Klink, Arjen Van; van Winden, Willem

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Towards a new hinterland orientation for Rotterdam: the entrepreneurial port

Paper for the 38th congress of the European Regional Science Association
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Willem van Winden and H. Arjen van Klink
Erasmus University Rotterdam
PO Box 1738
NL 3000 DR Rotterdam
vwinden@few.eur.nl

Abstract

Key words: port management, hinterland, Rotterdam

Fundamental changes suggest a new scene for seaports. In the new situation, ports cannot rely only on infrastructure and transport services to optimize their hinterland access. To optimize inland accessibility, port authorities have to look beyond infrastructure and give more value to intangible aspects of accessibility. The exploitation of knowledge available in the port community to develop innovative logistic concepts to bind shippers and regions to the port is recommended. Such a new hinterland approach is especially relevant for the port of Rotterdam. Rotterdam seems to have problems to penetrate in regions outside its captive market: the share of rail transport still is relatively low and its presence in Central Europe falls short to its 'mainport' status. To secure its present market and to extend its market reach towards Central Europe, a more active orientation on shippers and regions in the hinterland is required as a complement to infrastructure investments. The recently developed transport concept for Chrysler can be considered as an illustration of a new hinterland approach.

1. Introduction

Fundamental developments are changing the hinterlands of seaports in Europe. The following events from last year illustrate this: In 1997, Kia Motors opened a new plant for the assembly of cars for the Central European and Russian market in Kaliningrad, the Russian Baltic enclave; the plant is sourced from oversea mainly through the port of Hamburg. The rail operator NDX introduced in 1997 a service between Rotterdam and Barcelona, offering the opportunity for time critical products from Asia destined for Northwest Europe to be transshipped via Barcelona and to cover the final section of the transport chain by train. In the same year, Munich obtained an additional opening to the sea - next to the routes to the North European ports - by a block train to the south Italian port of Gioua Tauro.

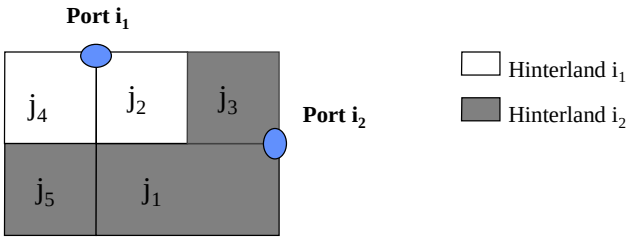
From fixed outlined areas, hinterlands are becoming difficult to demarcate. This situation has dramatic consequences for the way in which port authorities orient themselves on their inland market. In this paper, we discuss the issue of hinterland dynamics and port strategy from the perspective of Rotterdam. First, some theoretical backgrounds on hinterlands and inland accessibility are given. Then, an analysis of the present market position of Rotterdam is sketched, followed by a description of several fundamental developments with an impact on European seaports and hinterland development. The consequences of these trends on the position of Rotterdam and the way to answer these consequences are explained next. A case study on a new hinterland orientation of Rotterdam and some general conclusions complete this paper.

2. Hinterland and inland access: a theoretical delimitation

A seaport's hinterland is the continental area of origin and destination of traffic flows through a port, in other words, it is the interior region served by the port. As the region is the port's market, a prerequisite in developing a marketing strategy is to know its spatial dimensions.
One very simple method to define a port's hinterland is to consider transport rates from the port to the interior. In this approach, those places that can be served by the port cheaper than from other ports belong to the port's hinterland. This can be illustrated by a very simple numerical example: see figure 1. Imagine a continent with 5 regions and two ports. Each of the regions demands transshipment for its overseas imports and exports. Because the regions are not equal in size, some have a higher transshipment demand than others - see the import and export table. For the sake of simplicity, we assume that unity transportation costs arise when a border has to be crossed. It is clear that j_2 and j_4 form the hinterland of port i_1, and that the hinterland of port i_2 consists of regions j_1 and j_3. Region j_5 is indifferent regarding the ports; we assume that both ports transship an

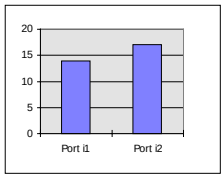
equal share of the overseas trade of j_5. Total transshipment of port i_1 amounts to 14; In the bigger port i_2 16 units are transshipped.

