Maritime Ports And Inland Interconnections: A Transactional Analysis Of Container Barge Transport In France

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(Topic area : Inland waterways and short sea shipping; Sub topic area : Logistics, intermodal and transport costs)

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ABSTRACT

Recent research on maritime ports hinterlands points out the relevance of mass ground transport modes such as barge transport for enormous flows of containers to and from harbours, especially when a maritime port is located at the mouth of a river. Though, the modal share of container barge transport in French maritime ports (9% of TEU in Le Havre and 5% in Marseille in 2007) is significantly lower than elsewhere (32% in Rotterdam and 33% in Antwerp). Some reports and studies explain the viscosity of container barge transport flows as a result of several factors, generally concentrated around the seaport community. In continuation of previous seminal works, this paper adopts a neo-institutional approach (Williamson, 1985; 1996) of container barge transport to understand how the factors generating this viscosity are managed. Section 2 describes the characteristics of the transaction of container barge transport. Section 3 is devoted to its attributes (asset specificity, frequency, uncertainty). According to Williamson's (1996) remediableness criterion, the observed governance structure of a given transaction is presumed efficient and aligned to its attributes. Thus, Section 4 deals with observed governance structures of container barge transport chains with a focus on Le Havre, main French container seaport and shows how agents try to limit opportunism in ex-post haggling over quasi-rents or under-investments. Implementation of a new institutional environment to modify governance structures is analysed, and a comparison with currently implemented governance structures observed in Rhine is made. Finally, Section 5 suggests ways of dealing with the remaining coordination problems impeding the development of container barge transport in France.

Keywords: container barge transport, transactional chain, transaction cost economics, interface seaport, governance structure

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1. INTRODUCTION

What's the problem with barge transport in French seaport ? Recent research on maritime ports hinterlands (Notteboom 2004 ; Frémont et al. 2007; Konings 2007 ; Minvielle 2007, Franc et Frémont 2008; Notteboom et Rodrigue 2009; Konings et al. 2010) points out the relevance of mass ground transport modes such as barge transport for enormous flows of containers to and from harbours, especially when a maritime port is located at the mouth of a river1. Though, the modal share of container barge transport in French maritime ports (9% of TEU in Le Havre and 5% in Marseille in 2007) is significantly lower than elsewhere (32% in Rotterdam and 33% in Antwerp) (CGEDD 2010, p. 46).

Research and studies that have been performed (Grégoire 1983 ; Fischer et al. 2003 ; Cour des Comptes 2006; Frémont et Franc 2008; Blum 2010; Revet 2011) indicate that the viscosity of container barge transport flows arises from several factors, generally concentrated around the seaport community. It may thus be noted:

- The lack of maintenance and investment in infrastructures (Blum 2010, pp. 61 and sq) which leads to the classic vicious circle (depicted in a cobweb diagram) in public transports: if a public decision maker invests according to the observed traffic, a minority mode such as inland waterway transportation will obtain insufficient investments, generating a progressive degradation of its transport conditions and, thus, a decrease of its traffic, etc (Blauwens et al. 2002, pp. 327). From this point of view, volumes handled in main French inland ports are stagnating, except the Port Autonome of Paris (PAP). Two inland ports only handled more than 5 millions tons in 2008 (19.4 MT for the PAP and 8.4 MT for the Port Autonome of Strasbourg; SOeS 2010). Except for containers, current handled tonnages do not motivate the public decision maker to invest in inland waterway infrastructures (Cour des Comptes 2006, p. 58). In Le Havre for instance, a waterway connection is missing between Port 2000's new container terminals and existing waterways.

- There are high transhipment costs in waterway transport compared to other ground transport modes (cf. Fischer et al. 2003, Cour des Comptes 2006). There are three contributing factors which explain it. 1/ The quantity of transhipment is significantly higher in container barge transport compared to the other modes. Usually, cartage (yard moves) is necessary to move containers from the maritime quay to the river wharf, adding at least two movements of containers compared to trucking. As with any intermodal transport, container barge transport involves pre- and end-haulage carried out by road in order to move the container from its loading point to its unloading terminal. Hence, the total amount of transhipments is almost double compared to container trucking. 2/ On French maritime ports, gantry cranes are used, both for barges and vessels, and are sized for the hugest containerships. Using these cranes is expensive for barge transport operators, much more than the usual handling costs supported in trucking or even in rail freight. Moreover, scope and scale economies reached in Rotterdam or Antwerp are limited in French ports due to their lower overall performance in relation with other competing ports of the same range (Notteboom 2002). Since a lower volume of containers is handled, economies of scales are lower than at Rotterdam and Antwerp. The average unit cost of handling is, thus, higher in French ports and impacts the cost of containers loading and unloading on barges (Konings and Priemus 2008). 3/ The use of dockers - with specific status – for transhipment in maritime ports raises additional costs for barge transport operators compared to truck or rail handling. All these costs reduce significantly the a priori comparative

1 Let's remind that a Jowi class container barge can carry up to 500 TEUs per trip (BVB 2009, p. 51), 250 times more than one truck.

advantage in waterway transport. Even in Rotterdam, according to Konings and Priemus quoting C. Macharis and A. Verbeke, 'container handling (move) is about 30% more costly for a barge than for a truck' (idem. p. 42).

- The productivity levels of other assets of the container barge transport chain affects also this transaction's price and attractiveness. Note particularly that barges are subjected to unproductive time: waiting time during loading and unloading, waiting time for quay access, waiting time before handling operations start… (CNT/ONTF 2005; Konings 2007; Beelen 2011, p. 97). For instance, as a delayed ship is more expensive than a barge, the docker staff is assigned to the ship, even if it means a waiting time for the barge (Merckx et al. 2004, p. 291).

This list is not meant to be exhaustive. It just shows the diverse factors affecting the transaction of container barge transport in France. In continuation of previous seminal 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), we propose to adopt a neo-institutional approach (Williamson 1985; 1996) of container barge transport to understand how these factors are managed. Transaction cost economics is a useful tool to tackle with coordination problems and to explain actual governance structures (market, hybrid, hierarchy) and strategies of firms to control this transaction chain. Previous studies do not address the specific coordination problems affecting container barge transport in French seaports. But, these problems affect shippers' modal choices (Fremont, 2008). We suggest that these difficulties could come from a lower degree of integration than in other North Range seaports.

