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Port Inland Transportation in Europe: Combined Transport versus Road Transport

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1. Introduction

Containerization is the backbone of globalization. In fifty years, it has totally transformed international freight distribution chains. A virtuous circle has been set up in which the use of ever-larger vessels (Cullinane et al., 2000), with its consequent large economies of scale and reduction in the cost per transported TEU (Brooks, 2000), goes hand in hand with an increase in transported volumes.

Port hinterland services mostly rely on road transport, particularly in Europe. However, the uninterrupted increase in port traffic is making the road's dominance of hinterland services increasingly frail because of costs, the risk of congestion and growing environmental constraints. On land, high volumes are achieved by using combined rail-road or waterway-road transport. The ability of transport operators to attract freight from the hinterland at the lowest possible cost and with reliable and regular services is an essential condition for them to have the advantage in the competitive situation in which they are placed. Consequently, those ports which manage to be a port of call for the largest container vessels and offer high volume inland services establish themselves as the major loading centre in their maritime range as a result of their control of a large hinterland (Hayuth, 1992; Heaver, 2002; Robinson, 2002; Panayides et al, 2002; Notteboom, 2004).

However, combined transport must still demonstrate that it can compete with road transport. Certain conditions must be met for combined transport to be set up: the waterway or rail infrastructure must exist, there must be sufficient volumes of geographically concentrated flows, transport integrators who provide door-to-door services to shippers. But in addition to these conditions, we shall make the simple hypothesis that combined transport becomes competitive when it is able to offer lower prices and additional services in comparison to the road. This hypothesis will be tested for the ports in the Northern European range, with a particular focus on river services from the port of Le Havre to the Paris region. This example, for which we have collected pricing data, is of particular interest as, on the face of it, Le Havre's position is much less favourable for the development of combined transport than the principal ports in the range.

In the first part of this paper, we shall show that at the present time a large number of actors in the different ports of the Northern European range share a dynamic that is very favourable to the development of combined transport. However, the conditions of development are very unequal from one port to another and mean that the development of combined transport varies a great deal. We shall then show that road transport and combined transport do not share the same organizational patterns. They are, in fact, two different transport services which are not immediately comparable. The example of river services between the port of Le Havre and the Paris region will then be used to highlight the extent to which combined transport is competitive in terms of price and services compared with different organizational patterns of road transport.

2. A shared dynamic, unequal situations

2.1. Common issues

A shared dynamic, that results from a combination of factors, leads to the use of combined waterway-road or rail-road transport for hinterland services from maritime ports. Although the benefits they derive differ, the various port stakeholders are all concerned about three issues which encourage the use of combined transport in preference to the road: cost, traffic flow and the environment.

We shall distinguish between three types of port stakeholders: economic agents, which are directly involved in organizing transport operations (shippers, shipping lines, forwarders and freight handlers), the public authorities, which consist principally of the port management and the various regional levels of decision-making from the State to the municipalities and

including the regions, and public opinion, which is most often expressed through the press or associations, in particular environmental associations, which represent social demands.

2.1.1 Costs

The issue of costs primarily involves the economic agents and the port management. Combined transport provides a way of moving much larger quantities than is possible by road. In a way, it extends inland the economies of scale that are made possible on the sea by very large vessels. Organizing a door-to-door combined transport chain requires additional freight handling at the maritime and inland terminals and also inland container transport services to and from the inland terminal. However, in spite of the fact that the organizational complexity of combined transport is greater than that of road transport, as a result of the volumes combined transport can carry there are economies of scale that reduce costs on the inland transport leg. Double-stack trains in North America with a capacity of 400 TEU provide the best example of this. In Europe, the economies of scale are smaller as the largest block trains only have a capacity of 80 TEU and on waterways the capacity of larger convoys partly depends on the quality of the infrastructure but may exceed 300 TEU on the Rhine.

Shippers are therefore interested in the development of combined transport as it can result in lower cost transport chains than the road on its own. It is also obviously in the interest of the transport organizers, be they shipping lines or forwarders who organize transport to provide their shipper clients with transport services that are cheaper than the road, particularly because of the competition that exists between them. For a shipping line or a forwarder, lower costs on the inland transport leg should provide higher volumes, which will consolidate its activity. It can also hope to achieve higher margins on the inland transport leg.

Promoting combined transport is also in the interests of the port management as a means not only of extending the port hinterland but also of protecting themselves from possible competition from a port on the same maritime range. This is because combined transport can extend a port's hinterland and enable it to compete with another port in that port's historical hinterland. The neighbouring port will therefore respond by promoting combined transport, in its near hinterland too, in order to protect its catchment area. Public opinion is sensitive to these arguments as preserving or increasing port activity means jobs.