Figure 1. Numerical example



	Import+export
j1	12
j2	6
j3	4
j4	8
j5	2

Transshipments



Up to this point we assumed that only transportation costs are relevant in the determination of the hinterland. In practice, however, direct monetary costs do not determine the relative attractiveness of the port towards a certain inland market only. Costs related to risks and time should also be considered. Together with direct monetary costs, these costs are included in the concept of generalized transport costs (van den Berg, 1987). Generalized transport costs cover all costs relevant for bridging the distance between places i and j. Imagine for example that region j_1 is a relatively risky region for the transit of goods, because of high theft rates. In this case, shippers in region j_5 are no longer indifferent between port i_1 and i_2 but will prefer port i_1 for all their transshipments because the generalized transport costs are lower when port i_1 is used.

Externalities can also be included in generalized transport costs. These are considered to have an exponential course: costs related to time and risk will increase more than proportionally to reach places farther away than those at a short distance.

The attractiveness of port i for regions Σj can be expressed in potential. In the spatial-economic literature, the concept of location potential has been developed to determine the attractiveness of a location. A location potential of place i is the sum of the location characteristics in all places j around i weighted with the generalized transport costs between i and j. On the basis of the concept of location potential, we define the *hinterland potential* of a seaport i as the demand for transshipment in terms of import and export to/from a set of places j weighted with generalized

transport costs between i and j. Delimiting a port's hinterland on the basis of generalized transport costs indicates the spatial dimension of the hinterland.

The hinterland potential of a port is dynamic. It can change due to fundamental developments in technology, economy and society, which have an impact on the demand of shippers for port services as well as on generalized transport costs. For the port authority, the demand for port services (the import and export of the regions j) is merely exogenous. To a large extent, this is also true for generalized transport costs. However, the port authority might influence this variable. For instance, appointing a port representative in an inland region may reduce the 'psychological distance' between this region and the port and, therefore, result in lower generalized transport costs. In this way, generalized transport costs can be considered as a tool for port authorities in strengthening the role of their port for a specific market and enlarging its hinterland.

In practice, delimiting the hinterland of a seaport is much more complicated than in theory. First, it is difficult to estimate or measure the generalized transportation costs from port to inland locations j ; It is not easy to measure the values that port users attach to risk and time, or to determine psychological perceptions. Second, the use of ports cannot always be traced to cost and market factors. In many cases, historical, psychological, political and personal factors result in a transport pattern that diverges from the perfect market outcome (see also Simons, 1984). The question remains how the hinterland of a port can be measured. As indication of the hinterland of a port, we will use available data on overseas imports and exports in tons of different countries (or regions, if possible). This comes down to an ex-post estimation of relative generalized transportation costs: Low volumes of shipped cargo between port i and region j are an indication of relatively high generalized transportation costs between i and j, and vice versa.

3. Rotterdam: mainport for the Benelux and Western Germany

Rotterdam is one of the gateways to Europe playing an important role as point of transshipment in intercontinental logistic chains. With a transshipment volume of 294 million tons in 1996, Rotterdam is the largest port of the world. In Europe, Rotterdam also is the largest container port with 4.9 million TEUs transshipped in 1996 and a market share of 37.5% in the Le Havre - Hamburg range. (Port of Rotterdam, 1997). However, compared to other ports such as Hamburg and Bremen, the level of containerization in Rotterdam is relatively low. This relates to the high share of bulk commodities in Rotterdam, such as oil, iron ore and coal.

