHargeurs- Opérateurs de transport") is a national survey designed to understand shipper's practices and whose measurement unit is the shipment sent by a shipper (Guilbault *et al.*, 2008).

found in the survey (from a total of 10 462 shipments involved in the survey) are outsourced and involved at least three operators. In other transport chains, only 7% of the shipments – parcels excluded – require at least three operators (Guilbault *et al*., 2008, p. 108; Bréhier *et al.*, 2009, p. 8). Hence, the CBT is usually more complex to organize than the other (often smaller) transport chains.

The CBT transactional chain includes at least six sub-transactions (ST).

- ST 1 is the transfer of organisation and coordination of a container transport by the shipper to an economic unit (usually different from the shipper, corresponding to the missions of a freight forwarder, but can be performed by a shipping company).
- ST 2 is the transfer of the rights to use a transport capacity between the transport organiser and the owner of barges (or of slots) or of containers.
- ST 3 is the transfer of the CBT service to provide quay to quay, from the transport organiser to the CBT economic unit. This sub-transaction is itself likely to be split in two: the CBT itself and the barge propulsion by a pusher-tug and a crew.
- ST 4 is the transfer of the service of cargo loading on barges between the transport organiser (often the shipping company) and the handling company at the departure quay.
- ST 5 is the transfer of the service of cargo unloading from barges between the transport organiser (often the shipping company) and the arrival quay handling company.
- ST 6 is the transfer of pre- and end-road haulage services between the transport organizer and road haulage operators.

Each of these sub-transactions includes many sub-sub-transactions. Handling operations (loading/unloading containers, managing containers at quaysides) are in themselves a complex ST set, even more so now that the container revolution has taken place. Indeed, the terminal operator must be able to implement the vessel-loading plan sent by the shipping line operator. Thus, the former has to face several external constraints to comply with container handling procedures, with a precise order of loading/unloading containers and, therefore, with onshore containers pre-arrangements (*cf.* Zhao and Goodchild, 2010). He also faces his own constraints (minimal number of container movements, optimisation of available space, management of human and material resources, and so on) to comply with loading plans (Galbrun and Le Du, 2007). Though interdependent, the container loading/unloading ST is sometimes dissociated from quay container handling ST. As for container inland navigation operation itself, it is likely split into the CBT operation and the barge propulsion by a pusher-tug, the latter being sometime divided in two parts: the availability of a crew and the provisions of a pusher-tug. Other STs may occur when local pushers (or harbour pusher-tug) move barges in a port, whereas power pusher-tugs make convoys of lashed barges for long hauls between ports. Thus, although it appears to be simple, the CBT transaction is actually quite complex (Figure 1).

Insert figure 1

According to a well-known mechanism, expanding demand by container standardization leads to the segmentation of the barge transport transaction into an increasing number of sub-transactions. Nevertheless, the actual number of governance structures framing these sub-transactions is surprisingly reduced compared to what is theoretically possible.

2. Governance structures of French CBT chains

As Williamson stated: ‘the critical dimensions for describing alternative modes of governance (…) are incentive intensity (…), administrative command and control (…), and

contract law regime (…)' (Williamson, 2010, p. 681). Following this typology, structures governing first- and second-level sub-transactions in French CBTs have to be assessed.

First level sub-transactions

The first point to consider is the theoretical number of combinations of governance structures permitted by the transactional chain of the river transport of containers. Considering that each of the six sub-transactions (if the river interconnection service is excluded as public service) may be achieved by at least three governance structures (spot market, hybrid or long-term contract, hierarchy), the decision tree includes a set of 729 possible combinations ($3^6 = 729$) of governance structures for this transactional chain (Williamson, 2010). The longer the chain, the bigger the set of possible combinations[3]. This exponential character of the economic complexity of the chain contrasts sharply with the very limited number of combinations (six) observed in the river transport of containers in France. If an inventory of these chains has already been done (Zurbach, 2005; IAU, 2008; VNF, 2009; Frémont *et al.*, 2009), their typology and their understanding in the insights of transactional analysis has still to be done for the French basins.