The second section (Section 2) describes the characteristics (nature, perimeter, main features) of the transaction of container barge transport. The third section (Section 3) is devoted to its attributes (asset specificity, frequency, uncertainty). According to Williamson (1996) remediableness criterion, the observed governance structure of a given transaction is presumed efficient and aligned to its attributes. Thus, the fourth section (Section 4) of this paper deals with observed governance structures of container barge transport chains in Le Havre, the main French container seaport. We point out that the need for control explains the features of the observed structures on the Seine river. A comparison with those observed on the Rhine revealed a lower degree of integration between barge operators and terminal operators. Finally (Section 5), the nature of remaining coordination problems impeding the development of container barge transport in France arises.

2. DEFINITION AND PERIMETER OF THE CONTAINER BARGE TRANSPORT TRANSACTION CHAIN

According to Williamson, 'transaction occurs when a good or service is transferred across a technologically separable interface' (Williamson 1996, p. 58). In simplistic terms, container barge transport is to transfer a service of transport, so that a container can be moved from one port to another during a given time. Yet, this apparent simplicity implies many sub-transactions, slightly different from those in bulk transportation (Fischman and Lendjel 2011) yet involving nearly the same actors.

A container is a standard loading unit of maritime transport designed to carry quite any kind of cargo that can be unitized and to be used recurrently. Hence, goods are not moved anymore, but their containers. By dissociating the vector of transport and its container, this modality of inland shipping adds up a sub-transaction – the supply of container – compared to bulk transportation. But even if a container is an essential asset for the container barge transport transaction, it remains peripheral as a maritime loading unit. Container barge transport can, therefore, be considered as a sub-transaction of the container transport's transaction. Indeed, most often maritime transportation is the main link of this transactional chain, and inland waterway transport is but the hinterland transport of shipping lines. It usually is the forwarder or the shipping company who has the commercial function to fill containers and sometimes to organise their packing/unpacking2. In other words, container's commercialisation (and thus its management) is usually peripheral to container barge transport3. A specific extraction from the ECHO4

2 In most of the case, the shipper fills the container in his warehouse.

3 Note that it could be part of the transaction's perimeter when container barge transport become independent of the maritime chain as it is on the Rhine (Zurbach 2005).

national survey data base (realized by INRETS in 2004) shows that 100% of the 23 container barge transport shipments found in the survey (from a total of 10 462 shipments involved in the survey) are outsourced and involved at least three operators. Hence, the container barge transport is a link in a larger chain and usually more complex to organize than the other transport chains, as only 7% of the shipments – parcels excluded – involve at least three operators (Guilbault et al. 2008, p. 108 ; Bréhier and Gavaud 2009, p. 8).

Above all, it is necessary to distinguish these sub-transactions and physical flows. At least three flows can be involved in this chain, implying a complex coordination between them : the container's flow is potentially the most complex, since it goes from the sender to the recipient and involves non-barge transport links; the barge's flow does not only link a port to another but, it, also, moves inside a harbour from one quay to another ; the power pusher-tug's flow (with a high power of about 2000 cv) moves a convoy of barges lashed together to link two ports ; the harbour pusher-tug's flow (with a low power of about 800 cv) deals with the positioning of barges in a port from one quay to another one.

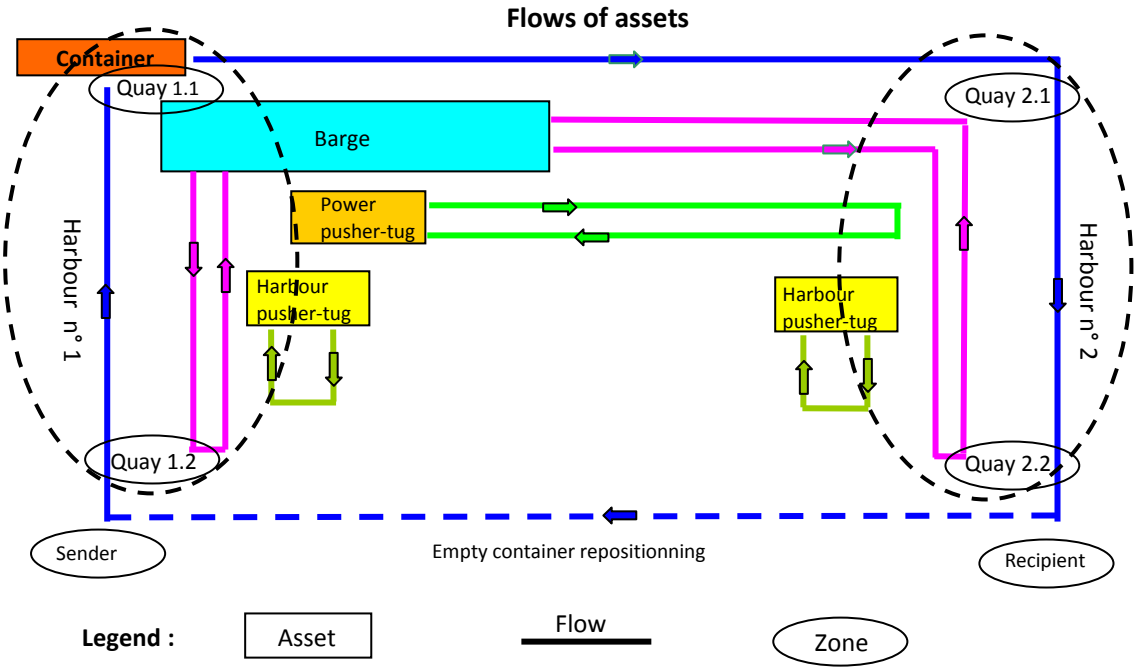

Figure 1

Managing the coordination of these flows has consequences on the governance structures' choices, as it will be explained in section 4. For the moment, this hierarchy helps us to restrict the perimeter of the container barge transport transaction. It first includes barge-handling operations in the maritime ports, the inland waterway transport and the barge handling operations in inland ports. Since functionalities, scales and institutional environments vary from maritime to inland ports, handling operations in a maritime port can be considered as a different sub-transaction from those in an inland port. Thus, the container barge transport transaction includes at least six sub-transactions that follow a sequential order.

Sub-transaction 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).

Sub-transaction 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.

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4 ECHO ("Envois - CHargeurs - Opérateurs de transport") is a national survey designed to understand shipper's practices and who's measurement unit is the shipment sent by a shipper. For a summary of the ECHO survey's results, see Guilbault *et al*. 2008. The very few observed shipments (70) involving a barge transport in the survey do not permit a quantitative analysis. Hence, our analysis of the data is « qualitative » and the proportions given cannot be statistically representative in the insight of the small sample size. Yet, they are not irrelevant.

Sub-transaction 3 is the transfer of the container barge transport service to provide quay to quay, from the transport organiser to the container barge transport economic unit. This sub-transaction is itself likely to be split in two: the container barge transport itself and the barge propulsion by a pusher-tug and a crew.