Figure 2. Container indexes 1995

	Container index
Rotterdam	0.71
Hamburg	2.2
Antwerp	1
Bremen	3.6

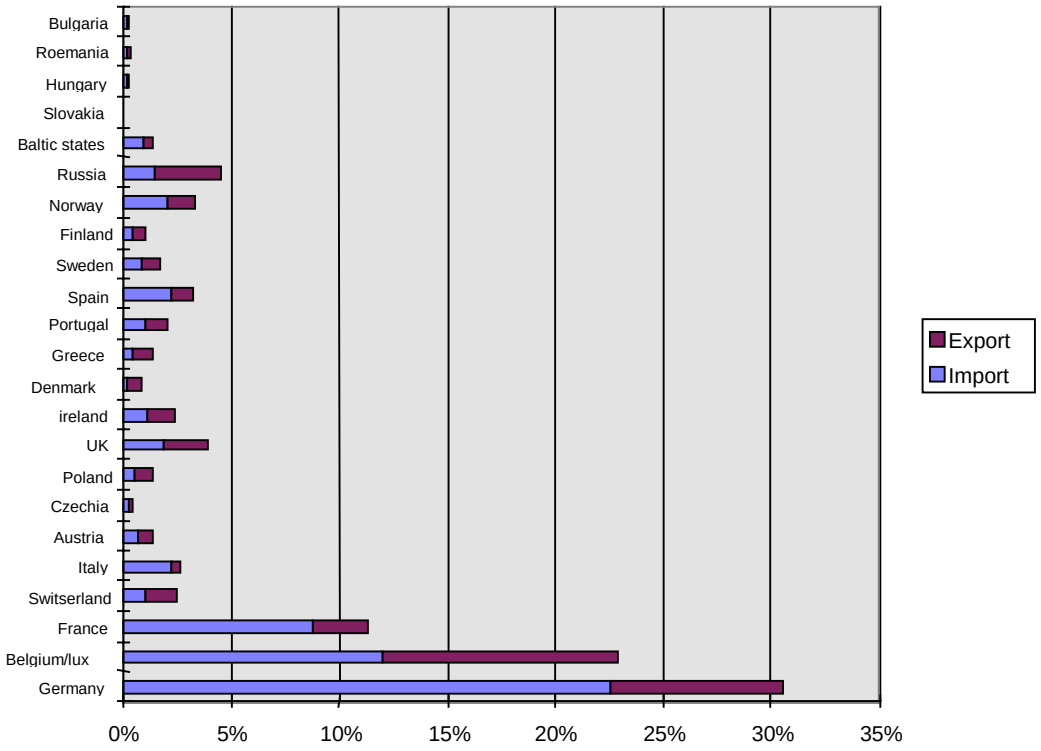
Source: Van den Berg (1996)

The container index is measured as the ratio of the share of the port in container transshipment in the Hamburg le Havre range on the one hand and the share of the port in non-containerized transshipment in the port in the Hamburg-le Havre range on the other.
Rotterdam scores only 0.71 in 1995, which indicates that Rotterdam's relative strength in containers is much less than in non-containerized cargo. In Bremen and Hamburg, the reverse is true. (Van den Berg, 1996). Figure 3 shows the hinterland of Rotterdam on the basis of the shares of imports and exports related to European countries in the total inbound and outbound transshipment of Rotterdam. As can be concluded from this figure, the hinterland of Rotterdam mainly consists of Germany (the western part), Belgium, Luxembourg and France. That does not only hold for bulk cargo such as crude oil and iron ore, but also for container cargo. Total containerized cargo amounted to 225 million tons in 1995. Of this volume, the share originated from/destined for Germany and Belgium was 39% and 19% respectively. The thought launched by marketeers that 'the mainport of Europe' is serving the complete continent thus is somewhat misleading.

The course of the river Rhine can be considered as the structuring element in the port's hinterland, as the low cost transport of bulk goods by barge to/from the port forms a clear advantage of the port of Rotterdam compared to other ports. With its mainly Rhine- based transport system, Rotterdam has been able to serve the most prosperous and densely populated part of the continent and to become the largest port of the world. The structuring effect of the Rhine becomes clear in figure 4, showing the market shares of Rotterdam, Antwerp and Hamburg in the states of Germany.

