COMPETITIVE AND SUSTAINABLE GROWTH (GROWTH) PROGRAMME

STRATEGIC PORT DEVELOPMENT PROJECTS

Working Paper

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SPIN-TN Working Paper

'Strategic Port Development Projects'

Theme setting

The aim of SPIN-TN (Strategies to Promote Inland Navigation-Thematic Network) is to develop a Common European Strategy to increase the share of inland navigation in the transport of goods and to encourage the acceptance and implementation of this strategy. The main objective is pursued by paying attention to various issues that could contribute to the further increase of inland navigation. These aspects are dealt with in six Working Groups, in which different Working Papers are produced, in order to arrive at a series of well-founded strategy recommendations.

The present Working Paper on 'Strategic Port Development Projects' focuses on inland ports, including barge terminals in seaports. The main research question to be answered in the Working Paper is the following: 'How can inland ports and barge terminals in seaports contribute to the growth of inland navigation in the future?' This research question demands an analysis of bottlenecks in European inland ports. In this respect the following three issues are investigated: (1) Operational transhipment performance, (2) Quality of hinterland connections and (3) Capacity: few expansion opportunities versus overcapacity.

This Working Paper is organized as follows. In Section 1 a brief statistical overview is provided of barge freight transport in the EU-25 Member states. The outcome of two recent reports which are of relevance to the present Working Paper is also discussed. Section 2 presents an overview of Europe's inland waterway policy and discusses national transport policies to promote inland navigation for selected countries where inland navigation plays an important role. Next, Section 3 focuses on the three above-mentioned bottlenecks with which inland navigation and inland ports in Europe are currently confronted. Finally, Section 4 contains policy recommendations.

1. Inland navigation and inland ports in Europe

In this section a brief statistical overview is provided of barge freight transport in Europe. Subsection 1.1 presents the barge freight transport volumes in the EU-25 Member states, the length of the navigable inland waterways in the EU-25 Member States and the location and cargo throughput of Europe's main inland ports. Subsection 1.2 discusses the outcome of two reports on barge container transport which are of relevance to the present Working Paper.

1.1. Barge freight transport and inland waterways in the EU-25 Member States

Despite the fact that the European Union comprises no less than 25 Member States, practically the entire European barge freight transport activity takes place in just four countries. According to statistics released by the European Commission (2004) barge freight transport registered 129.4 billion tonkm in the EU-25 in 2002. Germany, the Netherlands, France and Belgium accounted for nearly 94% of this volume (see Table 1). Given the dense network of navigable waterways and canals in those countries, particularly in the Rhine-Scheldt delta, this hardly comes as a surprise (cf. infra).

Table 1: Barge freight transport in the EU-25 Member States in 2002

	billion tonkm	%		billion tonkm	%
Germany	64.17	49.59%	**Latvia**	0.00	0.00%
Netherlands	40.80	31.53%	**Lithuania**	0.00	0.00%
France	8.27	6.39%	**Denmark**	-	
Belgium	8.07	6.24%	**Greece**	-	
Austria	2.85	2.20%	**Spain**	-	
Hungary	1.67	1.29%	**Ireland**	-	
Poland	1.13	0.87%	**Cyprus**	-	
Slovak Republic	0.93	0.72%	**Malta**	-	
Czech Republic	0.55	0.43%	**Portugal**	-	
Finland	0.30	0.23%	**Slovenia**	-	
Luxemburg	0.28	0.22%	**Sweden**	-	
United Kingdom	0.20	0.15%			
Italy	0.14	0.11%	**EU-25**	**129.4**	100%
Estonia	0.00	0.00%	**EU-15**	**125.1**	96.68%

Source: European Commission (2004)

The total length of the navigable inland waterway network in the EU-25 (comprising classified rivers and canals) amounts roughly to 35,600 km (see Table 2). This is less than one fifth of the total railway network length (about 200,000 km) and less than one tenth of the total road network length (about 415,000 km - including motorways, highways, main and national roads but excluding secondary and regional roads) in the EU-25 (Buck Consultants International et al., 2004; European Commission, 2004). Table 2 illustrates that the lion's share of the navigable inland waterway network in the EU-25 is located in six countries: Germany, France, the Netherlands, the United Kingdom, Poland and Finland together account for roughly 85% of the total navigable inland waterway network length.

Table 2: Length of navigable inland waterways in the EU-25 Member States (classified rivers and canals)

	km	%		km	%
Germany	7,367	20.71%	**Portugal**	250	0.70%
France	5,736	16.12%	**Spain**	69	0.19%
Netherlands	5,046	14.18%	**Luxemburg**	37	0.10%
United Kingdom	5,000	14.05%	**Latvia**	12	0.03%
Poland	3,650	10.26%	**Cyprus**	-	
Finland	3,577	10.05%	**Denmark**	-	
Belgium	1,434	4.03%	**Estonia**	-	
Hungary	953	2.68%	**Greece**	-	
Sweden	549	1.54%	**Ireland**	-	
Italy	535	1.50%	**Malta**	-	
Slovak Repblic	422	1.19%	**Slovenia**	-	
Austria	358	1.01%			
Czech Republic	303	0.85%	**EU-25**	35,575	100%
Lithuania	277	0.78%	**EU-15**	29,958	84.21%

Source: Buck Consultants International et al. (2004)

From the comparison of Tables 1 and 2 some interesting conclusions can be drawn. Firstly, and this is hardly surprising, the top-three countries with respect to navigable inland waterways length also account for the lion's share of barge freight transport. Their dominance, however, is more pronounced if one looks at the barge freight volume: Germany, the Netherlands and France together account for roughly 87% of barge freight transport in the EU-25, while representing 51% of the total navigable inland waterways length. Secondly, the United Kingdom, Poland and Finland together account for a substantial share of the EU-25's navigable inland waterways length (about 35%) while representing hardly 1.3% of total barge freight transport. This can be explained by the fact that the inland waterways in those three

countries are not well adapted to large-scale freight transport (see also Figure 1A in the Appendix). The opposite is true for Belgium and Austria, which together account for roughly 5% of the EU-25's navigable inland waterways length while representing about 8.5% of total barge freight transport. Belgium's relatively high share in European barge freight transport can be explained by the existence of two large industrial seaports and one large inland port (cf. infra), each generating a significant amount of inland waterway freight traffic. A detailed overview of the inland waterway network of the EU-25 Member States, divided per CEMT-class, can be found in Buck Consultants et al. (2004).