Among the six services observed on the Seine river between Le Havre and Paris (Fluviofeeder, Logiseine, Maersk, MSC, RSC/Greenmodal, SNTC Carline) and the two (Logirhône, RSC/Greenmodal) existing on the Rhône-Saône river basin, four services are really provided by barge operators, Maersk and MSC contracting with Logiseine to chart Logiseine's barges (VNF, 2009). The governance structures of CBT operators on the Seine and the Rhône are all integrated or quasi-integrated:

- Fluviofeeder is a subsidiary of Marfret shipping company. In a partnership with MSC, Fluviofeeder provides a regular line between Le Havre and Rouen. Here, the vertical integration involves transport capacity (ST 2) and CBT quay to quay only (ST 3).
- Logiseine, CBT operator, is a kind of joint venture ('*Société en nom collectif*') associating terminal operators at both ends of the service (*Terminaux de Normandie*, in Le Havre, and *Paris Terminal S.A.*, in the Port Autonome of Paris-Gennevilliers) and CFT (*Compagnie Fluviale des Transports*) barge operator. The transaction chain integration is quite complete here, from forwarder to handling operations. The withdrawal of PTSA from this joint venture in December 2006 doesn't mean a de-integration since TN and CFT are still owners of PTSA (IAU, 2008, p. 44). Henceforth, CFT owns 55% of Logiseine capital and TN 45%. Note that Logiseine owns floating cranes to handle its own operations if necessary and the operator owns 15% of the shares of the « Société d'Aménagement de l'Interface Terrestre du Havre » (SAITH) which runs the railway line between maritime terminal and quay of Europe dedicated inland terminals. The same strategy of quasi-integration is followed on the Rhône-Saône Basin by Logirhône.
- Maersk shipping line provides a carrier haulage service on the Seine river in the continuity of its maritime service. This is an example of vertical quasi-integration by a shipowner of the river link since Maersk charters transport capacity (barges and slots) to Logiseine with long-term charter contracts. Through Logiseine, Maersk also indirectly controls the barge handling in Le Havre and container's cartage.
- MSC shipping line has a similar strategy as Maersk. It charters transport capacity to Logiseine. But the partnership with Terminal of Normandie to operate on Bougainville

[3]Be n the number of elements in the subset of governance structures and p the number of transactions at stake, n^p is the total number of available combinations. Thus, if all the governance structures are taken into account (franchise, joint-venture, quasi-integration, long-term agreements, etc.), the number of possibilities increases more quickly.

terminal allows MSC to control barge handling more directly (but still in a hybrid manner) than Maersk does since this terminal is dedicated to barges too.

- The vertical integration is even stronger for the ship-owner CMA-CGM. Greemodal is its subsidiary dedicated to pre-and end-haulage which includes River Shuttle Containers (RSC) barge operator and LTI road-haulage company. GMP (Générale de Manutention Portuaire) terminal operator is a joint venture of CMA-CGM with DP World. GMP operates the dedicated barging terminal of Europe's quay and holds 35% of the capital of the SAITH's railways line in Le Havre. The same strategy is followed on the Rhône-Saône Basin.
- SNTC-CARLine operator is particularly interesting in the insight of neo-institutionalism since this company was created from a partnership between a shipper/ freight forwarder specialized in grains, Soufflet, an inland navigation cooperative, the SCAT, and a truck operator, STTI, member of a group of carriers ASTRE. Here is a form of horizontal cooperation between small or medium size companies to provide an integrated offer of carrier haulage services.

Strictly speaking, there isn't any arm's length transaction. Even when a barge operator has no specific agreement with a handling operator, its contract is usually settled on an annual basis even if it is proportional to the volume of containers handled. Hence, table 1 shows a systematic quasi-integration of the transaction chain by these eight operators, with six different modalities.

Insert table 1

Among the 48 sub-transactions, 63% have a hybrid governance structure and 21% are fully integrated (hierarchy). Hybrid modalities predominate when complete integration of the considered sub-transaction is not possible (lack of funds) or not wanted (for incentive reasons). Following Williamson 1996, the governance structure of a transaction is presumed aligned on its attributes: namely, asset specificity (*i.e.*, level of loss associated to alternate use of assets involved in the transaction, or redeployability's level of the asset), frequency (number of times a transaction occur in a given period), uncertainty (related to the environment of the transaction and to the behaviour of parties in condition of bilateral dependency). As regard CBT's sub-transactions, asset specificity and frequency are mostly determinant.