Sub-transaction 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.

Sub-transaction 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.

Sub-transaction 6 is the transfer of the service of ports interconnection (signalisation, locks, dredging, etc.) between a river infrastructure operator and a user.

Each of these sub-transactions includes many sub-sub-transactions. Handling operations (loading/unloading containers, managing containers at quaysides) are in themselves a complex sub-transaction set, especially since the container revolution. Indeed, the container stevedore must be able to implement the vessel-loading plan sent by the shipping line operator. Thus, the stevedore 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 the plans (Galbrun and Le Du 2007). Though interdependent, the container loading/unloading sub-transaction is sometimes dissociated from quay container handling sub-transaction. As for container inland navigation operation itself, it is likely split into the container barge transport 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 sub-transactions 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, the apparent simplicity of the container barge transport transaction is actually more complex, as illustrated in Figure 2.

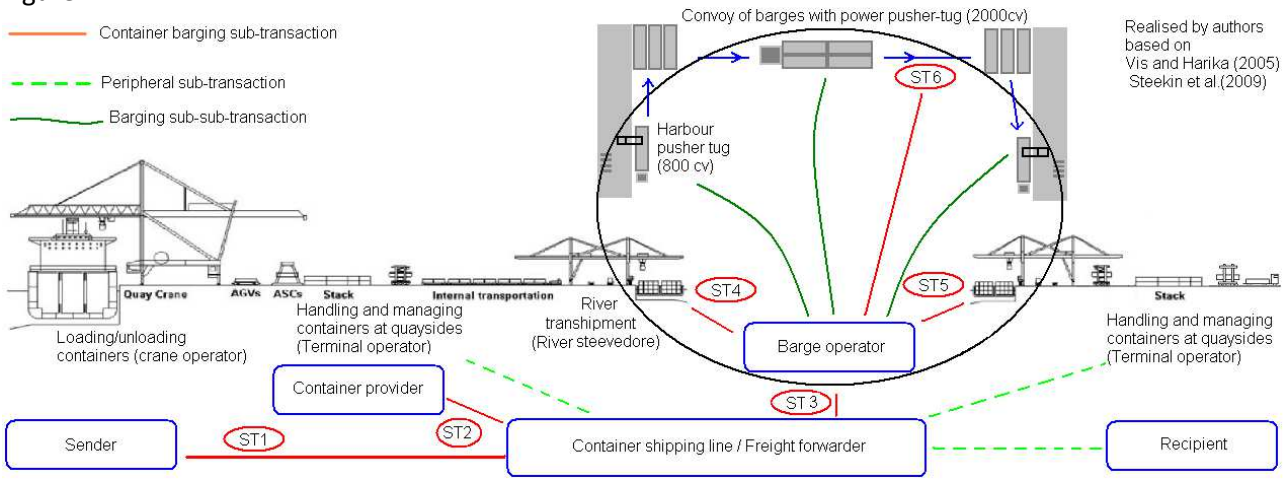

Figure 2

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, as one will see in section 4, the actual number of governance structures framing these sub-transactions is surprisingly reduced compared to what is theoretically possible. The study of the transaction attributes is thus required to explain it.

3. THE TRANSACTION CHAIN ATTRIBUTES

Following Williamson 1996, a transaction is characterized by its attributes: 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). Only those which

affect the efficiency of the container barge transport transaction chain, particularly in port connection, will be analysed here.

3.1. Assets specificity

Williamson (1996, p. 59) recognises six kinds of asset specificity: site specificity, physical asset specificity, human asset specificity, dedicated asset, reputation asset, temporal specificity.

Specificity of site

The first kind of asset specificity used by Williamson is
'site specificity, as where successive stations are located in a cheek-by-jowl relation to each other so as to economize on inventory and transportation expenses' (idem).
Maritime ports are highly site-specific for inland navigation agents (Franc and Van der Horst 2010). Indeed, these ports are places of maritime container departures and arrivals. Inland quays must, thus, be located in the vicinity of maritime quays to minimize costs (in space and time) between these two modes of transport.

Indeed, except for direct transhipment from ships to barges (as for instance in Hong Kong port, Fu et al. 2010), handling of maritime containers required to move containers between inland and maritime quays (cf. figure 2). In some ports, such as Le Havre (Fisher et al. 2003, p. 26; Frémont 2009, p. 17), this interconnection is minimized because the maritime quay is also an inland quay. But this multifunctional quay is costly for barge transport operators (oversized equipment, random availability of the quay…) (idem, p. 27) and advantageous for the terminal operators (higher rate of handling capacity utilization). It is even more expensive at the new Port 2000 in Le Havre, since there isn't any direct access for barges. Only multipurpose vessels (ocean/river) can reach it (like those recently put into operation by two French barge operators, Logiseine or River Shuttle Containers), but with much higher cost. 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 and of the transfer of containers from inland to the maritime quays that it implies. The development of extended gate model (Notteboom and Rodrigue 2009) is certainly a way of de-specifying maritime port for shippers but not for barge operators.

This very high degree of site specificity requires landowners, such as national government, regional state or city5 to deal with this issue (Gouvernal and Lotter 2001). The exceptionally long term contracts (from 15 to 30 years depending on terminal) of land concession (quasi-integration of site) is an indicator of the high level of site specificity and of the quasi-rent it generates (Monteverde and Teece 1992 ; Gouvernal and Lotter 2001). The length and the frequency of port strikes in France are thus a proxy of its significance for the port community and of tensions over its sharing, as De Langen noted it in 2007:
'The presence of economic rents may partly explain the strong bargaining position of port labour and resulting wage level and labour conditions (Goss, 1999)' (De Langen 2007, p. 463).

In fact, a strike highlights the risk of hold-ups generated by this specificity of site. The legal monopoly of port labour, before the French port reform, empowers one of the actors in the struggle for this quasi-rent distribution.