Figure 1: Geographical location of (main) European inland terminals/ports

Source: European Federation of Inland Ports

It goes without saying that most of the European inland ports (including barge terminals in seaports) are concentrated in those countries which rank highest in Tables 1 and 2. The geographical location of Europe's (main) inland terminals/ports is depicted in Figure 1. Table

3 presents the total amount of inland waterway freight traffic handled by the top-20 ports in 2002. As can be seen, the Low Countries are of strategic importance to inland navigation in Europe. This can be explained by the fact that the Netherlands and Belgium contain a handful of major industrial seaports, each generating a significant amount of inland waterway traffic (in particular bulk transport and container transport). Between them, the mainports of Rotterdam and Antwerp handled about 215 million tonnes of inland waterway freight in 2002. Other important load centres for inland waterway transport include the seaports of Amsterdam, Zeeland Seaports and Ghent and the inland ports of Paris, Liège and Duisburg.

Table 3: Inland waterway traffic in the top-20 European ports in 2002 (seaports and inland ports) – all cargoes

Port (country)	Traffic (mln tons)	Port (country)	Traffic (mln tons)
Rotterdam (Netherlands)	140.3	Hamburg (Germany)	9.4
Antwerp (Belgium)	74.3	Mannheim (Germany)	8.3 *
Amsterdam (Netherlands)	56.2	Ludwigshafen (Germany)	7.6 *
Zeeland Seaports (Netherlands)	22.2	Karlsruhe (Germany)	6.2 *
Paris (France)	18.5 *	Charleroi (Belgium)	5.6 *
Liège (Belgium)	14.4	Bremen (Germany)	5.0
Ghent (Belgium)	14.3	Neuss (Germany)	4.7 *
Duisburg (Germany)	13.6 *	Heilbronn (Germany)	4.4 *
Strasbourg (France)	9.6 *	Le Havre (France)	3.9 *
Cologne (Germany)	9.6 *	NV Zeekanaal (Belgium)	3.8 **

Notes: * = 2001 ** = 1999
Source: Port Authorities and European Commission (2003)

1.2. Barge container transport in Europe: summary of two reports

In 2003 two in-depth reports relating to barge container transport were released. The first report, "Basisdocument Containerbinnenvaart" (Stichting Projecten Binnenvaart et al., 2003a), provides a detailed insight into the current situation of barge container transport in Europe. The study focuses on three markets where barge container transport has developed very rapidly over the last few decades, namely the Rhine market (i.e. hinterland transport between the seaports of Rotterdam and Antwerp on the one hand and terminals along the river Rhine on the other), the Rotterdam-Antwerp market (i.e. container transport between both seaports) and the inland market in the Low Countries (i.e. container transport within the boundaries of the Netherlands and Belgium). For each market, six themes are discussed in

detail: Market structure, Organisation, ICT, Technical aspects, Infrastructural aspects, and Environment and safety. It is beyond the scope of the present Working Paper to discuss each of these six themes in detail. Instead we will present the most important features of the three markets and focus on some of their intrinsic strengths and weaknesses. Although inland navigation in Europe is certainly not limited to the transport of containers (to the contrary, its main markets are undeniably the markets for dry and liquid bulk goods), many of the issues discussed in the two reports can be generalized to the other markets as well.

(i) The Rhine market

The river Rhine connects the mainports of Rotterdam and Antwerp to major industrial areas in Germany, France and Switzerland. The river is divided into three parts, namely the Lower Rhine (up to Köln), the Middle Rhine (up to Karlsruhe) and the Upper Rhine (up to Basel). The first liner services between Rotterdam and destinations along the Rhine were started in the mid- to end-seventies. Since then this market has developed at an enormous pace. Between 1980 and 2001 container traffic on the Rhine increased from 60,000 TEU to no less than 1.2 million TEU (of which 30% on the Lower Rhine, 50% on the Middle Rhine and 20% on the Upper Rhine). This makes the Rhine market the most important of the three markets in terms of volumes transported. For an extensive overview of barge container transport on the river Rhine, see Notteboom and Konings (2004).

The existence of high-volume freight flows coupled with the large capacity of the river Rhine enables the deployment of large and modern container barges and push combinations between Rotterdam/Antwerp and terminals along the Rhine (cf. the JOWI-class with a capacity of 470 TEU). This is one of the big strengths of barge container transport on the Rhine market. Thanks to the existence of economies of scale, inland navigation is able to offer very competitive freight rates to shippers/receivers, resulting in a strong competitive position *vis-à-vis* other transport modes such as road transport or rail transport. Moreover, thanks to operational cooperation agreements between barge operators on the Rhine market (many of whom have their own terminals in Germany and/or Switzerland) frequent sailings with large vessels can be offered from and to the seaports of Rotterdam and Antwerp. In addition, as being part of the network of their parent companies, barge operators on the Rhine market are able to offer complete *port-to-door* solutions to their customers (i.e. covering the complete journey from the seaport to the customer's premises). The direct availability of full and empty

containers at the inland terminals is also a major advantage for shippers/receivers. All this obviously benefits shippers/receivers in the hinterland in that they are ensured of a smooth operation of their supply chains.

However, the reliability of Rhine operators' sailing schedules is increasingly coming under pressure. Barges operating between Rotterdam/Antwerp and terminals along the Rhine have to call at quite a number of terminals in both seaports, resulting in low call sizes per terminal. Moreover, booming container trade between Asia and Europe as a result of the so-called 'China-effect' (demand side), coupled with a huge amount of new containership deliveries (supply side) results in severe capacity bottlenecks in those seaports with a strong position on the Europe/Asia trade (Rotterdam, Hamburg and to a somewhat lesser extent Antwerp). Since deepsea traffic is granted priority over barge traffic at the large container terminals in those ports, barge operators have to cope with increasing waiting times, causing disruptions to their sailing schedules (recently, waiting times of up to 48 hours were no exception). This obviously hampers the image of inland navigation as a reliable transport mode.

In addition, new investments in large infrastructure projects, including investments in additional container handling capacity in seaports (e.g. the Western Scheldt Container Terminal in Flushing, the Second Maasvlakte in Rotterdam, the Deurganckdock in Antwerp and the proposed Dibden Bay development in Southampton) are increasingly facing opposition from certain stakeholders. The Birds Directive and Habitats Directive are considered by many ports as serious threats to further port expansion. A large number of zones have been classified as protected areas under these Directives, which means that port development in these zones is either not possible or only possible if there is 'overriding public interest' (Article 6 of the Habitats Directive). In the latter case, the loss of habitat needs to be compensated appropriately by the development of habitats elsewhere (preferably in the proximity of the lost habitat). It goes without saying that the resulting lack of capacity will only worsen the above problems in the years to come. Without significant investments in new capacity, inland navigation will probably become the victim of its own success.