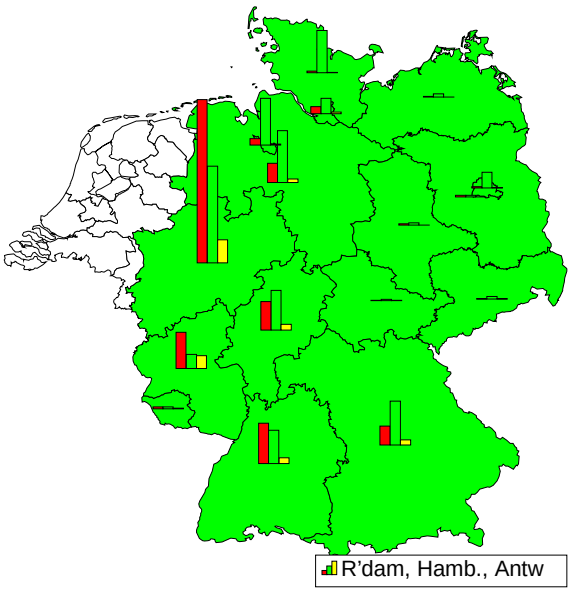
Figure 3. The Rotterdam hinterland in 1995, Imports and exports to/from Rotterdam in tons;

shares of European countries



Source: CBS (1996)

Figure 4. Container traffic (tonnes) to/from German Länder via the ports of Rotterdam, Antwerp and Hamburg



Source: NEA (1992)

4. Dynamics in the hinterland potential of ports: Fundamental developments

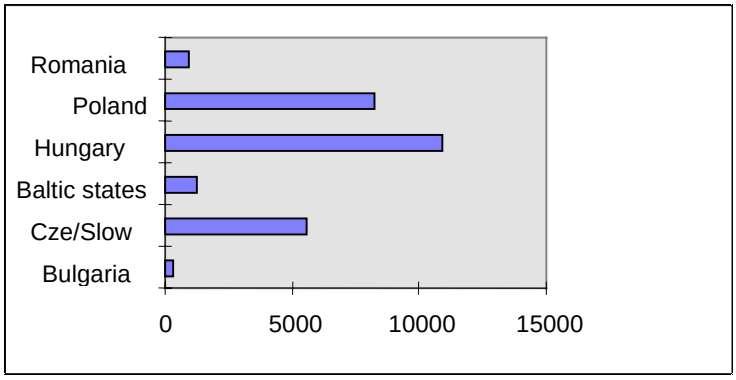
In section 2, the hinterland potential -representing the attractiveness of a port as a transshipment

node- was defined as the demand for transshipment in terms of imports and exports to/from a set of places j weighted with generalized transportation costs between i and j. This potential changes under influence of fundamental developments. Three types of fundamental developments can be discerned. The first type influences the generalized transportation costs between ports and hinterland. The second relates to changes in demand of transshipment, both qualitative and quantitative. The third important development finally is the entrance of new competitors in the market for transshipment. In this section, these developments are discussed.

Changes in demand

The demand for transshipment in Europe is changing because of geo-political developments and due to qualitative changes. The most important demand change due to geo-political factors is the opening up of Central and Eastern Europe. Directly after the fall of the Iron Curtain, imports from the West multiplied; Consumers in Central Europe turned to western products. Soon after, Western firms started to invest in the area.

Figure 5 Cumulative foreign direct investments 1991-1995, in million US$



Source: Worldbank (1996)

After a phase of decline, associated with a painful transition from central planned systems to more market-oriented economies, central European countries – in particular Poland and Hungary – seem now to have entered a period of expansion (IMF, 1996). The investments are not only aimed at benefiting from the growth of consumer markets, but also to reap the fruits of the region as low cost production site serving Western Europe. The inflow of consumer products and semi finished products has increased dramatically. In some cases, the attractiveness of the region as production site has resulted in overseas flows of cargo to the area. An example is the location of 'transplant' of a Korean car manufacturer in Poland. Seaports in the Le Havre – Hamburg range and in the Mediterranean as well are orienting themselves on the Central European market to benefit from expected growth of transshipment to and from the area. From their historic linkages with the

region, the German ports of Bremen and Hamburg have an advantage over other ports in serving the maritime transport needs of Central Europe.