Physical assets

As for any network activity, transport infrastructures are an essential asset for transport service. Their features (draft and air draft, width, locks' capacity, restrictions of navigation during nights and week-ends, etc.; see e.g. IAU 2008, p. 30-32) play an essential role in the transport service's efficiency. They constrain the production units – hence the functions of production – of barge operators. Assets in large gauge basins have an averge payload of 200 containers (TEU) on the Seine, and up to 500 containers for the biggest self-propelled barge, e.g. Jowi (BVB 2009, p. 51). These assets, with integrated propulsion and hulls specifically designed for containers, have a high level of specificity. Since there is a lack of large gauge interconnections between the main French inland waterway basins (Rhine, Rhône, Seine), barges on them have a high

5 Since the law n° 2008-660 of July, 4, 2008, related to the port reform, « Great Maritime Ports » in France are today owners of the state properties (Art.15) excepted those which belongs to the maritime public domain or to the natural waterway public domain.

specificity. Their transfer to different basins requires a maritime move with a tugboat, implying high redeployment costs. By linking Seine and Scheldt (and thus Rhine) in 2017, the Seine-Nord Europe project will thus reduce the specificity of these assets, since 'Seine and Oise will be branches of the Rhine basin'6. River-sea boats only will keep the same high level of specificity since they are able to 'face the risk of sea', but at higher cost. From this point of view, barges and pushers have a lower specificity since they can be separated and connected quite easily even if they work together (see figure 2). They can thus easily be used for other transports than containers. They are standard assets. Their necessary interdependence gives them a low specificity.

Note that containers are highly standardized physical assets (and thus with a low specificity) but, as quoted before in section 1, they are essential to transactions. Hence, they can have a higher specificity for barge operators who use them apart from the maritime chain since the activity of barge operators depends, thus, on the volume of maritime containers at their disposal (Zurbach 2005, p. 43).

Human assets

Container river transport transactions require, as in bulk, highly specific human skills both upstream (commercial skills, organizational skills, etc.) and downstream (related to transport service itself). Without referring here to the high level of specificity of boatmen (Fischman and Lendjel 2011), it is necessary to highlight the high level of specificity in maritime port handling. The frequent use of maritime dock workers to load/unload containers on barges in maritime ports has significant implications on human asset specificity.

The former legal monopoly of dock workers and cranes drivers (French law of September, 6, 1947) before the 1992 and 2008 reforms, gave them a high level of specificity since any handling operator had to employ them for maritime handling operations. It remains after the reform in a lesser extent due to the European principle that no ships can be "self-handled" (Turnbull 2006). Yet, port workers hired to load and unload barges may not be necessarily employees of maritime stevedoring companies (art. R. 511-2 of the French transports Code) if a dedicated barge terminal is owned by a barge operator. But, in fact, maritime handling workers are mainly employed at barge terminals.

This high specificity strengthened after the container revolution. The handling job has indeed changed due to the increasing technicality and capitalistic intensity of the operations needed by containers. Hence, the acquisition of more technical knowledge and a higher degree of dock workers and cranes drivers specificity. The intermittency associated with dock workers legal monopoly was justified by significant fluctuations of activity due to tramping (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. The development of a container regular line 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. It was the same for crane drivers, even when the gantry cranes belonged to the handling operator (Cour des Comptes 2006, p. 38 and p. 61).

Dedicated assets

Carrying containers entails dedicated assets from barge and terminal operators to reach high levels of productivity. Terminal operators need dedicated specific cranes and engines (appropriate berth, gantry cranes, stacking straddle carrier, stacking space,..) to secure container handling. Barge operators need specific barges designed to carry containers and dedicated terminals to load/unload them. The mutual dependency generates risks of under-investments and quasi-rent. Barges and cranes must be compatible with each other and grow in proportion. This concern is particularly high during the launching phase of a new service, as was the case for container barge transport on Seine in 1994. A barge transport operator (Logiseine) and 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

6 Interview of Mr. Fortrye (CFT), November 2010. Yet, remaining gauge differences between these two rivers (IAU, 2008, p. 31) will prevent any Jowi class vessel to move on the Seine till Gennevilliers. It will always stay on the Rhine only.

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 container barge transport line. For instance, Paris Terminal SA, the inland public port operator, was a stakeholder of Logiseine barge operator at the 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. Thus, unlike Franc and Van der Horst' Resource-Based View assertion, it is not « to convince shippers of the shipping lines ability to secure container flows, and consequently to offer reliable services » (Franc and Van der Horst 2010, p. 561) that operators integrate site assets, but because these assets are dedicated assets and thus generate interdependency. As we will explain further, shippers are usually (except in own-account transport) completely out of the transactional chain of container barge transport.

Time assets

Another kind of assets concerning barge operator and terminal operators is time asset. Indeed, in order to minimize loading and unloading times, handling operators identify time slots and can allocate them to their clients. These time assets are important for actors, since they allow the handling operator to optimize his handling means and the container barge operator to minimize his waiting time. Oddly, if these assets are the primary purpose of the agreements between terminal operators and barge operators on the Rhine (Zurbach 2005, p. 29), they are rarely subjected to recoverable property rights (unlike air slots in the United-States air transport system, for instance) though quasi-rent involved is far from being negligible. It is the same for container storage time at terminals, even if it is now frequently subjected to a particular pricing to avoid congestion (Rodrigue and Notteboom 2009, p. 175). This (and also lock time slots) is crucial for actors' coordination problems in ports, as we will see it in Section 4.

3.2. Frequency and uncertainty

The advantage of containers is that it increases the frequency of transaction due to the diversification of clients, since the service is standardised and allows the movement of almost any type of good. Container standardisation lowering transaction costs promotes the positive effects of the market governance structure, i.e. scale and scope economies due to the aggregation of diverse demands (Williamson 1985, p. 92; 1996, p. 66). Indeed, the unit cost of transport of a container will be less for a shipper if fixed costs of a boat with its crew are divided between several shippers. The use of a barge operator is less expensive here than the ownership of a dedicated fleet by each shipper. Thus, whatever the frequency of transactions is, no shipper is encouraged to internalize container barge transport owed to administration costs it generates and the loss of scale and scope economies reached by the market.

But it is different within the transactional chain. The frequency and the regularity of transactions between each link in the chain is high enough to justify a more integrated governance structure, particularly when assets are dedicated to the transaction. Frequency is the main (but not the only) factor justifying integration (or quasi-integration) of the chain. This is the case of the transport capacity needed to reach the frequency of the regular line service provided. For instance, 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. It is the same for all the other operators due to the networked nature of this activity.

This logic also prevails with propulsion and support sub-transactions in the container barge transport transaction. Integration of propulsion can technically be made on a self-propelled boat, so that propulsion costs decrease due to a better hydrodynamic shape of the hull. It can also be done by keeping separate the elements of propulsion (pusher) and the elements of support (barges). Integration is not technical then but only transactional. For barge operators, this dissociation has the advantage of avoiding waiting time for loading and unloading goods as barges only stay at quays7. It could also help the operators

7 These waiting times always have a random dimension since a third party can always influence the transaction (externality) and affect then the possible frequency of the transaction (Fischman and Lendjel 2011).

of a waterway basin to optimise the number of barges needed for the volume of transactions (Zurbach 2005, p. 17).