(ii) The Rotterdam-Antwerp market

Barge container transport between the seaports of Rotterdam and Antwerp has developed because of the fact that many deepsea liner services only call at one of these two seaports,

while Bills of Lading (B/L) are issued on both ports. Volumes on the Rotterdam-Antwerp market have increased from about 400,000 TEU in 1995 to about 1,100,000 TEU in 2003. Because of these large volumes, coupled with the existence of operational cooperation agreements between a handful of barge operators, the latter are able to offer frequent sailings with large vessels, fully benefiting from economies of scale (as is also the case in the Rhine market). Contrary to the Rhine market, however, the barges sailing between Rotterdam and Antwerp only call at a limited number of terminals in both seaports, resulting in higher call sizes per terminal. This reduces the amount of time spent in port.

(iii) The inland market in the Low Countries

Despite their limited geographical size (and therefore limited transport distances), the Netherlands and Belgium have recently witnessed a fast development of barge container transport within their borders (i.e. between their respective seaports and terminals on their territories). Container traffic within the Low Countries has more than tripled from about 200,000 TEU in 1995 to about 700,000 TEU in 2001. In the last ten to fifteen years many inland container terminals have been constructed along waterways in the Netherlands and Belgium (and to a lesser extent in France).

The high density of the inland waterway system in the Low Countries enables cost-efficient and frequent barge container transport between the seaports and regions with a high potential container volume, i.e. containing large shippers with big import- or export flows. Smaller shippers benefit from this situation as well. Contrary to the Rotterdam-Antwerp market where barge container transport is ‘dominated’ by the deepsea shipping lines (carrier haulage), the inland market is dominated by large shippers (merchant haulage).

Because of infrastructural limitations (e.g. limited waterway depths and air drafts) the container barge fleet sailing within the Low Countries comprises smaller vessels than the container barge fleet on the other two markets (cf. the introduction of Neokemp vessels, which can carry 32 TEU). Hence, economies of scale are not as pronounced as in the other two markets.

The follow-up report, "Kanshebber in de keten: toekomstperspectief containerbinnenvaart" (Stichting Projecten Binnenvaart et al., 2003b) describes a number of trends and developments in the field of transport and logistics that are likely to affect the future evolution of barge container transport. The same six themes as in the first report are discussed. For each of the themes a number of opportunities and threats for barge container transport are identified. It is again beyond the scope of this Working Paper to discuss the entire report in detail. Instead we will focus on those issues which are of importance for the present Working Paper, i.e. having a clear impact on inland ports/terminals.

A first underlying trend with an obvious impact on the future of (container) barge transport and inland terminals is the expected growth of freight transport in general. The European Commission (2001) expects that by 2010 freight transport will have increased by nearly 40% over its 1998 level. Barge container transport is expected to increase even faster, due to strong growth in the international container trades and an increasing containerisation rate. In this respect, a container barge volume of 4.5 million TEU is expected by 2010. The highest growth figure is expected for the inland market within the Low Countries. Volumes on the Rhine market and Rotterdam-Antwerp market will also grow, albeit at a slower rate. The impact on inland container terminals is obvious: they will have to cope with a significant increase in volumes in the years to come, which requires additional investments in infrastructure and superstructure.

A second important trend is the fact that deepsea shipping lines are expected to develop hub-concepts in the hinterland in order to cope with terminal congestion, the growing problem of imbalances and the need to reposition (empty) containers. Inland terminals will have to respond to this need by jointly developing regional services (e.g. setting up a central organisation responsible for empty containers). Moreover, inland terminals will increasingly have to develop ancillary logistics services such as Container Freight Stations (CFS), warehousing (including value-added services), container repair and container cleaning.

As far as technical/operational aspects are concerned, it is expected that the future will see further scale increases of the fleet deployed on certain markets (e.g. the Rhine market), as well as a further increase in the amount of pure container vessels deployed. Moreover, the introduction of small container vessels especially adapted to the limited dimensions of certain rivers/canals and limited bridge heights ensures the future development of those markets

which cannot be served by big vessels (e.g. the inland market within the Benelux). By the same token, the introduction of a new 'continental load unit', especially constructed to carry a large number of pallets, would be a big stimulus for inland navigation to access new markets and hence increase its market share at the expense of other transport modes. Until now inland navigation is mainly involved in the transport of maritime containers.

As far as infrastructure is concerned, inland navigation can only realise its full potential if sufficient investments are made to solve current bottlenecks such as limited dimensions of certain rivers/canals, limited air drafts, limited opening hours of locks/bridges and missing links in the network. Without those investments the capacity of vessels cannot be used optimally (i.e. potential economies of scale do not fully play), resulting in increased costs throughout the supply chain and a distortion of the competitive position *vis-à-vis* other transport modes.

2. Europe's inland waterway policy

In this section an overview of Europe's inland waterway policy is presented. As an introduction, subsection 2.1 presents figures on the evolution of the freight transport modal split in the former EU-15 Member States during 1990-2002. Next, subsection 2.2 outlines Europe's inland waterway policy which, broadly speaking, can be split up into three main areas. Subsection 2.3 then discusses national transport policies to promote inland navigation for five selected countries where inland navigation plays an important role. Finally, subsection 2.4 briefly treats general European policy to stimulate sustainable transport modes.

2.1. Introduction

During the last decade countries in Western Europe witnessed a sharp increase in road freight transport. According to the European Commission (2004) road freight transport increased from 976 billion tonkm in 1990 to 1,376 billion tonkm in 2002 in the former EU-15 Member States. This corresponds with an average annual increase of 2.9%. With this growth figure road transport easily outpaced the other freight transport modes. Only intra-European shortsea shipping registered a somewhat comparable growth figure (+2.6%). Inland navigation (+1.3%) and pipeline transport (+1.6%) grew substantially slower, while rail transport (-0.6%) even

registered a small decline. As a result, the share of road transport in the modal split increased from 41.9% in 1990 to 44.7% in 2002 (see Table 4). An overview of the modal split for the current EU-25 Member States (excluding shortsea shipping) can be found the Appendix.