A second category of changes in demand with fundamental consequences for ports is the individualization of demand. It is no longer true that the producer determines what the customer can buy, but the customer determines what the producer makes. In other words: Logistic chains are reversed form producer-driven to consumer-driven. The flexible production methods and the trend of location secondary production geographically close to customers directly stem from this demand individualization. Enabled by advanced information technology, changes arise in the choice of storage, distribution and even production locations. (Van Klink and Van Winden, 1997).

Changes in generalized transportation costs

A first important development that influences generalized transportation costs is the increasing mobility constraints on road transport in Europe. The first reason is that the growth of road traffic has caused environmental problems. Secondly, the growth of traffic is affecting the accessibility of economic centers – such as ports – negatively. Given the importance of accessibility and quality of life for the present society, a further growth of traffic is not tolerated by the public. Longer distance trips and traffic within urbanized areas should be curtailed and business trips should get priority over private trips. Switzerland, Austria and France have already taken measures to limit truck traffic in weekends. The measures to restrict road traffic limit the freedom of choice of citizens and enterprises with regard to their transport behavior. Consequently, they will seek alternative modes and routes or, whenever no alternatives are available, reduce their interaction.
The development of selective mobility in general and the policy to restrict long distance truck transport has dramatic consequences for ports. Generalized transportation costs incurred in the transportation by road of goods from the port into the hinterland increase. In particular, ports with a relatively high share of road haulage in the modal split for their inland transportation are hard hit.

A second development influencing the level of transport costs is the slowly but steady development of rail transport from national bureaucracy towards international competition. National railway companies operating inefficiently and inflexibly have controlled rail transport in Europe. This situation is an impediment for stimulating rail transport. Only in a few countries some steps forward have been made to transform the bureaucratic railway companies into market oriented companies. Another obstacle for intra European rail transport is the national orientation of the railways. The liberalization of rail transport has to take both barriers away. Third parties are

getting permission to run trains. Freeways are being developed to offer shippers an integrated product for transport on corridors through several countries. As a consequence of these policy initiatives, all kinds of alliances are concluded to profit from the new chances. The promotion of rail transport will change the competitive scene of seaports in Europe: their inland accessibility will partly be organised by new actors with new management principles and seaports with efficient access to the European rail network will have a start over other ports.

Thirdly, information and communication technologies (ICTs) play an important role. ICTs have become strategic weapons in the transport and logistics industry (Cooper et al., 1992). Without these technologies, efficient and responsive actions cannot be made in the present world with its complexity, information excess and competition. ICT's are a strategic tool in rationalizing transport chains. They are not simply aids to transport planners anymore, but are playing more and more an intervening role in decision making: they tell the planner what to do or even act without human intervention. In the last few years, software for route planning has changed the role of traditional dispatchers and has improved the efficiency of transport in terms of, among others, empty mileage reduction. Especially shipping companies have invested in ICTs to rationalize their inland operations. Virtual transport booking offices have arisen. The internet is coming up as communication tool, overrunning long lasting initiatives to introduce EDI in port communities (Business Week, 1996). ICTs add to the transparency of transport markets and stimulate the footlooseness of traffic patterns: if parameters change, the computer simply shifts the transport chain's routing.

ICT's have different impacts on the hinterland of ports. Firstly, the use of ICT's influences the generalized transport costs between seaport i and market locations Σj. For example, the use of electronic tracking and tracing systems make shipments to riskfull areas less risky, and thereby reduces the generalized transportation costs. Secondly, ICT's make transport patterns more footloose, thereby adding to the seaport's position of dependency: Cargoes are less and less bound to one transshipment node.