In ST1, both CFT's subsidiaries (Logiseine/Logirhône) are the only ones to perform the organization of the CBT with a market governance structure. The others intervene mostly in broader maritime chains within hybrid governance structures. This ST is part of the shipping line offer of door-to-door service that needs, as such, to be controlled by hybrid governance structures.

The transfer of rights to use a capacity (ST2) is supported logically by hybrid (5 over 8) and hierarchic (3 over 8) governance structures, due to the regularity and frequency of the ST at stake.

This is also the case for the ST3 where long-term contracts (50%) or hierarchy (50%) are governance structures necessary to provide a regular service, due to the frequency and the regularity of the ST at stake. Niérat (2012) shows that a self-propelled river container ship on the Rhône basin makes about 66 trips a year, with a rate of loaded trip of 99% and a fill rate expressed in TEUs of 72%. With four shuttles per week between Le Havre and Gennevilliers (IAU, 2008; VNF, 2009), Logiseine can't rely on spot transactions to purchase every week the human and physical assets (with more or less high degree of specificity) needed, except during peak activity to increase its capacity. It is the same for all the other operators due to the networked nature of this activity.

As regard ST4, hybrid governance structures (5 over 8) dominate on market governance structures (3 over 8) in maritime ports even though the latters are highly site-specific for inland navigation agents (Franc and Van der Horst, 2010). Inland quays must be located in the vicinity of maritime quays to minimize costs (in space and time) between the barge and containers. But using maritime quays is costly for barge transport operators (oversized equipment, random availability of the quay…) (Fischer *et al.*, 2003, p. 27) and advantageous for the terminal operators (higher rate of utilization of handling capacity). Barge operators are faced with the trade-offs between extra costs of maritime handling (but at the vicinity of inland quays) and additional costs of a dedicated handling quay with the related transfer of containers from inland to the maritime quays. That's the reason why long-term contracts dominate here.

ST5 offers a diversity of governance structures (3 markets, 4 hybrids, 1 hierarchy). Most often, barge operators are shareholders of inland terminal operator. Carrying containers entails dedicated assets from barge and terminal operators to reach high levels of productivity. Terminal operators need to dedicate specific cranes and engines (docks, gantry cranes, stacking straddle carrier, stacking space,..) to perform container handling for barges. Barge operators need specific barges designed to carry containers and dedicated terminals to load/unload them. This mutual dependency generates risks of under-investments and quasi-rent (Joskow, 1987; Klein, 1988). This concern is particularly high during the launching phase of a new service, as was the case on the Seine in 1994. A barge transport operator (Logiseine) and two terminal operators in Le Havre and in Gennevilliers (near Paris) have had to generate simultaneously large investments to start a regular line. If maritime ports can easily allocate part of their resources to barge calls (when free of container ship to be loaded/unloaded), this is not the case for inland ports which first need to invest. The large amount of required capital and its negative profitability in the short term explains why public port authorities are often involved during the launching phase of a CBT line. For instance, Paris Terminal SA, the inland public port operator, was a stakeholder of Logiseine barge operator at its very beginning. Based on Joskow (1987) and Klein (1988) we know that vertical integration is likely to occur when dedicated assets are involved in the transaction, in order to avoid hold-up risks associated to the quasi-rent at stake in dedicated investments.

100% of ST6's governance structures are hybrids, because long-term contracts are necessary to convince the road carrier to invest in "skeleton" trailers configured to carry containers. B. Kauffmann[4] tells that 'difficulty in starting the activity was that road carriers would not buy skeletal trailers; so we had to find artisans who were willing to invest, hence our commitment to these artisans'. Relationships with these carriers are structured by framework contracts, generally on annual basis (Eccles, 1981), but accompanied by spot contracts with "big doers" in case of necessity.