Table 4: Freight transport in the former EU-15 Member States (billion tonkm)

	Road transport	Rail transport	Inland navigation	Pipeline transport	Shortsea shipping	Total
1990	976	255	107	70	923	2,332
1995	1,124	222	115	82	1,070	2,613
2000	1,319	250	128	85	1,270	3,052
2001	1,344	241	126	87	1,254	3,051
2002	1,376	236	125	85	1,255	3,076
1990-2002	+ 41%	- 7%	+ 17%	+ 21%	+ 36%	+ 32%
Avg annual growth	+ 2.9%	- 0.6 %	+ 1.3 %	+ 1.6 %	+ 2.6 %	+ 2.3 %
Modal split 1990	41.9%	10.9%	4.6%	3.0%	39.6%	100.0%
Modal split 2002	44.7%	7.7%	4.1%	2.8%	40.8%	100.0%

Source: European Commission (2004)

The strong growth of road freight transport, accompanied by strong growth of road passenger transport (by private cars, buses and coaches)[1], resulted in ever-increasing congestion on the Western European highways, yielding significant costs for society. According to INFRAS/IWW (2000) the external congestion costs of road transport amounted to EUR 33.3 billion in 1995 in the then 15 Member Countries of the EU plus Norway and Switzerland. This was roughly 0.5% of the then GDP of the European Community. Moreover it is expected that "unless major new measures are taken by 2010 in the European Union so that the Fifteen [Member States] can use the advantages of each mode of transport more rationally, heavy goods vehicle traffic alone will increase by nearly 50% over its 1998 level. This means that regions and main through routes which are already heavily congested will have to handle even more traffic" (European Commission, 2001). In this respect, if no measures are taken, the congestion costs of road transport are expected to rise by as much as 142% to EUR 80 billion in 2010, about 1% of the EU GDP by that time (European Commission, 2001).

[1] Again according to the European Commission (2004) a total of 4,927 billion passenger-km (pkm) were registered in the year 2002 in the then 15 member countries of the European Union, representing an increase of 24% as compared to 1990. Transport by passenger car amounted to 3,882 billion pkm or 78.8% of the total. Buses and coaches registered 411 billion pkm (8.3%), rail transport 307 billion pkm (6.2%), air transport 280 billion pkm (5.7%) and tram and metro 48 billion pkm (1.0%). Hence, the dominance of road transport is significantly bigger in the passenger transport market than in the freight transport market.

Policy makers, both at the national and European level, are aware of the fact that this situation can hardly be sustained any longer and that urgent measures need to be taken in order to safeguard the competitiveness of the European economy. In this respect, the idea of a modal shift from road transport to the more sustainable freight transport modes is often put forward in policy documents. For example, in its recent White Paper on Transport Policy the European Commission (2001) argues that "Europe must bring about a real change in the Common Transport Policy. The time has come to set new objectives for it: restoring the balance between modes of transport and developing intermodality, combating congestion and putting safety and the quality of services at the heart of our efforts, while maintaining the right to mobility".

2.2. Europe's inland waterway policy

The European Commission's inland waterway policy consists of a number of pillars of which infrastructure development, capacity control and market liberalisation are the most important ones (Merckx and Notteboom, 2002). On top of this EU policy, several countries have developed individual policy measures to support the inland navigation sector.

2.2.1. Infrastructure development

In order to play an essential part in the multimodal transport system, inland navigation requires an efficient infrastructure. The national waterway networks of the different Member States are however not always optimally interconnected. The aim of the European Commission is to stimulate the creation of a coherent trans-European network of continuous waterways of reasonable gauge (if possible class Va/Vb dimensions of the ECMT waterway classification, i.e. draft of 2.8 m and an air draft of 7 m) through the modernisation of existing canals and rivers (deepening, widening or creating the necessary lock capacity) and, where necessary, the creation of new links (Merckx and Notteboom, 2002).

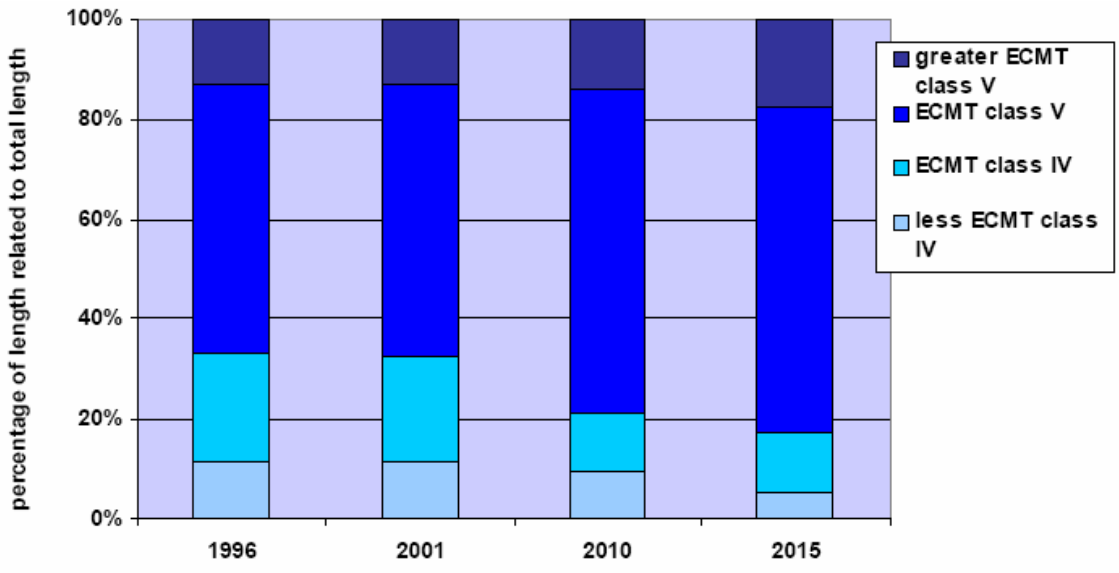
In 1990 the European Council adopted an initial outline plan for high-speed railway lines, which was proposed by the Commission. Subsequently, in 1994, in order to provide crucial political incentives, a list of 14 priority projects was adopted by the Essen Council and the European Parliament. In 1996, the European Parliament and the Council adopted Decision No. 1692/96/EC on guidelines for the development of the Trans-European transport network

(TEN-T) by 2010. Article 21 of the Decision contains a revision clause, under which the Commission is required to submit a report after five years indicating whether the guidelines should be adapted to take account of "economic development and technological developments in the field of transport, in particular in rail transport". The Guidelines encompass the 14 priority projects, as well as the outline plans for roads, rail, inland waterways and airports. Since then, on 22nd May 2001, the Parliament and the Council on 22 amended the outline plans to incorporate seaports, inland ports and terminals (Decision No. 1346/2001/EC) (Planco Consulting, 2003, o.c.).