New competitors

During the last years, ports in Southern Europe develop as competitors for ports in the Hamburg-le Havre range. Until recently, Southern European ports had virtually no transit function, but only served as a port for their direct surroundings, mainly because of a lack of (natural) hinterland corridors. Also, the strong position of the state and trade unions in the southern European ports hampered their development. Recently however, budget cuts and liberalization has reduced the role of the state; some ports have even been privatized. A further important change is the drastic

decrease of the number and intensity of strikes in Southern European ports. Their position is also strengthened by the cohesion policy of the European Union: large subsidies flow to these ports, and are used to modernize the ports and ameliorate their inland accessibility by constructing highways and railways to the hinterland. All in all, the position of Southern European ports has become stronger. This is illustrated in figure 6.

Figure 6. Container transshipment 1992-1996 (x 1.000 TEU)

	% Change (92-96)	1996	1992
Algeciras	+68%	1,307	780
La Spezia	+46%	871	596
Genua	+250%	826	330
Barcelona	+39%	765	552
Valencia	-	710	n.b.
Gioia Tauro	-	572	-
Marseille	+57%	548	350
Antwerpen	+45%	2,654	1,835
Hamburg	+35%	3,065	2,268
Rotterdam	+19%	4,936	4,125

Source: Brolsma (1997), Rotterdam Port Authority (1997)

An example is the port of Giao Tauro in the southern part of Italy. Investments in the port have resulted in a modern container terminal near deep water. The port is used by global carriers as a hub. Cargo is feedered by sea to neighboring harbors, and recently by train to Northern Italy, Switzerland and Austria. With these services, the port seriously threatens the position of Northwestern ports, in particular regarding Asian cargo destined for central Europe.

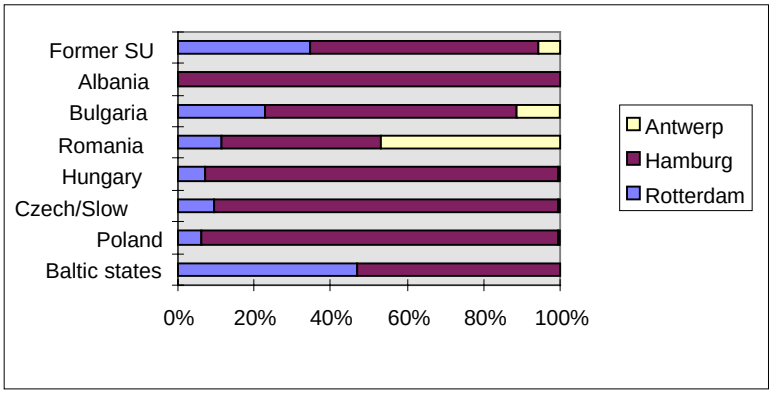
5. The need for entrepreneurship in the hinterland focus of ports

The fundamental developments set a new scene for seaports. Demand conditions change - new regions emerge, demand becomes more individualized-, generalized transport costs change because of mobility constraints, and the use of ICT's, and new competitors -ports form Southern Europe- enter the market for transshipment. New criss-cross patterns of traffic flows will arise. New agents will enter the market as transport operators and logistic service providers. New demands on transport efficiency and reliability will be made.

The changes make is difficult to assess who is the port's client, what his logistics needs are, what

the origin/destination of the load is and which port he will select. For Rotterdam, the fundamental changes imply that the advantage of the Rhine has come under pressure. Firstly, semi-finished and finished products have come up in international transport, as a result of growing prosperity and new production strategies. These products set other demands on transport than bulk cargo. Higher requirements on flexibility, rapidity, reliability and safety make inland shipping not the most appropriate mode of transport.(Kreukels and Wever, 1996). Secondly, other regions than the traditional hinterland of Rotterdam are showing strong economic development and can be expected to exercise strong demand on port services in the future. These regions are situated in Central and East Europe, and cannot be served by Rotterdam at all via waterways or only after a long journey passing numerous locks. Consequently, Rotterdam has a weak position in this region, in particular compared to Hamburg. See figure 7.