2.1.2. Traffic flow

Traffic flow refers not only to the congestion-free flow of containers within the port enclosure and the hinterland, but also the fact that operations such as customs clearance can

be performed on the freight with minimal delay. However, the increase in port traffic means that most large ports suffer from congestion problems which threaten the reliability of the international transport chains within which they operate. There is a serious danger for these ports that some of the traffic will be transferred to less congested secondary ports, as a result of what is known as the peripheral port challenge (Hayuth, 1981). By offering diversified transport supply and higher volumes than is possible by road, combined transport is one possible way of improving traffic flow in the port and hinterland (ECMT, 2006b). The issue of traffic flow is thus decisive not only for port managers but also for the public authorities as traffic flow is directly responsible for part of a port's competitiveness (Notteboom and Winkelmanns, 2001).

Using combined transport can therefore be in the interest of shippers if it is more reliable than the road, particularly as regards meeting deadlines in the framework of just-in-time transport operations. Traffic flow is also an important issue for carriers as the reliability of the services they provide to their shipper clients depends on it. One group of carriers, the shipping lines, is affected in another way. Reductions in container turnaround time result in capital savings for the shipping lines because they can reduce the size of their container fleet. As it is almost impossible to reduce sea crossing time, greater efficiency in container turnaround must be sought on land. Combined transport provides an additional way of optimizing container logistics, particularly for repositioning empty containers. As for freight handlers, they may well be inclined to favour modes that can transport high volumes to avoid the saturation of their port terminals. This explains why some port terminal operators are involved in developing "extended gates". (Slack, 1999).

2.1.3. The environment

In principle, combined transport is more environmentally-friendly than the road transport. In energy consumption terms, waterways are more energy efficient per tonne transported than rail (by a factor of 2 to 1) which itself is more energy efficient than road transport (by a factor of 2.6 to 1) (ADEME, 2006). To give one example, in the case of door-to-door transport between the port of Le Havre and the Paris region, combined waterway-road transport is responsible for between 20 and 50% less greenhouse gas (CO₂) emissions than road transport (Frémont et alii, 2007). Combined transport seems to offer a valid alternative, particularly in view of the fact that road transport is responsible for most of the CO₂ emissions from freight transport, and transport is the only major sector of the economy that is responsible for an ever growing percentage of total CO₂ emissions (ECMT, 2006a).

The environmental problem is primarily dealt with by the public authorities, particularly European Union which is at the forefront on this issue internationally. It receives strong support at national level from governments, as witnessed, for example, by the Grenelle environment forum in France, but also locally as there is very strong social pressure to reduce the environmental harm caused by economic activities, particularly transport. There is thus strong political and social pressure in favour of combined transport.

These environmental concerns are increasingly taken on board by both shippers and carriers who at present see them as a way of expressing their commitment to sustainable development but which are unable to discount the possibility of ultimately including environmental costs in their transport costs.

Table 1. The benefits of combined transport for different stakeholders

	Costs	Traffic flow	The environment
Economic agents			
Shippers	Reducing inland transport prices	Need for reliable transport chains	Sending out messages about sustainable development Anticipating a possible inclusion of environmental costs in transport costs
Shipping lines	Competing with the other transport organizers to attract freight from shippers	Offering reliable transport chains to clients	
Forwarders		Reducing container turnaround times	
Freight handlers	Same as above if the freight handler is also a transport organizer (as in Hamburg)	Offering reliable transport chains to clients	
The public authorities			
The port management	Interport competition	Interport competition	Reconciling sustainable development and economic development
The government, the regions, the municipalities	Economic development and jobs	Regional planning	
Public opinion	Same as above	Not tolerating the negative impacts of ports. NIMBY syndrome	

2.2. A very unequal situation in the Northern Range ports

All the Northern Range ports are currently involved in the development of combined transport. But the situation varies a great deal from one port to another as is shown by the modal split in the five largest ports in the range. In a schematic way, Le Havre can be contrasted with the other ports: it is not only the port with the lowest traffic, it is the port where almost all the hinterland services are by road. In the other four ports, the road still accounts for more than 50% of hinterland services but combined transport also plays a very important role, with waterway-road transport dominating in Antwerp and Rotterdam and rail-road transport dominating in the two German ports of Hamburg and Bremerhaven.

Table 2. Hinterland traffic of Northern European Range ports in 2005

	Traffic million TEU	Transshipment %	Hinterland traffic M TEU	Modal split		
				Road	Rail	Barge
Le Havre	2	28	1.4	87.4	6.2	6.4
Antwerp	6.5	16	5.5	59.1	9.4	30.7
Rotterdam	9.3	27.5	6.7	60.1	9.1	30.5
Bremerhaven*	4.5	62	1.7	55	43	2
Hamburg	8.1	41.9	4.7	67.4	30.2	2

* in 2006. *Source:* Port authority websites

The development of combined transport in Antwerp, Rotterdam, Bremerhaven and Hamburg is explained by a virtuous circle that has existed for some time. This results from a combination of several factors.