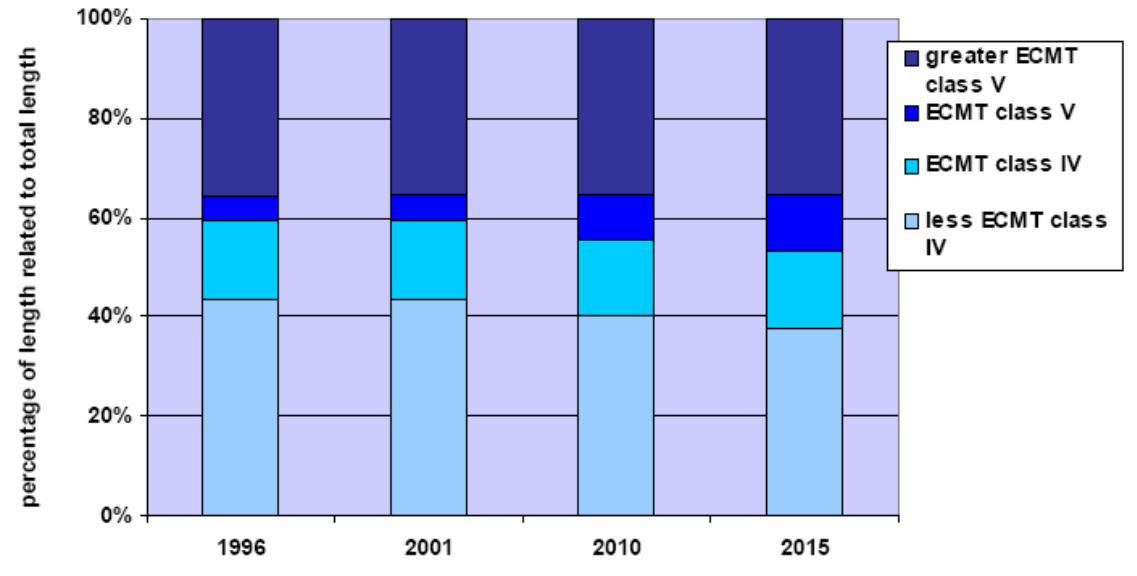
As far as the TEN-T inland waterway network is concerned, Figure 2 provides an overview of its anticipated development, split up between different CEMT-classes. As can be seen, the share of inland waterways of class IV or lower in the total network length is expected to halve from about 33% in 1996 to about 17% in 2015 in the former EU-15 Member States. For the 'Candidate Countries' (comprising Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia) the share of inland waterways of class IV or lower is expected to decrease slightly from about 60% to about 53% during the same period. A comparison of the TEN-T inland waterway network in Germany and neighbouring countries for the years 1996 and 2015 can be found in the Appendix.

Figure 2: Anticipated development of the TEN-T inland waterway network

(a) Former EU-15 Member States



(b) 'Candidate Countries'



Source: Planco Consulting (2003)

Table 5 provides an overview of the (projected) investments in the TEN-T network for the period 1996-2010, divided per 'mode' (road transport, rail transport, inland waterway transport, ports and airports). A total amount of 436 billion euro will be invested in the TEN-T network in the former EU-15 Member States between 1996 and 2010. About three quarters of these investments go to rail transport (50.5%) and road transport (26.0%), while inland waterway transport gets only a very small share (1.9%). In this respect, it is important to recall that there are only six former EU-15 Member States with river systems which are interconnected (Austria, Belgium, France, Germany, Luxemburg and the Netherlands).

In the 'Candidate Countries', a total amount of 49 billion euro will be invested in the TEN-T network between 1996 and 2010, roughly one tenth of the total investments in the former EU-15 Member States. Road transport takes up 71.4% of the total investments, with rail transport and inland waterways accounting for 21.1% and 1.1%, respectively. A detailed overview of the TEN-T network investments on a country-per-country basis can be find in Planco Consulting (2003).

Table 5: (Projected) investments in the TEN-T network (million euro)

Former EU-15	1996/1997	1998/1999	2000/2001	2002/2003	2004/2005	2006/2010	Total	Share
Road transport	15,595.2	19,433.2	13,820.7	24,078.8	18,271.7	21,996.9	**113,196.5**	26.0%
Rail transport	15,025.3	32,257.2	35,033.0	44,035.2	39,932.9	53,465.8	**219,749.4**	50.5%
Inland waterways	1,068.6	1,016.9	1,066.4	1,975.0	1,331.4	1,779.1	**8,237.4**	1.9%
Ports	6,218.6	7,534.4	5,917.4	6,121.4	5,305.2	7,062.5	**38,159.5**	8.8%
Airports	7,893.1	8,917.7	7,852.3	10,182.3	8,069.7	13,299.6	**56,214.7**	12.9%
Total	**45,800.8**	**69,159.4**	**63,689.8**	**86,392.7**	**72,910.9**	**97,603.9**	**435,557.5**	**100.0%**
Candidate Countries	**1996/1997**	**1998/1999**	**2000/2001**	**2002/2003**	**2004/2005**	**2006/2010**	**Total**	**Share**
Road transport	448.2	925.1	2,397.9	5,300.3	8,920.7	16,978.1	**34,970.3**	71.4%
Rail transport	445.5	890.3	1,611.1	2,320.4	2,324.2	2,751.6	**10,343.1**	21.1%
Inland waterways	14.2	16.6	32.2	99.0	141.3	225.3	**528.6**	1.1%
Ports	16.4	252.6	269.2	341.4	418.3	448.1	**1,746.0**	3.6%
Airports	74.7	212.9	232.0	281.3	251.6	351.2	**1,403.7**	2.9%
Total	**999.0**	**2,297.5**	**4,542.4**	**8,342.4**	**12,056.1**	**20,754.3**	**48,991.7**	**100.0%**

Source: Planco Consulting (2003)

2.2.2. Tackling vessel overcapacity

The European Commission addressed the issue of vessel overcapacity by joint scrapping actions and by curbing investments in new vessels. Two instruments were used in order to achieve these objectives. The breaking-up premiums were to make the industry competitive for the long term by improving its structure and productivity, at the same time allowing many owner operators to bow out with an acceptable level of financial compensation. Under the 'old-for-new' rule, vessel operators who increased their capacity by acquiring a new vessel must either scrap a given proportion of their old tonnage or pay a financial penalty for the tonnage in question. This rule was introduced by a 1989 Regulation. A new Commission Regulation N° 3690/92 provided that all special contributions received by the Scrapping Funds are to be immediately used for scrapping of old tonnage. The 'old-for-new' rule initially expired in April 1994 but was prolonged to 28 April 1999. A new regulation adopted by the Council of Ministers in March 1999 extended this scheme for a further four years. On 29 March 2003 the 'old for new' scheme was ended and since then new vessels can be brought into service unconditionally. In the event of a crisis, however, the 'old for new' rule can still be reactivated. So the market needs to be monitored very carefully. The Commission has set up an inland waterway observatory in the form of a database. This will allow prices, freight flows, capacity take-up rates, etc. to be monitored very closely.