Figure 7 Share of ports in overseas container imports (tonnes) of central and Eastern Europe



Source: NEA (1992)

Both developments described above affect the role of the river Rhine to serve the market from Rotterdam. In addition, road haulage has also come under pressure. In container transport from Rotterdam, the truck dominates. Container transport from/to the port entails some 4,000 truck movements every day. The dominance of this mode of transport adds to the congestion in the port area. Besides, European policies to reduce truck transport may affect the role of the truck. Also in that respect, the present system of hinterland transport is involving risks for the port.

Given the limited market reach of inland shipping and the pressure on trucking, the Rotterdam port's strategy is focusing on rail transport, more in particular on building new infrastructure (Betuwelijn and Rail Service Centers) and introducing new transport services (shuttle trains). Nowadays, some 300,000 TEU are transported by shuttle trains per year. Trains to destinations in the traditional hinterland of the port appear to be a success. However, shuttles to 'new destinations'- such as Munich, Warsaw and Prague - show a low occupancy rate. Generalized transport costs between Rotterdam and these destinations seem too high to attract cargoes.

The inability to build these trades successfully has external and internal causes. Rotterdam is blaming the German rail operator Deutsche Bahn for the limited accessibility towards south and central Europe. Indeed, the discriminatory behavior of the *Deutsche Bahn* still seems to favor the German ports and can be considered an external cause. Another cause - asking for more attention in Rotterdam in the light of the fundamental changes - is the rather large psychological distance between Rotterdam and new markets in Europe. Shippers in Central Europe are not aware of Rotterdam. That can be considered an internal cause, one of which the port itself can be blamed for, of the limited position of Rotterdam outside its traditional market. In the past few years, the port community has invested not enough in making contacts with shippers in the new markets.
To reduce psychological distances between the port and new markets, new infrastructure is not the answer. At least not the only answer. Neither are transport services.

The need for knowledge based development

In ever more complex logistics operations and increasingly open transport markets, know-how comes at the first place to bind clients. The knowledge intensity of operations is increasing in order to find the most optimal transport mode, transport route and value adding services.
A possible strategy of the port could therefore be aimed at knowledge-based development. Knight (1995) describes knowledge- based development as the transformation of knowledge resources into local development. In a time in which society becomes increasingly knowledge based, cities should focus on the types of knowledge resources, which are already based in the city, and create conditions conducive to their development. This concept can be translated to the development of ports. Given the demand for more knowledge in the market, seaports should consider the expertise of their port community as an asset and basis for competitive advantage.

The knowledge base of the port consists of several elements. It is embedded in firms in the transport industry -transshipment firms, transport operators-, but also in banks, insurance companies, consultants, planning specialists, technology suppliers, education and research institutes, the port authority and so on. The knowledge base of the port is not the same as the knowledge capacity. Knowledge capacity is the ability to benefit from the existing knowledge base. It can can be defined as the capacity of port actors to create new knowledge, attract knowledge from elsewhere, store, transform, and use knowledge, and link various actors in the field with each other. (Geenhuizen/Nijkamp, 1997). The knowledge capacity can be deployed to improve inland accessibility in a broad sense, or, in other words, reduce the relative generalized transportation costs between port and hinterland and improve the ports potential as a transshipment node. How can this be achieved? First, the port community can organize itself and act jointly as a

logistical engineer for individual shippers, for example by advising them transport concepts and routes. Second, the port can make its know-how available to inland regions and assist them in building inland terminals and logistic business parks. Through these activities, a relationship with the port can be build physically and psychologically. A ports' role as logistic engineer requires a more entrepreneurial and strategic orientation on the hinterland. It means changing attitudes fundamentally: cargoes do not come with the ship anymore (carrier port oriented on the sea), but the ship comes where cargoes are (shipper port with an inland orientation). To prevent ad hoc engineering, the port should have a vision on the position to would like to reach.

Although the knowledge available in the port community is wide-ranging – it varies from forwarders and stevedores to customs and banks - the expertise is fragmented. Moreover, as every actor in the port has own commercial objectives, it is difficult to bring multicompany knowledge together. In other words: It is hard to transform the existing knowledge base into knowledge capacity. That asks for organizing capacity to bring relevant knowledge together to answer questions of specific shippers. A good example of organizing capacity in the Rotterdam port community is the Chrysler-case.