- The infrastructure: the Rhine with its tributaries is a natural waterway that penetrates more than 600 kilometres into the continent of Europe, providing access to the Rhineland of Germany, which is the economic core of the world's largest exporting economy. The principle of the free movement of freight vessels has applied on the Rhine since the Congress of Vienna in 1815.
- The characteristics of the market: the concentration of traffic in the four ports, which is chiefly explained by the wealth of their hinterlands, makes combined transport particularly attractive. The concentration of traffic that takes place in them justifies the use of modes with extremely high capacities (Notteboom, 2004).

- The number of inland terminals and rail or waterway services has increased steadily over time, making combined transport more attractive to shippers (Notteboom et alii, 2004). The nature of service patterns also affects the competitiveness of high volume modes. (Konings, 2006)
- The organization of the market is doubtless the most important factor. A handful of large transport organizers have structured combined transport services. In the two German ports, this has been done mainly by freight handlers which have set up rail services to new EU members, in particular Poland and the Czech Republic (Gouvenal et alii, 2005; Debrie et alii, 2005). On the Rhine, after a period of operation by small firms, a limited number of large waterway transport firms (Combined Container Service and Alcotrans Container Line in 1975, Rhinecontainer and Frankenbach in 1978) organize the market. From the early 1990s, inland waterways have handled almost 30% of Antwerp and Rotterdam's traffic. The 1990s saw the arrival of large firms performing both forwarding and logistics activities and which brought about vertical integration of the transport chain: Wincanton in 1990, Rhenus in 1995, Imperial Holding Logistics in 1998 (Zurbach, 2005). These three major forwarders control 70% of containerized volumes on the Rhine¹.

In Le Havre, the changes have occurred much more recently and primarily involve combined waterway-road transport. The combined transport market is driven by three shipping lines (Maersk, MSC and CMA-CGM) which own dedicated terminals (Frémont et alii, 2007). The volumes controlled by these three shipping lines are sufficient to justify the provision of commercial combined transport services on the Seine between the port of Le Havre and the Paris region. Gennevilliers, in the immediate vicinity of Paris, is the principal inland terminal, which means that it is possible to run frequent and regular limited volume shuttle services. The three shipping lines are currently competing fiercely for the Paris region's freight via this new combined transport service. The involvement of the shipping lines has encouraged considerable growth in combined waterway-road transport from the port of Le Havre, with its market share increasing from less 3% in 2001 to 8% in 2006. Unlike the Rhine model where the forwarders dominate, the French model is organized by the shipping lines.

¹ These figures date from 2004 given in the Annual Report of the Central Rhine Navigation Board

3. The organization of road transport and combined transport

The different factors set out above describe the context which has resulted in the unequal development of combined transport in the ports of the Northern European Range. It now remains for us to show in concrete terms how combined transport can be more attractive than the road. It achieves this essentially through a lower price than the road and by providing additional services.

However, before comparing of road transport and combined transport with reference to prices and services, we need to see how road transport and combined transport are organized from the port terminal to the final destination or vice-versa. In contrast to combined transport, road transport offers a choice of diversified organizational patterns. To begin with, road transport and combined transport do not offer the same physical transport service so the two are not directly comparable.

3.1. The different types of hinterland services provided by road transport

The road container transport community is constantly attempting to streamline transport, reducing costs and consequently prices. Starting with the exclusive provision of Round Trip services at the beginnings of containerization, road transport has gradually developed other forms of transport, which all aim to reduce the distances travelled by each transported container. The following organizational patterns have thus been developed.