It is thus clear that, among the three dimensions described by Williamson (incentive intensity, administrative command and control, contract law regime), control strongly dominates the CBT chain. If the number of services can be explained by the amount of investments necessary to get network economies at the current level of demand, the limited number of governance structures chains observed here can be explained by the attributes of the sub-transactions composing that transaction chain. High frequency and regularity of transactions and the quite high degree of assets specificity may also explain that four barge operators only can be found in CBT on the Seine and Rhône rivers compared to almost 800 barge operators in bulk river transport (SOeS, 2012).

[4] Interview of Bruno Kauffmann, CFT's Commercial Director, the 6th of June, 2012.

Second level sub-transactions

Integration or quasi-integration also characterises second level sub-transactions (or sub-sub-transactions). It is not possible to describe here all the chains. But some phenomena are interesting in the light of transaction cost analysis. Let's note two contradictory movements in second rank sub-transactions. The sub-transactions in handling service tend to be integrated (following the trend observed in other big ports in the world) but those in barge transport itself follow a segmentation process and an increasing outsourcing trend.

In the sub-transactions in handling service, the integration to control human assets (dockers first, then cranes drivers) has been done while market (*via* the dockers' intermittence system) prevailed before the reforms in 1992 and 2008 of the docker's status[5]. It aims to integrate dockers in handling operator companies and thus to promote hierarchical coordination activities (Galbrun and Le Du, 2007). The container revolution increased the specificity of stevedore's human capital. The stevedoring industry has changed due to the increasing technicality and capitalistic intensity necessary to handle containers. Hence, dock workers and cranes drivers have acquired a more technical specific knowledge and a higher degree of specificity. The intermittency associated with dock workers legal monopoly was justified by significant fluctuations of activity due to tramping (Cour des Comptes, 2006, Galbrun and Le Du, 2007). The container regular line development has deeply changed the frequency in handling and the degree of specificity of the assets used. A regular activity requires the regular attendance of qualified staff, which has also reinforced this high degree of specificity. Hence, a discrepancy arose between the governance structure (intermittency) based on an institutional environment and the attributes of the port handling transaction. The lobbying of the handling firms syndicate (UNIM) to change their institutional environment helped them to align governance structure and the container handling transaction attributes. Henceforth, handling operators have integrated cranes drivers and gantry workers in almost all the main maritime French ports (Revet, 2011, p. 26). But dockers' intermittency regime had advantages of flexibility and redeployment capacity that still can be seen in Antwerp today.

Regarding transport, an opposite movement can be observed. A bargeman, whether employee or not, accumulates knowledge - often informal - and skills about his boat, the river basin, the practices of loading / unloading in different ports (Fischman and Lendjel, 2011). Bargemen acquire a perfect knowledge of their navigation area and must rely on the knowledge of other bargemen when they venture on another waterway. When they do not own the boat, they accumulate experience and expertise on specific equipment (pushers and barges) they will not find elsewhere in another French company. As control of specific human and physical assets is needed, the barge operator CFT has no other choice but integration or quasi-integration. Meanwhile, CFT wants to have a more incentive device than hierarchy. Thus a singular hybrid structure (« Société En Participation ») is sometimes used for some of its pushers[6]. The SEP pools resources from each partner. CFT rents the physical asset (the pusher) and a small dedicated company (SARL) rents human resources (two crews of six people to secure a 24/24 driving each week). The SEP sells a pushing service per hour or kilometre (with a yearly contract) to CFT. Logiseine commercialises the capacity of transport on its barges and asks CFT to make the transport service. Thus, CFT sub-contracts the pushing service to the SEP. The SEP assumes earnings and operating expenses of the pusher so that each partner is directly involve in its operating income. Particularly, the structure incites the crew to take care of the equipment (a pusher is very expensive, which explains

[5] Law n° 92-496 of June 9, 1992 changing the work arrangements in maritime ports and Law n° 2008-660 of July 4, 2008 related to port reform

[6] Interview of S. Fortrye (CFT).

why CFT needs to be part of the SEP), its fuel consumption (main variable cost) and the service liability and punctuality. Nevertheless this hybrid governance structure (*i.e.* quasi-integration) is often used in road haulage (Fernandez *et al*. 1998) but relatively uncommon in river transport, even with CFT. In contrast, other more usual hybrid structures (regular sub-contracting, long term charter, barge transport pool, etc.) can be seen on the Rhine (Zurbach, 2005).