Likewise, a high and regular frequency of handling transactions can be observed in ports too. Starting from Le Havre, Voies Navigables de France (VNF, the French transport infrastructure manager) indicates an average of three services per day (from Monday to Friday), with one or two more departures if necessary (VNF 2009, p. 33). Arrivals are significantly less distributed with two activity peaks (5 services) on Monday and on Wednesday morning, the other days of the week having one or two services only. Given the high degree of specificity of physical and human assets in handling (and of scale economies they gain with the recurrence of transactions), it is not surprising that these assets be, as for quays, integrated by stevedoring companies.

The last factor affecting barge transport transactions is uncertainty. Williamson (1985) distinguishes two sources of uncertainty: behavioural uncertainty (coming either from the bounded rationality of agents or from opportunism) and environmental or institutional uncertainty (change in demand, technical progress, change in regulation, etc.) (Masten and Saussier 2002 ; Finon and Perez 2007, Glachant and Hiroux 2010).

Environmental uncertainty is prevalent in container barge transport (Franc and Van der Horst 2010), especially in France, because of the new Seine-Nord Europe channel which should be open in 2017 (Bernardet 2007). The opening of the Seine basin is likely to change the governance structures because of the increased traffic (as we will explain it below).

Operationally, a study (Muntudeguy 2011) of Strasbourg's Port – second French inland port after Paris) – shows the ubiquity of everyday hazards on the container barge transport terminal (north terminal). Barge transport activity has a cyclical dimension of high amplitude, with peaks of activity on Tuesdays and Fridays. But, if the number of barges coming at the quay is known and predictable, adds the author, it may change at any moment, like their arrival time. If some constraints, as the maintenance of locks can be correctly anticipated by barge transport operators, this is not possible for some others constraints as for the level of the river water. Besides, hazards may happen in the port itself: equipment failure, incident within container handling, disagreement concerning a container's status. The random dimension of the activity requires the control of proper physical and human assets to handle it. The huge extended operating hours (nearly 23h/24h, Saturdays included) of port activities suggests the attendance and coordination of three teams.

4. WHICH ALIGNMENT OF GOVERNANCE STRUCTURES TO THE TRANSACTIONAL CHAIN ATTRIBUTES?

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 France in waterway regular lines have to be described and compared to those of the Rhine.

4.1. First level sub-transactions in France

The first point to consider is the theoretical number of combinations permitted by a transactional chain of the river transport of containers. Considering that each of the five sub-transactions (if the river interconnection service is excluded, cf. section 1) may be achieved by at least three governance structures (spot market, hybrid or long-term contract, hierarchy), the decision tree includes a set of 243 possible combinations of governance structures for this transactional chain (Williamson 2010)8. The longer the

8 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 field of potential increased more quickly.

chain, the bigger the set of possible combinations. This exponential character of the economic complexity of the chain contrasts sharply with the very limited number of combinations observed in the river transport of containers in France. If an inventory of these chains has already been done (Zurbach 2005 ; Frémont and Franc 2008; IAU 2008; VNF 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 Paris9 (Fluviofeeder, Logiseine, Maersk, MSC, RSC, SNTC Carline), four services are really provided by barge operators, Maersk and MSC having slots on Logiseine's barges (VNF 2009), acting as shipper for Logiseine (see section 2). All of the governance structures of those container barge transport operators on the Seine are integrated or quasi-integrated:

- Fluviofeeder is a subsidiary of Marfret shipping company. Through a partnership with MSC, Fluviofeeder provides a regular line between Le Havre and Rouen. Here, the vertical integration involves forwarding and container barge transport quay to quay only.

- Logiseine, container barge transport operator, is a 'Société en nom collectif' associating terminal operator companies from the two ends of the chain (Terminal of Normandie, in Le Havre, and Paris Terminal S.A., in the Port Autonome of Paris-Gennevilliers) and the barge operator, CFT. The transaction chain integration is 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.

- 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 ship owner of the river link since Maersk charters transport capacity (barges and slots) to Logiseine with long-term charter contracts. Through Logiseine, Maersk also 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 terminal allows MSC to control barge handling more directly (but still hybrid) than Maersk does since this terminal is dedicated to barges too.

- The vertical integration is even deeper for the owner CMA-CGM since it not only owns the barge operator River Shuttle Containers (RSC), but also 35% of the capital of the SAITH's railways line via the Générale de manutention Portuaire (GMP) in Le Havre, a joint venture of CMA-CGM with DP World. GMP operates the dedicated barging terminal of Europe's quay.

- 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 integration between small or medium size companies to provide an integrated offer of carrier haulage services (see Table 1).

9 The services observed in Dunkirk and Marseille are similar, so they will not be described here. See Frémont *et al*. 2008 for instance.

N° Transaction		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	Interconnection
Fluviofeeder	XHHMM	X (Marfret's subsidiary, contrat avec MSC) ou M	H	H	M	M	M
Logiseine	MHXXX	M	H (Barges of Logiseine)	X (Logiseine is GIE with CFT)	X (Logiseine is a GIE with TN)	X (CFT and TN shareholders of PTSA)	M
Maersk	XXXXX	X (long-term agreement with Logiseine)	X (charter capacity to logiseine)	X (Logiseine is GIE with CFT)	X (Logiseine is a GIE with TN)	X (CFT and TN shareholders of PTSA)	M
MSC	XXXXX	X (long-term agreement with Logiseine)	X (charter capacity to logiseine)	X (Logiseine is GIE with CFT)	X (TN MSC is a GIE with TN)	X (CFT and TN shareholders of PTSA)	M
RSC	XHHXM	X (CMA-CGM's subsidiary) or M	H	H	X (GMP is a GIE with CMA-CGM)	M	M
SNTC-Carline	XXXMH	X (GIE with Soufflet) or M	X (GIE with SCAT)	X (GIE with SCAT)	M	H (SNTC owns handling of Nogent/Marne)	M

Table 1 : Governance structures (M-Market, X-Hybrid ; H-Hierarchy) on the Seine river

When a barge operator has no specific agreement with a handling operator, its handling agreement is annual or multiyear even if it is proportional to the volume of containers handled. Thus, strictly speaking, there isn't any spot contract. Hence, this table shows a systematic quasi-integration of the transaction chain by these six operators, with five different modalities. It is thus clear that among the three dimensions described by Williamson (incentive intensity, administrative command and control, contract law regime), control strongly dominates here. Hybrid modalities predominate when complete integration of the considered sub-transaction is not possible (lack of funds) or not wanted (for incentive reasons). As described in Section 2, the limited numbers of governance structures observed here can be explained by the attributes of the sub-transactions of that transaction chain. High frequency (and besides regular) of transactions and the (quite high) degree of assets specificity may also explain that four barge operators only can be found in container barge transport on the Seine river compared to the 800 barge operators in bulk river transport (SOeS 2011).