6. The Chrysler case

The Chrysler Company has a joint venture with Puch-Styer in Austria. In the city of Graz, the joint venture operates a assembly plant, where the Chrysler Voyager en the Jeep Cherokee are being assembled for the European market. A large proportion of the parts – with exempt from some types of engines and tires – is imported from Chrysler works in the United States of America. Grouped per vehicle or set of vehicles, the parts are shipped in containers oversea.
Up to 1994, the inbound traffic of automotive parts to the plant in Graz was relatively unstructured. Several ports were used at the European side and various transport modes were deployed for the inland leg of the transport chain. The largest portion of the shipments was moved through the port of Hamburg. As a consequence of the unstructured transport, the assembly operation was hit by operational problems in the transport chain, such as delays and wrong shipments. The problems became a serious bottleneck for the production, as the concept of assembly was applied at a broader scale by Chrysler in Graz to compete in the European car market.

In 1994, the marketing department of the Port of Rotterdam, together with several other Rotterdam based companies, took the initiative to investigate alternatives for the Chrysler transport operation in Europe. It concluded that intermodal transport by means of a dedicated shuttle train from

Rotterdam could offer advantages to the company. The scale economies generated through concentrate all shipments in one port could be translated into various advantages (Van den Berg et.al, 1997). First, regular rail shuttles from Rotterdam could be cheaper than hiring ad hoc transport from various ports by truck and rail. Second, the shuttle concept could realize a faster transit times and thus lower storage costs. After introducing the concept, it was possible to reduce the average stock at the Graz plant from seven weeks to only four days. Next to the faster transits, the reliability of a fixed schedule and the possibility to decide about priority containers in the port added to these savings. Deciding about priority containers implies that boxes with materials needed at short notice at the plant can be given priority for inland transport in the port, as information on the containers' contents is available at the maritime terminal.

Since the introduction of the shuttle concept in 1995, four fifths of the volume destined for the Chrysler plant in Graz is transshipped via Rotterdam. The other part arrives in Antwerp, as one of the carriers of Chrysler – Canadian Maritime – has chosen for Antwerp as first port of call. Every week, several dedicated trains of 40 TEU are directed to Austria. In weeks with high production in Graz, up to eight trains leave the port of Rotterdam. The transport system is operated by Optimodal (trains from Antwerp are controlled by Transfracht).

Remarkably, the role of the Port of Rotterdam has not ended with the implementation of its advice to Chrysler. The port management is still involved in the project as final manager of the transport system. Not for the Rotterdam part only, by for the operations in Antwerp as well.

7. Conclusions

The hinterland potential of a port is based on the demand for port services in inland regions and the level of generalized transport costs to bridge the distance between the port and these regions. Generalized transport costs do include not only monetary costs, but also costs related to bridging the distance in psychological sense.

Fundamental changes influence the hinterland potential and suggest a new scene for seaports. The surroundings are becoming more complex. New criss-cross patterns of traffic flows are arising. New agents will enter the market as transport operators and logistic service providers. New demands on transport efficiency and reliability will be made. In the new situation, ports cannot rely only on infrastructure and transport services to optimize their hinterland access. To optimize inland accessibility, port authorities have to look beyond infrastructure and give more value to intangible aspects of accessibility. The exploitation of knowledge available in the port community

to develop innovative logistic concepts to bind shippers and regions to the port is recommended. Such a new hinterland approach is especially relevant for the port of Rotterdam. As its present position is due to historic circumstances - the transport of bulk commodities over the Rhine - the fundamental changes may undermine its position. Rotterdam seems to have problems to penetrate in regions outside its captive market: the share of rail transport still is relatively low and its presence in Central Europe falls short to its 'mainport' status.

To secure its present market and to extend its market reach towards Central Europe, a more active orientation on the shipper is required as a complement to infrastructure investments. The case of Chrysler shows that the Rotterdam port is able to play a role as logistic engineer. The challenge is to build on knowledge capacity: organize relevant actors in the port community to activate available knowledge at a structural basis.

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