2.2.3. Market liberalisation

Another question was whether the existing price fixing and cargo sharing arrangements (the so called 'tour-de-rôle' system), which were operational in certain segments of the EU-waterway market, could continue to exist. The 'tour de rôle' system was a sort of alternate chartering system. The main part of the international waterway market, in particular the Rhine market, was already subject to a free regime. The Commission opted for a gradual liberalisation of the other sub-markets. The inland waterway transport market is completely free since 1 January 2000 (Council Directive 96/75 of 19 November 1996), when the 'tour de rôle' system was abolished. Since then, prices can be freely negotiated between shippers and carriers. Some countries abolished the 'tour-de-rôle' system before 2000. For instance, the Belgian governments anticipated the directive by fully deregulating their market as of 28 November 1998 (cf. infra).

2.3. National transport policies to promote inland navigation (selected countries)

In this subsection, an overview is provided of national transport policies to promote inland navigation for five selected countries. The following paragraphs draw heavily on the first chapter of "Part C: Policy and legislation" of the PINE Full Final Report (Buck Consultants et al, 2004).

2.3.1. Austria

In 1999 the Austrian Federal Ministry of Transport, Innovation and Technology set up the national development agency 'via donau', with the aim of increasing the competitiveness of inland waterway transport and thus encouraging a modal shift from road transport to inland navigation. In 2001 a national grant scheme to subsidise combined transport on the Danube was set up for the period 2001-2005. Finally, in 2002 a 10-point programme to promote Danube navigation was launched with, amongst others, the following objectives:

- Improving fairway conditions east of Vienna, in the Wachau, and on critical Danube sections in Germany and Hungary;
- Implementing navigation management systems and information services;
- Developing ports into intermodal logistic centres;
- Improving interfaces between rail and inland navigation;

- Setting up intermodal door-to-door liner services;
- Improving framework conditions for Austrian waterway transporters;
- Promoting industrial locations close to the Danube.

2.3.2. Belgium

In Belgium the different regions (Flanders, Wallonia and Brussels) are responsible for the navigable waterways, providing investment, maintenance and operation. The regions also deal with aids to the profession, although in a limited manner. On the other hand, the Federal Ministry of Transport is responsible for regulations with respect to vessels, crews, dangerous goods etc. In addition to the regionally responsible ministries, associations to promote inland waterway transport exist both in Flanders and Wallonia.

In the past decade or so, three initiatives have been taken in order to stimulate freight transport on Flemish inland waterways. Firstly, the Belgian inland navigation sector was fully deregulated as from the end of 1998. With this deregulation Belgium anticipated on the earlier indicated European Directive (cf. paragraph 2.2.3) which stated that chartering and pricing in the national and international transport market by inland waterways in the Community had to be completely liberalised by 1 January 2000 (Dullaert et al., 1998; Blauwens et al., 2002). Following this deregulation, the system of chartering by rotation ('tour-de-rôle') was abolished and prices could be freely negotiated between shippers and carriers. This resulted in a substantial decrease in freight rates, which obviously had a positive impact on the volumes shipped.

Also in 1998 a Public-Private Partnership (PPP) programme concerning the construction of quay walls along the Flemish inland waterways was initiated. Under this programme, the Flemish Government intervenes in the costs of building infrastructure (loading and unloading quays) for companies that want to make use of inland navigation to transport their goods flows. Ever since its inception this programme has been very successful within the local industry. In the period up to June 2004 no less than 100 requests for the construction of quay walls had been submitted, all of which obtained formal approval. The lion's share of the requests concern the transport of dry bulk goods (51), waste products (17) and containers (13). By June 2004 a total of 43 terminals were effectively operational (see Table 6). The European Commission recently took an important decision in this respect and formally

approved the prolongation of the PPP-programme till 2010. This clearly illustrates the importance the European Commission attaches to initiatives aimed at stimulating inland navigation.

Table 6: Overview PPP-programme concerning the construction of quay walls along the Flemish inland waterways (situation as in June 2004)

Sector	Requests approved No.	Quays in operation No.
Waste	17	2
Dry bulk	51	24
Containers	13	9
Indivisible parts	3	2
Conventional cargo	7	3
Liquid bulk	9	3
Total	**100**	**43**

Source: Website Promotie Binnenvaart Vlaanderen

A third important stimulus for inland navigation was the decision by the Flemish Government to drastically reduce the navigation rights on the Flemish inland waterways as from 1 January 2000. The navigation rights were reduced by as much as 90% to a symbolical 0.00025 euro per tonkm. This decision played a crucial role in the traffic increase of about 16% on the Flemish inland waterways by the end of 2000.

One of the markets where inland navigation has been very successful in recent years is container transport (cf. supra). Whereas the Flemish inland container terminals handled slightly over 75,000 TEU in 1998, this figure has risen to more than 400,000 TEU in 2004 (Promotie Binnenvaart Vlaanderen). This represents an average annual increase of about 32%. Inland navigation clearly positions itself as an ever-stronger competitor for road haulage as far as container transport from and to the seaports is concerned. For example, the share of inland navigation in container transport between the port of Antwerp and the hinterland increased from 27.7% in 1998 to 31.0% in 2003. During the same period, the share of rail transport increased from 7.8% to 9.5%, while road haulage declined from 64.5% to 59.5% (see Table 7). It is expected that, partially because of the above-mentioned PPP-programme and the increasing congestion on the highways, the modal shift from road transport to inland

navigation will continue in the years to come. Other ports where inland navigation has increased its share of hinterland container transport between 1998 and 2003 include the port of Rotterdam (from 34.2% to 40.0%), Le Havre (from 1.3% to 4.8%), Dunkirk (from 1.0% to 2.7%) and Hamburg (from 0.2% to 1.7%), although barge container volumes in the latter three ports remain small. In the port of Zeebrugge, on the other hand, the share of inland navigation in hinterland container transport declined sharply in recent years (from 15.0% to 4.7%).