4.2. 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 chains10. 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 (France following with a delay 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, for instance, site specificity is so high in Le Havre that the railway line (operated by SAITH) between port 2000 and the dedicated inland terminal of Europe's quay involve almost all the main actors (CMA-CGM via GMP which control also Europe's quay, Logiseine, indirectly MSC via TN's partnership) in its capital. The amount of dedicated investments and of flows to

10 However, Logiseine's governance structure is provided as an example in the annex.

generate explains this quasi-integration. The natural monopoly, which characterized this railway line, requires control by main actors. Besides, it is what SNTC objects when it protests against the prohibitive cost of this transfer (VNF 2009). Integration to control human assets (dockers first, then cranes drivers) has been done while market (via the dockers' intermittence system) prevailed before the 1992 and 2008 the docker status reforms11. It aims to integrate dockers in handling operator companies and thus to promote hierarchical coordination activities (Hislaire 1994 ; Galbrun and Le Du, 2007). The lobby of the handling firms syndicate (UNIM) to change the institutional environment allows them to assign governance structure to 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 the theoretical advantages of the intermittency were dockers' flexibility and redeployment as it still can be seen in Antwerp today.

During the transport, an opposite movement can be observed. As control of specific human and physical assets is needed, 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 pushers12. 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 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).

4.3. The handling operator companies' involvement on Rhine

A comparison with the Rhine-Scheldt basin and with Antwerp and Rotterdam ports highlights the differences with governance structures observed in France. Indeed, the governance structures of container barge transport on the Rhine and Scheldt rivers are slightly different from those observed at Le Havre or Marseille. Barge transport governance structures in the Middle and Upper basins of the Rhine are quite similar to those in the Seine and the Rhône-Saone (with a high degree of integration of the barge transport chain13). But the lower part has original governance structures that may explain the important modal share (32 or 33% of the tons-kilometre) of barge transport at Antwerp and Rotterdam.

In fact, many factors (special regulation and fiscal environment on Rhine since the 1815 Vienna's agreement (Zurbach 2005, p. 9), price competitiveness, transport distance, activities and households concentration's density, the lack of locks on Rhine, etc.) explain the high modal port of barge transport in these main European sea ports, which occurs over a period of time as historian Fernand Braudel dates it from the 18th century due to the density and the links of the river network (Braudel 1979, p. 412). Particularly, the « liberty of transport » (fuel de-taxation, free use of the network except in French ports like in Strasbourg…) on Rhine affects the comparative advantage of barge transport compared to road transport. But they cannot explain the singularity of observed governance structures in the lower part of the Rhine.

11 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

12 Interview of Mr. Fortrye (CFT).

13 From this point of view, the repurchase of Wincanton Europe (leader on the Middle basin) by Rhenus Logistics (leader on Upper Basin) on August, 16, 2011 is emblematic. The cumulated market share of this new set (which includes Contargo since 2004, Interfeeder since 2006, Rhinecontainer since 2011) should represent almost half of containers moved on Rhine (Zurbach 2006).

In Rotterdam's port, Van der Horst and De Langen (2008) have made an impressive list of "arrangements" set up to enhance coordination between all the agents of the container barge transport chain in Rotterdam (26 for the sole waterway transport, to which 17 arrangements related to inter-modality must be added for a total amount of 76 coordination arrangements for all kind of modes). Most of them try to increase the integration of this chain with different kind of modalities (inter-firm alliances, changing scope of an organisation, collective action) (idem., p. 119). Only 6 arrangements set up to enhance coordination (among 76) are related to the incentives system (thus without changing the market governance structure). The set of arrangements shows the presence and involvement of seaport cluster in Rotterdam. But the most important for our thesis is the maritime handling operator company ECT's one (main terminal operator company in Rotterdam, henceforth subsidiary of Hutchison Ports Holding from Hong Kong) in the organisation and control of barges lines with several inland river ports (Duisburg, Moerdijk, TCT Belgium, Venlo). The originality of this vertical integration is that it comes from maritime handling operator companies, instead of coming from inland operators (barges operators or handling operators) everywhere else (Zurbach 2005, p. 19; Rodrigue and Notteboom 2009; Revet 2011). It's true that Duisburger Container Terminal (DeCeTe), on behalf of its parent company (ECT), organises and commercialises barges lines and feedering through river sea vessels in Europe too (Zurbach 2005, p. 39), but

'in this, the ECT seeks to extend the gate of its deep-sea terminal to inland terminals by offering both container handling and hinterland transport services to their own hinterland terminals. […] In [this] Extended Gate Model, the TOC organises terminal services and hinterland transport' (Van der Horst and De Langen 2008, p. 121-122).

Following our deconstruction of the container barge transport transaction chain, one may consider that the terminal operator extends to an inland terminal the cartage sub-transaction (see Figure 2) between maritime and river quays that has to be done on its terminal. This extension affects the commercial dimension of the sub-transaction, because if DeCeTe bears its responsibility by operating barge transport, its handling parent company supports it by sending clients.

All the agents are interested in this Extended Gate Model:

First, handling operator company ECT decreases its unproductive (and costly) storage of containers on its sea terminal in Rotterdam; thus, it avoids congestion, menacing its terminal due to the increasing flow of containers, and facilitates container moves on its terminal, hence increasing its productivity (Rodrigue and Notteboom 2009, p. 177-178). The handling operator company switches a negative externality to a source of quasi-rent. The internalisation of this new service for the shipper allows then to keep the total amount of the rent it generates. It is true that ECT extends the free storage time to 21 days on its inland terminal TCT Belgium instead of 5 in Rotterdam for instance (idem), but it supports lower costs that those it would undergo without this service. Outsourcing this service would lead ECT to pay for it or to loose its clients due to the increase of its handling rates and thus the quasi-rent from this service.

Shippers then have a length « free » storage service compared to the conditions in seaports with a custom clearance service. This service allows them to consider containers stored in an inland terminal as a buffer before their distribution into several regional warehouses due to an integrated information system (ibid.). Finally, it allows them to get a security level equivalent to its level at the maritime terminals (since certified ISPS as « extended gate »). The shipper thus outsources high storage security costs.