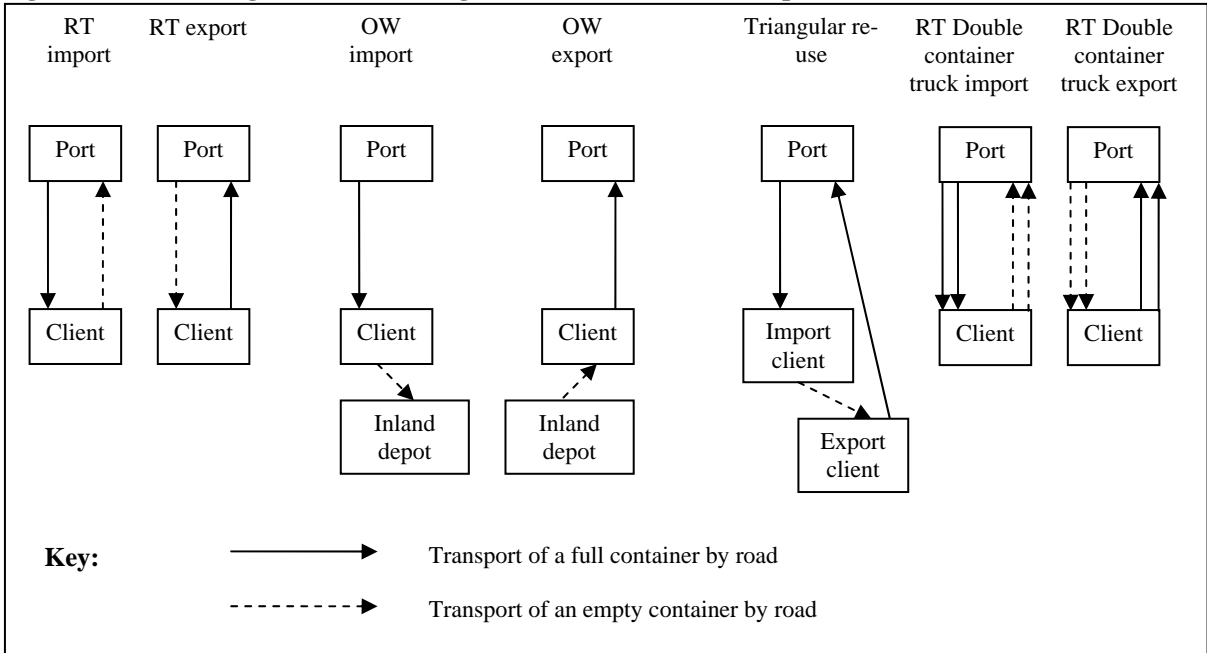
- Round Trip (RT) road transport. For import flows, the container is unloaded from the vessel and taken full to the consignee, unstuffed then returned empty to a depot in the port where it was unloaded. Conversely, for export flows, the empty container is taken from a depot in the loading port. Half the inland journey is therefore performed with an empty container.
- One Way (OW) road transport. This differs from RT transport in that an inland depot (in the hinterland) serves as a hub from where the empty container is taken and to which it is returned. The distances covered by empty containers are therefore smaller than in RT transport as the distance between the client and the depot is shorter than the distance between the client and the port (otherwise OW transport would be unjustified).

The freight rate per unit of distance by RT is approximately 75% that by OW. So, in a theoretical case where the empty container depot is just next to a client, for import flows RT transport would cost 1.5 times more than OW transport. This difference is explained by the

willingness of carriers to lower the per-kilometre freight rate in the case of RT transport as they are certain to be paid for the return journey. However, OW transport requires them to find a load for the return journey. Uncertainty in this connection results in higher per-kilometre freight rates for OW than RT transport.

- Triangular re-use. After the container is taken full to the client during the import journey, it is taken empty to an export client, refilled and returned full to the port.
- Double container truck. This is only possible for 20 foot containers which are light enough for the weight of the two 20 foot containers not to exceed the maximum permissible laden weight. The diagram below shows only the situation where two containers are loaded or unloaded at the same client’s premises. However, the two containers are often taken to and from different clients.

Figure 1. Different organizational strategies for road container transport



Source: the authors

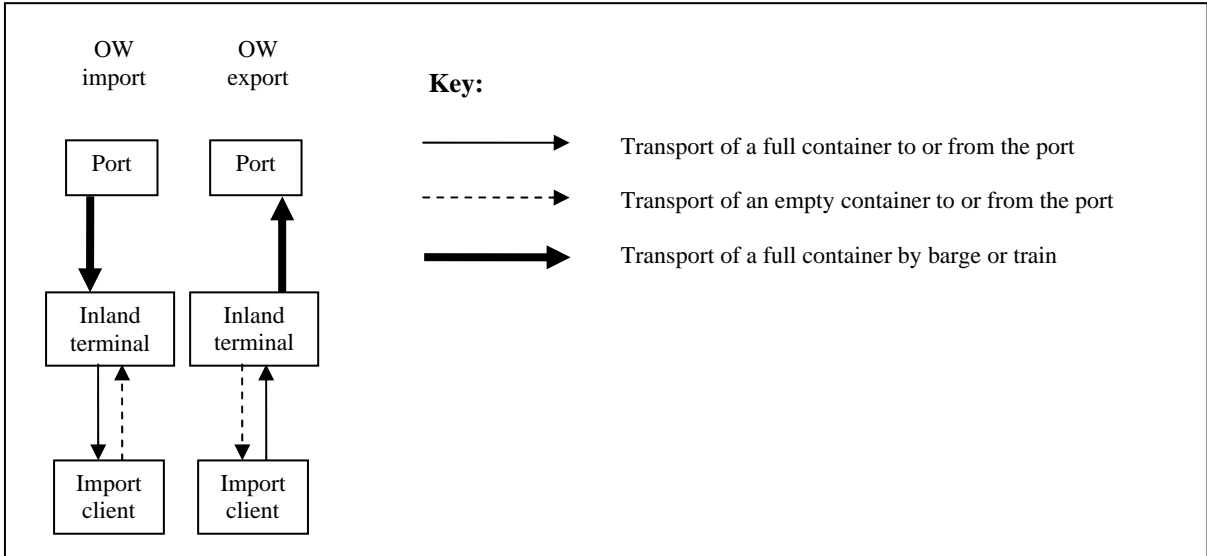
3.2. Combined transport hinterland services

Most combined transport involves the OW strategy. Moreover, the inland terminals where the shipping lines have not provided an empty container depot find it difficult to attract traffic. For import flows, the container is grouped with others in order to be transported by a high volume mode (train, barge) from the unloading port to the combined transport terminal. Before it is returned empty to the same combined transport terminal the full container is taken

to the consignee and unstuffed there without being taken off the truck chassis. For export flows, the same procedures are carried out in reverse order.