Table 7: Modal shares of container throughput for selected Northern European ports, transhipment excluded (percentage of port volumes)

	Rail			Road			Barge		
	1998	**2001**	**2003**	**1998**	**2001**	**2003**	**1998**	**2001**	**2003**
Rotterdam	14.5	12.9	10.0	51.3	48.4	50.0	34.2	38.7	40.0
Antwerp	7.8	8.8	9.5	64.5	61.3	59.5	27.7	29.9	31.0
Le Havre	14.2	11.5	12.4	84.5	85.4	82.8	1.3	3.1	4.8
Zeebrugge	34.4	41.9	40.2	50.6	48.8	55.1	15.0	9.2	4.7
Dunkirk	9.0	13.5	20.5	90.0	82.5	76.8	1.0	4.0	2.7
Hamburg	29.7	28.7	28.7	70.1	69.9	69.7	0.2	1.4	1.7
Bremerhaven	33.1	36.0	30.6	65.0	62.0	67.3	1.9	2.0	2.0

Source: own calculations based on Ocean Shipping Consultants

In the past, the Flemish and federal governments have pursued an infrastructural policy aimed at expanding and upgrading the network of waterways with a reasonable gauge. It is no coincidence that the three busiest waterways in Belgium are no natural waterways but canals – notably the Scheldt-Rhine Canal, the Albert Canal and the Ghent-Terneuzen canal. The last couple of years, infrastructural efforts have mainly been focusing on the bottlenecks near seaports (e.g. the link of the port of Antwerp to the Albert Canal) and on stimulating the development of inland cargo handling facilities alongside the main waterways.

As far as Wallonia is concerned, a four-year plan to aid inland waterway transport was set up in 2000 and terminated at the end of 2003. Some 220 inland waterway transporters have been supported since 1996 to upgrade their vessels and another 25 to buy transfer equipment; securing an additional inland waterway traffic of 2.8 million tons. Indeed the total traffic of 41 million tons in 2002 was 38% higher than in 1995. The Region's plan for 2004-2007 awaits

Commission approval; in addition to the above types of aid it envisages a contribution towards creating scheduled inland waterway container services.

2.3.3. Germany

Navigable inland waterways in Germany are largely a matter for the Federal Authorities. The basic law (Bundeswasserstrassengesetz) of 1968 still applies, but has been amended several times, most recently in June 2002. Waterways used for sports and water supply usually resort under the Federal States (Länder).

In general, the German Government supports EU efforts to liberalise inland waterway transport and to allow its modal share to increase. Enthusiastic statements about improving the competitiveness of inland waterway transport have been issued by the Ministry of Transport, Construction and Housing, but the relative infrastructure budgets for new investment, replacement and maintenance are well below inland waterway transport's modal share of inland transport. Various investment and maintenance plans for waterways are running, partly in parallel. Recent examples include:

- The Federal Transport Infrastructure Plan (BVWP) 1992-2002;
- The Federal/ERDF (European Regional Development Fund) Budget 2000-2006;
- The 'Anti-Congestion' Budget;
- The 'Future Investment Programme 2001-2003;
- The new Federal Transport Infrastructure Plan 2001-2015.

To some extent, current projects which often take years to complete are covered by more than one of these plans.

According to BVWP a total of 2.0 billion euro for inland waterways was budgeted for the period 1999-2002, of which 1.3 billion euro for replacement and maintenance and 0.6 billion euro for extensions and new projects. The remainder included a small sum for 'priority' projects and for the first time about 10 million euro from the European Regional Development Fund (ERDF). Thus spending was at the rate of about 500 million euro per annum. In the joint Federal/ERDF plan (2000-2006), a very modest inland waterway transport budget of approximately 12 million euro is foreseen, two thirds from the ERDF. The share of inland waterway transport would be only 0.4% of the 3 billion euro expected to be spent on inland

transport as a whole, nearly 44% going to railways and almost 56% to roads. The 'Anti-Congestion' plan will provide about 450 million euro for waterways which

- cause stoppages because of poor construction or lack of safety,
- have insufficient water depth or
- cause high waiting times at locks or lifting devices.

In this plan investments in inland waterway transport are augmented, obtaining 12% of the total budget or close to its modal share. The so-called 'Future Plan' 2001-2003 envisages spending 1.4 billion euro. As part of its general transport policy the Ministry has examined 3 scenarios for the period to 2015. Under the 'laissez faire' scenario in which no further transport policy measures would be undertaken, inland waterway freight traffic would increase from 62 billion tonkm to 87 billion tonkm in 2015, a rise of about 40%. Its modal share, however, would drop from 16.8% to 14.3%. Under the preferred 'integration' scenario, slightly lower figures would be reached (86 billion tonkm, 14.1%). In both cases the forecasts are based on a 25% reduction in inland waterway transport unit costs.

As mentioned, the planning emphasizes a better competitiveness of inland waterway transport, to be reached by:

- optimising transfer areas and equipment in inland ports;
- making use of harbour capacity reserves and developing inland ports.

A Federal Directive of March 1998 provides for subsidies to be granted to building combined transport terminals in ports. Some 36 million euro have been budgeted for trimodal (rail/road/inland waterway) terminals and by 2000 seven goods traffic centres of this kind had been set up. There is also emphasis on building 'wet' transport chains.

2.3.4. France

The public institution Voies Navigables de France (VNF), created by the State in 1991, represents and is responsible for the inland waterway transport network in its broadest sense. As such it can play an important role in implementing the desired modal shift from road to inland waterway transport, bearing in mind the network's potential transport capacity reserves. A contract with the Government is envisaged for the near future, specifying the

aims, competences and sources of income of VNF, as well as the transfer of some Ministry functions with their officials to this body.

VNF's first priority is the 'master' network of large gauge waterways, with some connections between separate basins, the exact extent of which still requires Government definition. Within this the Canal du Nord improvements, the biggest inland waterway transport project in France for decades and an essential link in the Seine-Northern Europe corridor, will play an important role. Having finally obtained number 1 priority as a European TEN-T infrastructure, it will become eligible for an EU contribution of up to 30% of the cost. VNF is planning preparatory stages to allow construction to be started by 2010 and completed by 2020.

In a more general sense VNF plans to increase the reliability of the network by preventive maintenance and thus eliminate waiting times at locks, etc, at least on the larger waterways. Clear operating and service standards will be worked out and communications improved by creating 'intelligent waterways' which will have GPS tracking, faster data transmission and optimal use of locks. A 15 year programme for investment in waterway & structure restoration is planned, including e.g. automating a chain of locks and renovating manually handled booms, which are partly unsafe: for the latter 500 million euro have been budgeted over a 10 year period. Plans also exist for improvements in fleet operations.

As regards Government aids policies of subsidising the use of branch waterways and redeveloping inland ports is under consideration, whilst a Higher Institute of Inland Navigation has just opened its gates at Elbeuf for training young recruits to the profession.

After a 30 year decline, the volume of inland waterway transport in France increased 22% in the 5 year period 1997-2002, with container transport more than doubling. In the year 2002 tonnage amounted to 58.6 million of which 3% also used sea waterways; traffic was 7.2 billion tonkm, with 4% seagoing.