Given the governance structures currently governing the transaction of CBT and its sub-transactions, what governance structures are needed for urban river logistics?

3. Discussion: which governance for an urban river logistics?

Negative externalities generated by road haulage lead public and private decision-makers to turn their eyes towards more sustainable modes such as river transport, especially for urban logistics. Urban logistics, or the "art to convey in the best conditions the flow of goods entering, leaving and circulating in the city [...], can be up to 20% of overall transport cost" (Raynard, 2012, p. 1). It is mainly carried out by road, which is a source of significant environmental pollution, noise, accidents... Urban density, particularly in Paris and the Ile-de-France, and land value impose a strong constraint on the space dedicated to logistics. Urban final distribution has become a complex matter. Hence, supplying cities by barge should lead to better economic and environmental performances - especially if escaping at least partially the saturation of roads which penalizes road haulage in terms of reliability and cost became possible –. River transport is indeed a mass-scale mode of transport which achieves economies of scale and reduces negative externalities. The asset of penetrating to the heart of major French cities on non-congested roads is undeniable on paper. It remains to be seen how these assets can effectively meet the expectations of all stakeholders. In particular, how to combine the advantages of a mass-scale mode of transport with the growing importance of lean management and just-in-time in supply chain management (Guilbault *et al.*, 2008).

Two experiments to supply supermarkets are regularly cited as examples of sustainable urban logistics in Paris area: Monoprix's supply (achieved by its subsidiary Samada) that accesses by rail to the Halle Gabriel Lamé of Paris Bercy, on the one hand and more recently, on the other hand, Franprix's one (Casino Group subsidiary) that relies on the river port of la Bourdonnais, in Paris (Greenport, 2013). This last experiment started in September 2012 after two years of study and one year commercial engineering. Operated in partnership with Norbert Dentressangle (for road haulage) and SCAT (the barge operator), the service carries each day 26 containers by barge from the river port of Bonneuil-sur-Marne (94) to the quay of La Bourdonnais in the 7th arrondissement of Paris. Then, the containers are delivered by truck in 80 stores within a radius of 4 km. Another example comes from the delivery of parcels by Vert-Chez-Vous, a courier using green modes of transport, on the model of DHL in Amsterdam. Picks up and parcel deliveries in Paris are achieved with several electric tricycles which meet a barge at different points of loading/unloading docks along the Seine banks of Paris on a given schedule.

Those last examples help to identify the economic and organizational conditions of possibility of barging logistics in urban area:

1. Barging being a mass-scale mode, the volume of demand must reach the breakeven point on a regular basis, taking into account that it depends on many parameters (Beelen, 2011). For Franprix this minimal volume appears to be 26 containers per day, with a loading rate of 54% (total capacity is 48 containers).
2. Last kilometers have to be performed by road. Thus, barge and trucks rotations have to be synchronized. A sufficient number of trucks is scheduled to take delivery of containers from the barge serving as a floating warehouse.

3. Road transport being the most expensive, kilometers traveled by road should be minimized so as to maximize those of the waterway, following Palander's law of refraction (Aydalot, 1985, p. 24). Docking cost apart, this logic leads to multiply the number of calls of the barge so as to minimize ton-kilometers performed by trucks (or by bikes, as designed by Vert-Chez-Vous). But the importance of fixed costs in handling and the scarcity of river docks connected to the road are not compatible with the multiplication of these river access points. A solution developed by Steunpunt Goederenstromen (Gort, 2009) is to internalize the sub-transaction of handling by a "side loader gantry crane" installed on the barge that load and unload containers sideways. This solution has the advantage of reducing river ports' high degree of site-specific for logisticians.
4. The scarcity of available space on urban riverbanks involves a zero storage time of containers (or only reduced to time loading/unloading). The storage can then be done on a barge, or in a warehouse on a suburb river dock where land constraint is lower. When flows are regular but with unpredictable content and temporal specificity as in the case of Franprix, a warehouse on the outskirts of the town reduces the access time to the city center. In that case, Ports of Paris-Gennevilliers and Edouard Herriot (at Lyon) are well positioned, also because of their connections to maritime Ports. When flows are regular with predictable content, the location of the warehouse in a seaport connected to the river system reduces the number of transshipments (see Radicatel, for example, that offers a logistics area dedicated to river close to the port of Le Havre).
5. Finally, the total cost of the entire river logistics chain must be less than the cost of alternative schemes. If Franprix's supply chain cost by barge proves higher than that of a road scheme, as notes Stéphane Bonneton (driver of this innovation at Norbert Dentressangle), it is not the case if we include the marginal social cost. According to the calculations put forward by the company, this solution would remove 374 trucks from Parisian roads. The forthcoming probable introduction of congestion charging systems in major French cities should logically make a river-road scheme less expensive than any road scheme.