Triangular re-use and the use of double container trucks are not as advantageous in the case of road transport of this type to or from a port as they are in the case of long haul road transport. The benefits of streamlining are smaller in the case of short distances than long distances. The detour that is necessary for triangular re-use may be negligible in the case of a long distance, but for a short distance it may be preferable to pass through the inland depot again. The same applies when a double container truck is used to serve two different clients. Consequently, most road transport to and from ports involves return journeys with one container at a time.

Figure 2. Different organizational patterns for combined container transport



Source: the authors

4. What are the advantages of combined transport over road transport? The example of combined waterway-road transport between the port of Le Havre and the Paris region.

The competitiveness of transport by inland waterways is not pre-ordained. It only comes about as a result of a desire to improve on the service provided by the road transport alternative. Waterway-road services must outperform road transport in terms of price, quality and quality of service. An analysis of waterway services to and from the port of Le Havre allows us to highlight some of the components of the competitiveness of water-borne transport.

4.1. Prices

Combined transport can establish itself in the place of road transport if it proposes lower prices. In fact, in the context of well-established road transport to which transport operators have become culturally accustomed, transfer from the road to combined transport will only occur if its pricing is attractive. According to the various transport operators we interviewed, the prices must be about 10 to 20% lower than the prices of road transport to stimulate a move from one mode to another.

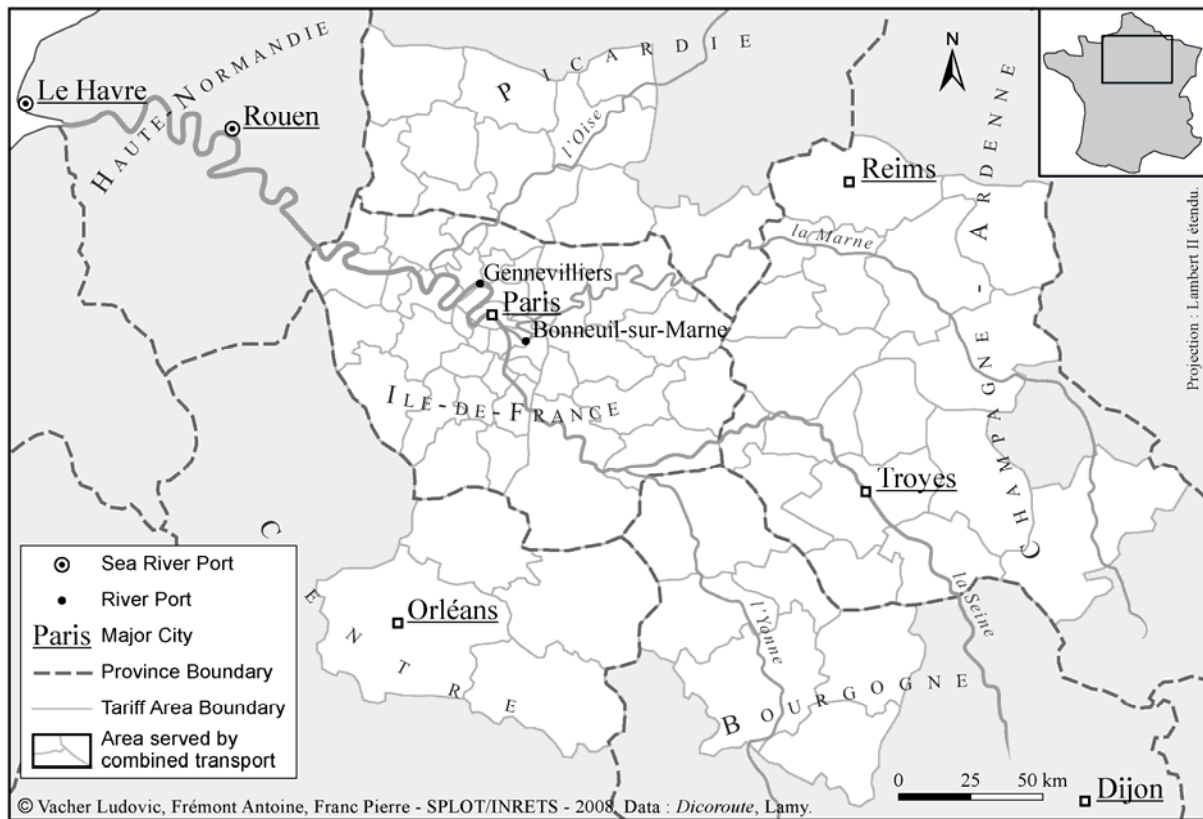
4.1.1. Methodology

In order to make price comparisons between the two modes, in 2007 we examined the pricing schedules of a number of combined waterway transport operators at Le Havre and those of a number of road haulage operators. The pricing schedules of the road haulage operators reflected the different organizational patterns described above.