Barge operators are sure to have regular freight, with lower waiting time at calls (Melis et al. 2003, Moonen et al. 2004). Indeed, this subsidy is contractually coupled with content and commitments, especially about call time, contrary to what is observed in France. Besides, agreements on time windows are the primary purpose of the contracts observed on the Rhine (Zurbach 2005, p. 29), especially for ECT and barge operators (Melis et al. 2003). Thus, stevedore operator companies are not only involved in barge transport through equity investments but, also, by the profitable contracts for barge transport.

According to Franc and Van der Horst (2010 p. 561), a similar system is organised in Antwerp by global terminal operator (DP World) and multimodal operator (Shipit), although this system is not as generalized as in Rotterdam. It highlights the remaining coordination issues which can be useful to understand the low modal share of waterway transport in France and the persistence of externalities due to seaport congestion and to the lengthening of waiting time undergone by operators, still based on our transaction analysis of the container barge transport chain.

5. REMAINING COORDINATION ISSUES

All the arrangements set up to align governance structures to the transaction attributes are not always enough. As said in Section 2, transaction needs to coordinate flows through a governance structure. But (1) voyage charter contract usually used in container barge transport involves agents only in a very limited part of the transactional chain (Fischman and Lendjel 2011) ; (2) externalities (dues to third parties to the contract) affect barge operators.

5.1. Voyage charter in container barge transport transaction

Container barge transport transaction transfers a service of transport between a shipper and a barge operator, so that a container can be moved from one port to another during a given time. Its governance structure is usually the spot market14 even when sub-transaction 1 has a hybrid governance structure. A voyage charter contract involves a shipper and a barge operator. It is a transfer of rights (and thus of liability) on the container transport. This (limited) transfer to the barge operator is taken into account only when containers are loaded (under the responsibility of the shipper) on a barge. It terminates when unloading is done.

Voyage charter is a governance structure, which includes

- the sub-transaction 1 of the container barge transport transaction ;
- the sub-transaction 3 (transfer of the container barge transport service to provide quay to quay).

Hence, some essential sub-transactions to achieve the transaction are out of a voyage charter:

- the availability of a transport capacity (ST2), necessary for the barge operator to honour his contract ;
- the handling service (ST4 and ST5), even if the shipper has to load/unload the container ;
- the service of providing port and transport's infrastructures (the web, clocks, quays, etc.) (ST6).

Sub-transactions out of a voyage charter have other governance structures. ST2 usually has either hierarchy or hybrid (long term agreement) governance structures. ST4 and ST5 are governed by handling spot contracts, even if these last are also supervised by hybrid governance structures. ST6 occurs on each move, but through fees and taxes.

Thus, container barge transport involves several contracts, with a theoretically full mapping of liabilities. In case of problem occurring during sub-transaction ST2, ST4, ST5 or ST6, out of a charter voyage, (externality) the court procedure is complex and costly (since it implies a third party).

The comparison between hybrid structures governing ST 4 and 5 in France and on the Rhine shows two main differences: (1) They do not come from maritime terminal operators; (2) terminal operators in Le Havre, Marseille, Dunkirk, Paris, Lyon or Lille are not contractually or commercially directly involved in container barge transport transaction. These two differences may be helpful to understand the low modal share of barge transport in French port hinterlands. Seaport stevedore companies are economically involved via their capital equity in container barge transport companies in France as on the Lower Rhine, but the lack of joint commercial structure, of the Extended Gate model kind, drastically reduces their convergence of interests with other river transport agents to develop this mode of freight transportation.

5.2. Externalities and voyage charter

Externalities undergone by barge operators (In Le Havre as any other maritime ports) are mainly port congestion and waiting time (Fischer et al. 2003, p. 26). These externalities have significant consequences on the regularity and the reliability of container river transportation. According to the Cour des Comptes (2006, p. 109), waiting time for access to terminals, cranes failures and strikes cost 500, 000 € to Logiseine in 2004. For instance, access priority to vessels instead of barges is very costly for Barge operators. According to Fischer et al. (2003), in Le Havre,

'the waiting time may be as long as the vessel loading/unloading ; it may be too long, hence the barge has to find a farer place to be loaded/unloaded, with the disadvantage of a more or less expensive cartage. […]

14 Interview of C. Rose, General Secretary of the French Association of Shippers (AUTF).

Barges access to container terminal is rotating among quays and departures and arrivals of vessels which have priority on this quays ; barges must ask permission to move to quay for each operation ; it creates difficult planning problems since barges can only leave the port of Le Havre with the stream' (Fischer et al. 2003, pp. 25-26).

Far from being insignificant, vessel delays are common in shipping, according to Rodriguez-Alvarez et al. (2001), since it concerns 40% of them. The Handling operator's planning (and hence of barge operators) is thus after rescheduled. Their significance in Antwerp and Rotterdam has generated several research papers (Melis et al. 2003; Merckx et al. 2004, Konings 2007; Van der Horst and De Langen 2008; Douma et al. 2009, De Langen and Douma 2010; Caris et al. 2011).

It is known that

'a primary function of property rights is that of guiding incentives to achieve a greater internalization of externalities' (Demsetz 1967, p. 348).

Externalities suffered by barge operators exist only because of very significant transaction costs to define and allocate property rights. The question is whether it is possible (and for what organizational cost) to define property rights on temporal assets (see Section 3.). In economics, the shadow price approach is used to determine the amount that operators will accept to pay to relax or dissolve this externality (ITF 2009, p. 12)15. In container barge transport, valuing time is possible but complex since barges are not the only link in the chain. The delay of the barge and its pusher (measured in hourly cost of operating a barge plus the losses of possible earned income) also impacts the schedule and thus, the reliability of its service for the shippers who will eventually suffer from it (Notteboom 2006). Is the total amount of these costs enough to change priorities in the allocation of handling resources between a barge and a ship for a stevedoring company? Surely not, due to the vessels' size, the volume of containers to operate and the frequency of transactions between owners and handling operators. But it should be enough to incite handling companies to suggest solutions to barge operators, since it is also the interest owners and shippers.

In some cases, externality is known and « integrated » in the contract. It is the case for demurrage. The charter voyage warrants an over payment for barge operators as soon as their barges have to stay longer than it is necessary due to unusual long handling operation time (art. 2.13 of the French decree 96-855). But it is clear that this externality is underestimated in the containers chain, since any delay impacts the entire chain and at least it requires a buffer to cushion any hazard. Thus, if the voyage charter pays any inadequate delays (fixed over two or three days and a half by contract, according to French art. 9.1 of the decree 96-855) with demurrage, this adequate delay far exceeds those needed by containers (a few hours). Hence, delays are not correctly integrated in container barge transport.