On a transactional level, the examples clearly reveal at least two obstacles impending river supply of cities:

1. Engineering costs of the scheme, which can be subsumed under the category of *ex-ante* transaction costs, are important. Urban logistics by barge indeed requires a tight coordination of the actors, hence long contracts with one (or several) barge operator, one (or several) road operator, one (or several) port operator, one (or several) terminal operator and one (or several) storage operator. Costs of organization and coordination are logically high enough, especially with the frequency of sub-transactions involving asset- and site-specificity, to justify the quasi-integration of the chain. In the case of Franprix, it took three years to initiate such a scheme (incidentally made feasible by subventions and significant investments supported by the port authority). Its importance is relative, however, with regard to the innovative character of the transaction. Indeed, any innovation can't but generate many *ex- ante* transaction costs. And, like any other cost, the unit transaction cost falls as the transaction volume increases. Spreading this innovation should drop significantly *ex-ante* transaction costs of urban river logistics in the future. As Stéphane Bonneton stressed it, "many cities have contacted us for a similar service". Incidentally, this project has increased the brand-name capital of the company. But except some shippers of the retail sector, only few shippers have sufficient volumes to adopt such river logistics. The threshold necessary to get economies of scale in barge transport is only achieved by pooling flows between several customers. Additionally, as barge logistics includes pre- or end-

haulages by road, the organizer must provide door-to-door transportation solutions so as to lower shipper's transaction costs. Yet, *ex- ante* transaction costs are still high in river logistics. For example, the delay proposed by RSC to position a container in the warehouse of a client is almost twice longer for a barge-truck transport (4 days) than for an all-truck transport (2 days), with the same transit times (2 days for Paris-Le Havre). This delay increases the *ex-ante* transaction costs of a barge-truck trip compared to an all-truck trip for a shipper (Lendjel, 2013). Unfamiliar with barge logistics and its transaction costs, the shipper turns more readily to road haulage which has the advantage of ease and flexibility, despite its high cost. The development of urban logistics by barge therefore requires a significant reduction in its transaction costs.

2. Second, the barge-truck system implemented for Franprix reveals the site-specificity of river ports in major cities. Indeed, the scarcity of available space on the docks, combined with increasing traffic jam (and thus the prospect of the inexorable rise of environmental taxation), justified Franprix's strategic choice to take in advance a strategic position in the heart of Paris, by long-term contracts with Port de Paris and Paris Terminal. The increase of river logistics can't but raise urban docks' degree of site-specificity. Several ways are possible to reduce this specificity. One of them comes from the fact that, in urban area, the relevant unit of loading is often the palette or the mini-container rather than the container. At that level, one must look for economies of scale necessary for urban river logistics. This observation has led the Dutch to innovate with Distrivaart, a barge that carries palletized goods between distribution centres and supermarkets (Wiegmans, 2005). In terms of transactional analysis, this approach amounts to internalize the services provided in the warehouse, namely management of pallets and loading / unloading of vehicles. It also has the advantage of eliminating the handling usually made by a port operator, and then, to reduce the degree of specificity of the river docks. Develop urban river logistics involves rethinking the scope and attributes of sub-transactions included in this transaction.

Urban river logistics faces many organizational and transactional barriers that should be recognized, especially if the government wants to encourage its development.