In Europe, and in France in particular, combined waterway-road transport uses the One Way (OW) organization. This means there must be inland depots to and from which the empty containers transported by combined transport are taken. However, these depots also help to perpetuate OW road transport as they are also used by road transport for returning empty containers, which improves its price competitiveness in comparison with a conventional RT service.

The prices of inland transport from the port of Le Havre are calculated on the basis of a breakdown of the Paris basin into “dico-route” zones (Figure 4). All the stakeholders involved in inland transport use long-established charts that calculate average distances.

Figure 4: Breakdown of the Paris basin into “dico-route” zones



Freight forwarders and shipping lines are able to purchase inland transport services in a number of ways. Import or export combined transport services for 20’ or 40’ containers are always sold to the forwarder or shipping line as an OW service. However, road transport services are marketed either as OW or RT services. The transport of 20’ containers weighing less than 13 tonnes can also be sold as an RT double container truck service. In view of the congestion problems in the Paris region most road haulage operators in Le Havre charge a minimum price for services to it, which tends to drive up the price of road transport.

We then compared the price that is proposed to transport organizers – freight forwarders engaging in merchant haulage and shipping lines engaging in carrier haulage – by a combined transport operator to that proposed by a road haulage operator. These prices do not include any commercial reductions. Neither are they the prices ultimately charged by the shippers as they do not include the transport organizer’s margin. Nevertheless, they clearly show the competitiveness of one mode in relation to the other. For example, it is quite likely that if any commercial reductions are applied to road transport for large volumes similar reductions will also be applied to combined transport.

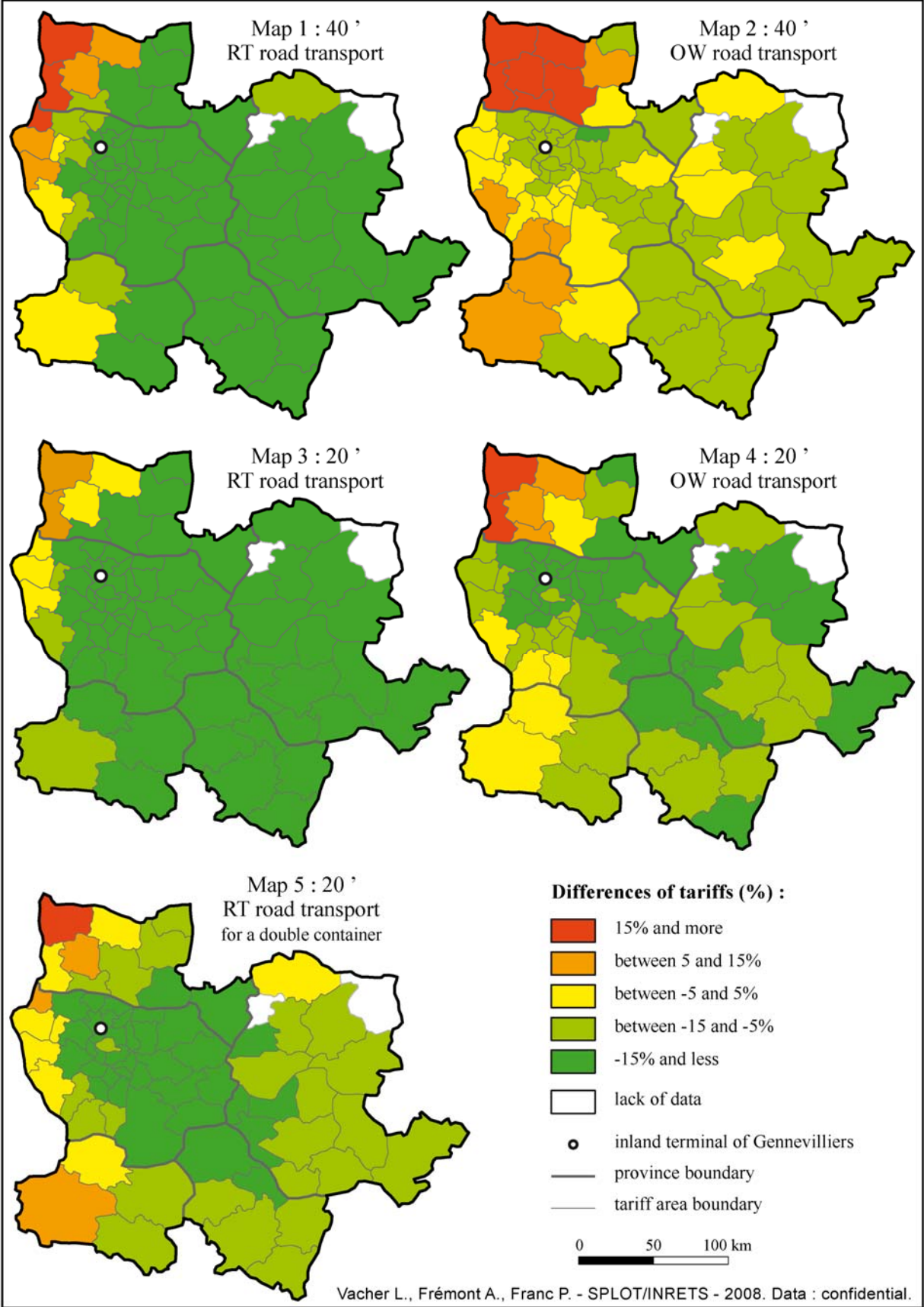
As the road constitutes the reference mode, the competitiveness of combined transport has been defined in the following way:

Percentage saving or loss resulting from the transfer to combined transport = (price of combined transport – price of road transport)/ (price of road transport)

The further the result is below zero, the more competitive combined transport is in terms of price. Conversely, the further the result is above zero the more competitive road transport is.

Five maps have been drawn to show the influence of the type of container (20' or 40') and the organizational pattern of road transport (OW, RT or double container truck) on the competitiveness of combined waterway-road transport.

Figure 6: Difference between the tariffs of a river combined transport and the tariffs of road transport between Le Havre and the Paris region



4.1.2. Results

It is apparent from the maps that, generally, combined transport is very competitive with road transport. Combined transport has a price advantage to the east of the Gennevilliers inland terminal, including for distant destinations more than 200 km from Gennevilliers. However, to the west of the Gennevilliers terminal, towards the port of Le Havre, combined transport is not often competitive. There is a logical explanation for this: the distance by road between Le Havre and the inland destination is shorter the further west the latter is from Gennevilliers, which reduces the cost of road transport. In contrast, combined transport involves transport by barge to Gennevilliers and then doubling back for the journey to and from the inland terminal.

Combined transport's overall price competitiveness over such a large geographical area is doubtless explained by the commercial desire of the combined transport operators to promote the mode. The combined transport operators at Le Havre are the three largest shipping lines in the world. They are currently in fierce competition with each other for the very large hinterland that consists of the Paris region. This freight is essential to justify their large vessels calling at their dedicated terminals at Le Havre in which they have recently invested heavily.

However, the overall competitiveness of combined transport varies a great deal according to what road transport alternative is available. The combined mode is more competitive when the road transport alternative consists of RT rather than OW transport (comparing maps 1 and 2). The reason for this is that RT road transport is more expensive than OW as the empty container has to be returned to the maritime terminal. Combined transport also becomes less competitive in the case of 20' containers when road transport changes from RT to OW services (comparing maps 3 and 4).

Combined transport is more competitive for the transport of 20' containers of more than 13 tonnes than for 40' containers (comparing maps 1 and 3). The reason for this is that a 20' container takes one barge slot while a 40' container takes two, with a minimal price difference between the two in the case of road transport. However, the market area for combined transport shrinks considerably when the 20' containers weigh less than 13 tonnes and road transport is able to use double container trucks (comparing maps 3 and 5).

The way road transport is organized is changing over time. It depends on the balance of power between the road haulage operators. The clients themselves have differing interests. As far as the transport organizers are concerned, it is in the interest of the freight handlers to

purchase the cheapest possible road transport, so they are not interested in purchasing RT transport. For the shipping lines, the problem of repositioning the empty container is added to the price of purchasing full container transport. This leads them to employ a variety of strategies depending on how well hinterland flows are balanced.

Different road haulage operators also have differing opinions. For some, selling OW services is a way of ensuring they offer competitive services to their clients. Others consider that OW services may reduce their profit margins. Under these circumstances, the way the services are distributed between RT, OW and double container truck services depends on the type of client and the strategic decisions made by road haulage operators.

4.2. The importance of additional services

Price on its own is not enough to prompt the actors in the transport chain to break their habit of almost systematically using road transport. In order to promote combined transport it is necessary to offer additional services that road transport does not provide. The development of combined waterway-road transport on the Seine reveals three stimuli which assist waterborne transport.