Even if these delays are out dated, a second issue arises. The demurrage can't be paid to barge operators, since shippers do not operate handling with their own equipment and workers. Shippers ask barge operators to turn towards those responsible for delay: the handling operators who have no contract with container barge transport! The ECT governance structure in Rotterdam is one possible solution to these issues. This vertical integration by a stevedore company is also an answer for the centralized coordination between agents, which is discussed in many papers (Van der Horst and De Langen 2008; Douma et al. 2009; De Langen and Douma 2010; Caris et al. 2011).

6. CONCLUSIONS

In the French context of container barge transport development, these unsolved problems are major obstacles. Solutions like those already made by agents will be necessary to remove them. In order to address these problems, this paper considers Transaction Cost Economics. It firstly distinguishes between physical flows, transactions and contracts (or governance structures). It analyses these three levels of understanding in container barge transport and shows the complexity of each of them. It thus outlines the French and the Lower Rhine container barge transport governance structures. From this point of view, it shows that the new specific agreement highlighted in Rotterdam is due to ECT maritime stevedore

15 It is 'the amount that « society » would pay to have the constraint relaxed or removed, which in turn reflects the degree to which there are substitutes, more or less adequate, for the bottleneck capacity' (ITF, 2009, p. 12).

company's initiative, i.e. the Extended Gate Model, which is certainly an adequate answer to coordination problems in barge transport. It might inspire the other operators in Europe, especially in France and in Belgium.

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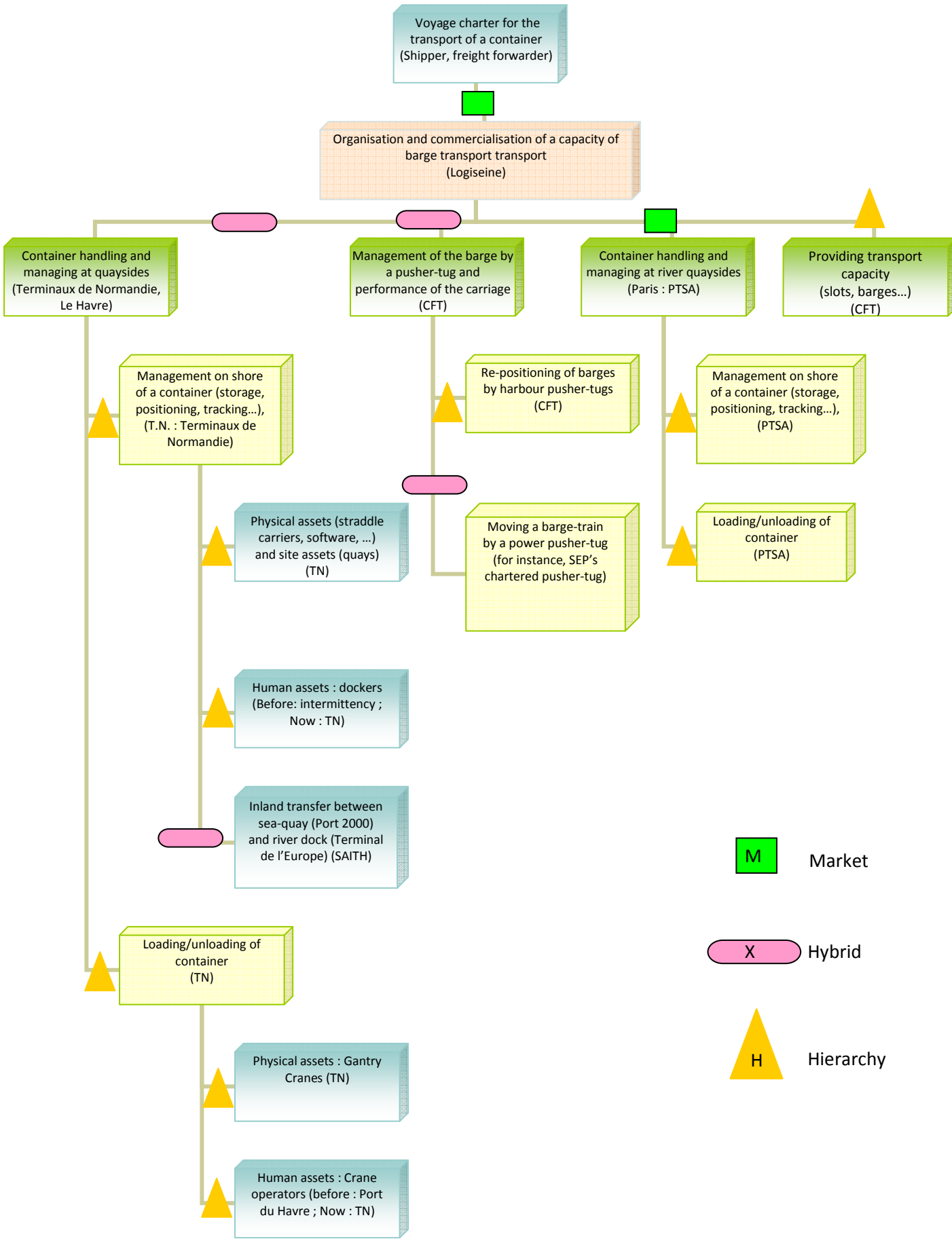
APPENDIX 1 : LOGISEINE'S COMBINATION OF GOVERNANCE STRUCTURES FOR CONTAINER BARGE TRANSPORT


Voyage charter for the transport of a container (Shipper, freight forwarder)
Organisation and commercialisation of a capacity of barge transport transport (Logiseine)
Container handling and managing at quaysides (Terminaux de Normandie, Le Havre)
Management of the barge by a pusher-tug and performance of the carriage (CFT)
Container handling and managing at river quaysides (Paris : PTSA)
Providing transport capacity (slots, barges…) (CFT)
Management on shore of a container (storage, positioning, tracking…), (T.N. : Terminaux de Normandie)
Re-positioning of barges by harbour pusher-tugs (CFT)
Management on shore of a container (storage, positioning, tracking…), (PTSA)
Physical assets (straddle carriers, software, …) and site assets (quays) (TN)
Moving a barge-train by a power pusher-tug (for instance, SEP's chartered pusher-tug)
Loading/unloading of container (PTSA)
Human assets : dockers (Before: intermittency ; Now : TN)
Inland transfer between sea-quay (Port 2000) and river dock (Terminal de l'Europe) (SAITH)
Loading/unloading of container (TN)
Physical assets : Gantry Cranes (TN)
Human assets : Crane operators (before : Port du Havre ; Now : TN)
M
Market
X
Hybrid
H
Hierarchy

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