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Tables and Figures

Figure 1

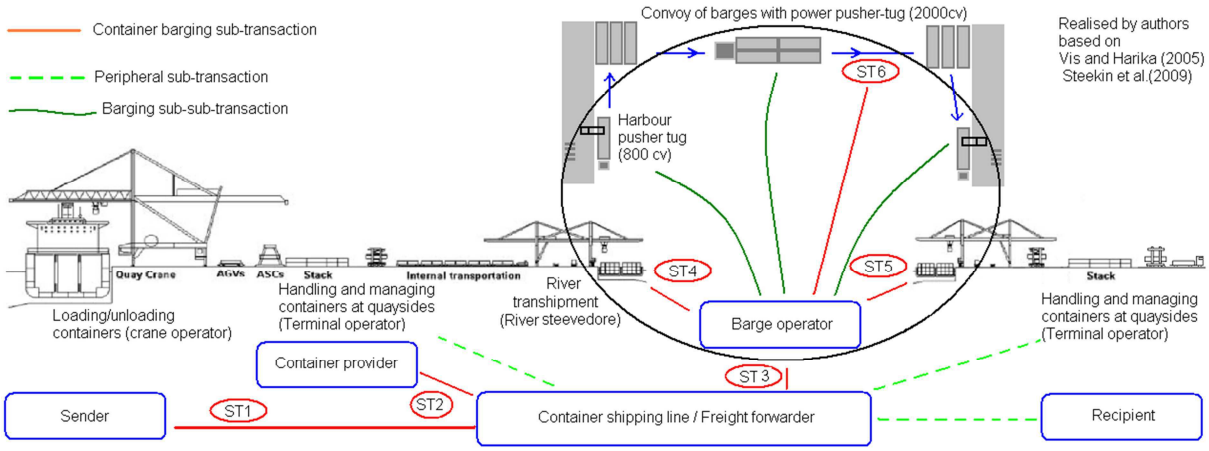

Table 1

Table 1: Governance structures (M-Market, X-Hybrid ; H-Hierarchy) of CBT

N° Transaction	Synthesis	ST1	ST2	ST3	ST4	ST5	ST6
Label	**Synthesis of GS for the transaction chain p**	**Transfer of the container transport organisation between a shipper and a forwarder**	**Transfer of rights to use a transport capacity between the transport organiser and the owner of capacity**	**Transfer of the quay to quay transport operation between the transport organiser and the barge operator**	**Transfer of the maritime port handling from the transport organiser to the handling company at the departure quay**	**Transfer of inland port handling from the transport organiser to the handling company at the arrival quay**	**Transfer of the pre- and end-road haulage between the transport organiser and the road haulage operator**
SEINE BASIN							
Fluviofeeder	XHHMMX	X (Marfret's subsidiary ; long termcontractwith MSC) or M	H	H	M	M	X
Logiseine	MHXXXX	M	H (Barges of Logiseine)	X (Logiseine is a Joint venture hold by CFT and TN)	X (Logiseine is a Joint venture hold by CFT and TN)	X (CFT and TN shareholders of PTSA)	X
Maersk	XXXXXX	X (long-term agreement with CFT)	X (charter capacity to CFT)	X (Logiseine is partially hold by CFT)	X (Logiseine is a Joint venture hold by CFT and TN)	X (CFT and TN shareholders of PTSA)	X
MSC	XXXXXX	X (long-term agreement with CFT)	X (charter capacity to CFT)	X(Logiseine partially hold by CFT)	X (TN MSC is a joint venture with TN)	X (CFT and TN shareholders of PTSA)	X
RSC/Greenmodal	XHHXMX	X (CMA-CGM's subsidiary) or M	H	H	X (GMP is a Joint Venture hold by CMA-CGM and DPW)	M	X (LTI Is part of Greenmodal)
SNTC-Carline	XXXMHX	X (Alliance with Soufflet) or M	X (Alliance with SCAT)	X (Alliance with SCAT)	M	H (SNTC owns handling of Nogent/Marne)	X (Alliance with STTI)
RHONE-SAONE BASIN							
Logirhône	MHHMXX	M	H (CFT's Barges)	H (CFT's subsidiary)	M	X (CFT is a shareholder of Lyon Terminal)	X
RSC/Greenmodal	XHHXMX	X (CMA-CGM's subsidiary) or M	H	H	X (Eurofos is a Joint Venture hold by CMA-CGM and DPW)	M	X (LTI Is part of Greenmodal)