The first stimulus consists of offering more flexibility than the road as regards container parking durations. Lengthening the free parking period for containers at inland terminals constitutes an initial incentive. Shipping lines often stipulate a demurrage time for containers. This is usually of the order of one or two weeks depending on the shipping lines and the trades². Beyond this limit, the shipper pays a daily fee. The free parking times that are fixed by the freight handlers in the port are added to the demurrage times. To give an example, parking is free for four to five days in the majority of the terminals at Le Havre. Beyond this limit, the shipper has to pay parking fees. Clients who use combined waterway-road transport have extra free parking time as in addition to the free parking period at the port terminal there are two days of waterway transport followed by eight more days of free parking at the Paris. In addition, the parking fees at inland freight terminals are considerably lower than those at maritime terminals. Shippers therefore have more flexibility as regards the delivery day if they use combined waterway-road transport. Some shippers make use of this opportunity to store their goods for a longer period on barge trains and inland terminals.

This first stimulus combines with a second which offers customs facilities to shippers that use combined transport. For import flows, French customs and some combined transport

² Shipping line data

operators have signed agreements that make it possible to set up simplified Community transit procedures. These grant combined transport operators the right to store import containers in Temporary Warehouse or Storage Areas in the Gennevilliers and Bonneuil-sur-Marne inland terminals for up to 45 days after their departure from Le Havre. This facility costs the shipper between €20 and €30 per container. The client can then have the container delivered to its warehouse. In the event of this being a bonded warehouse, the client has 20 more days before it becomes necessary to declare its freight. Consequently, the customs clearance deadline becomes 5 days in Le Havre + 45 days in Paris (on condition parking fees at the inland terminal are paid) + 20 days in a warehouse = 70 days. This additional time is particularly attractive in view of the high customs clearance costs for a container. Major shippers, in particular large-scale distributors, are particularly interested by these arrangements. They mean they can wait until the products to be sold are on display in an outlet before making any payments. When end-consumers pay at the supermarket checkout, they pay almost at the same time as the distributor pays the customs charges. For export flows, there is a customs procedure that allows the formalities to be carried out during waterway transport which helps lower door-to-door transit times.

Thus, far from constituting a handicap for combined transport, the time factor becomes an asset of the first order. It is establishing itself as an additional adjustment technique for freight just-in-time delivery times while at the same time offering greater flexibility for customs clearance.

4.3. Incentives from the public authorities

The public authorities are also taking measures to promote combined transport. The French Transport Ministry subsidizes cargo handling operations for containers that use combined transport. These subsidies are justified because combined transport requires more handling operations than road transport at both maritime and inland terminals. The THC include placement on the truck chassis for road transport, but the freight handlers in the port make an additional invoice for these supplementary handling operations. In the other Northern European ports, the THC also include placement of the containers on barges. These subsidies have therefore been approved by the European Commission which considers that they do not distort competition. In 2007, this aid amounted to €12 per container per handling operation. It can be increased on the basis of the number of handling operations carried out in France. The Transport Ministry can thus pay up to €48 per container, on condition the sum amounts to less than 30% of the total transport costs. The Autonomous Port of Paris (PAP) has also

introduced commercial measures to encourage combined transport that involve reducing property costs by means of a “waterways package”. The principle is as follows: the more a shipper or forwarder located on land belonging to the PAP uses waterborne transport, the less rent it pays. The resulting savings compensate for the few hundred metres of road transport between the inland terminal and the client’s warehouse, effectively transforming the latter into a waterside warehouse. Schenker and Les Grands Moulins de Paris, which are located at Gennevilliers on PAP land and which use combined waterway-road transport, take advantage of this arrangement.

5. Conclusion

In the ports of Northern Europe, a strong dynamic currently favours the development of combined transport, with respect to both absolute value and relative value compared with road transport. For it to develop, the price of combined transport must be lower than that of road transport. In order to compare the price of combined transport and road transport it is first of all necessary to highlight the different organizational patterns that are employed in road transport. The example of hinterland services to and from the port of Le Havre shows that the competitiveness of combined transport compared with road transport is primarily due to the commercial policy of combined transport operators. In order for clients to make the switch from the road to combined transport the latter must be between 10 and 20% cheaper than the road.

Le Havre is a particularly interesting case in view of the fact that combined transport operators manage to offer prices that are so much lower, even though the high volume flows involve only a very short distance (Le Havre-Gennevilliers), which is a highly adverse situation for combined transport. On the Rhine, which is straight and much longer than the Seine, it should be possible to provide greater price differences, particularly in view of the fact that the transported volumes are much higher. The same applies to rail services from Hamburg and Bremerhaven. Nevertheless, we have also shown that the competitiveness of combined transport in terms of price varies greatly according to the way road transport it competes with is organized.

These variations in price in fact prove that road transport and combined transport are services of two different types which compete with each other to carry freight between the same origins and destinations. Indeed, shippers also choose combined transport because of

additional services which are not provided by road transport. Paradoxically, the time factor is central to these additional services.

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