As regards products, minerals and construction materials took up as much as 44% of the tonnage and nearly 35% of tonkm. In second place, agricultural products accounted for 14% tonnage, but 20% of tonkm, whilst solid fuels and petroleum products each took about 10% of tonnage and tonkm. Total tonnage transported was 1% up on the year 2001, tonkm nearly 3%;

domestic traffic increased by 8.5%, but international traffic declined by over 3%. The fleet remained practically unchanged.

In this connection it should be noted that a framework contract was signed with the cereals business in March 2002 regarding the respective inland waterway transport and shore investments, leading to 10 projects and additional inland waterway transport traffic of 500,000 tons. Similar agreements are to be entered into with quarries/construction materials, whilst in the longer run they cold be envisaged for wastes, metals and non-grain agricultural products.

Another subject for discussion between the Government and VNF relates to shipping dues, where VNF wishes to ensure a dedicated income and thus less reliance on the national budget. Whilst the official statistics for France show a modal share for IWT of only 2.7 % in 2001, a study has been made of the 'wet' part of the country which makes up just over one half of the national territory. If this were taken as the basis French IWT would account for 5.1% of tonnage and 7.0% of traffic in tonkm. The really significant modal share lies in international traffic, making up 24.3% in tons and 16.5% in tonkm.

2.3.5. The Netherlands

In the Netherlands, water transport has a larger modal share than anywhere else because of the widespread and well-maintained waterway network, linked to the important seaports of Rotterdam and Amsterdam (see Section 1).

As regards waterway transport policy, the national Ministry of Transport and Waterways is primarily responsible for the network of 2 200 km comprising:

- the major waterway axes, defined as carrying a minimum of 5 million tons per year of international inland waterway transport to and from the Dutch sea ports and able to handle at pusher units with at least 4 barges
- the major waterways which carry a minimum of 5 million tonnes or 10,000 containers per year and can handle large motor vessels and pusher units with at least 2 barges.
- The remaining waterways are managed by the provinces or other local authorities.

All these authorities must see to it that, for example, locks are able to handle waiting vessels with minimum delays, that the formation of ice is prevented or minimised, that major waterways are available 24 hours per day, etc.

Since the Netherlands is a Rhine Commission and EU Member State, inland waterway transport Regulations are largely determined by

- those issued by the CCR (Central Commission for the Rhine) and resulting from the Treaty of Mannheim for the Rhine basin as a whole, and
- EU legislation, mainly in the form of Directives requiring to be implemented by national measures.

Such regulations cover items such as safety and efficiency by providing traffic rules, the provision of overnight facilities, technical requirements for the vessels, rules for the crew as regards working hours, number on board and professional knowledge, rules on access to the profession of inland waterway transport operator etc, both national and international.

Until fairly recently, the Dutch 'inland waterway transport Law' also regulated the alternating cargo system ('tour de rôle') via shipping exchanges, but this was abolished recently in the EU as a whole; since 1998 inland waterway transport in the Netherlands operates as a free market.

As for further promoting inland waterway transport in a country well provided with it, the deteriorating economic situation of the country, highlighted in the September annual budget, will probably reduce funds for both maintenance and investment on the waterways, but such reductions are likely to hit rail and certainly road transport even harder. Emphasis may well be laid on better informatics and other 'soft' promotion techniques. As regards maintenance, 700 million euro have been reserved in the national budget for the period up to 2010. Priority will be given to linking the ports of Rotterdam and Amsterdam with the sea and to the corridors Amsterdam/Rotterdam – Germany and Rotterdam-Antwerp. In 2005 a start will be made on dredging the Noordzeekanal and the Waal route.

2.4. General European policy to stimulate sustainable transport modes

On a European level many policy initiatives aimed at triggering a modal shift from road transport to the so-called alternative freight transport modes have been taken. In order to restore the balance between the different transport modes the European Commission established two programmes to support the European Transport Policy, namely the 'Pilot Actions for Combined Transport' (PACT) programme and its successor, the 'Marco Polo' programme. Both programmes cover or covered all transport modes in the international freight transport market, but are primarily eyed "to reduce road congestion and to improve the environmental performance of the freight transport system within the Community and to enhance intermodality, thereby contributing to an efficient and sustainable transport system" (European Commission, 2005, o.c.).

In the PACT programme the European Commission granted financial assistance to innovative projects contributing to the increased use of combined transport and encourage the transfer of traffic from roads to more environment friendly modes of transport through:

- increasing the competitiveness of combined transport as compared with exclusively road haulage, or
- promoting the use of advanced technology in combined transport, or
- improving the possibilities of supplying combined transport services

The Marco Polo programme on the other hand intends to reduce congestion, to improve the environmental performance of the transport system and to enhance intermodal transport, thereby contributing to an efficient and sustainable transport system, in order to achieve a traffic shift of the expected yearly aggregate increase of international road freight traffic, measured in tonkm to short sea shipping, rail and inland waterways or to a combination of modes of transport in which road journeys are as short as possible.

The Marco Polo programme runs from 2003 to 2006 with a budget of 100 million euro for the EU-25. Countries such as Norway, Iceland and Lichtenstein have joined the programme. Each additional fully participating country will contribute to the available budget. The first call for proposals was published on 11th October 2003 and closed on 10th December 2003, the 13 successful projects concluded a contract in autumn 2004. The second call for proposals was published on 15th October 2004, with deadline for submission on 15th December 2004.

Successfull projects should have a contract in mid 2005 (indicatively) (European Commission, 2005, o.c.).

On 15th July 2004 the Commission presented a proposal COM (2004) 478 to establish a second, significantly expanded Marco Polo programme from 2007 onwards. 'Marco Polo II' includes new actions such as motorways of the sea and traffic avoidance measures. The programme, which has a budget of 740 million euro for 2007-2013, has been extended to countries bordering the EU. The Commission estimates that every 1 euro in grants to Marco Polo will generate at least 6 euro in social and environmental benefits. The final form of Marco Polo II will depend on the outcome of the negotiations with the European Parliament and the Council (European Commission, 2005, o.c.).

Apart from the above-mentioned PACT and Marco Polo programmes, different forms of congestion charging/road pricing have been installed in various European Countries (e.g. the 'congestion charge' in London and the 'Maut' in Germany and Austria). The impact of these measures on inland waterway transport is not known yet, but it is generally assumed that inland waterway transport will benefit from the increase in road haulage transportation costs.

3. Bottlenecks and challenges for inland navigation and inland ports in Europe

This section focuses on three bottlenecks with which inland navigation and inland ports in Europe are currently confronted: poor operational transhipment performance (3.1), poor quality of hinterland connections (3.2) and the issue of limited expansion opportunities versus overcapacity (3.3). On top of this, this section discusses some of the challenges for inland ports in streamlining European logistics chains and in relieving seaports from potential congestion.

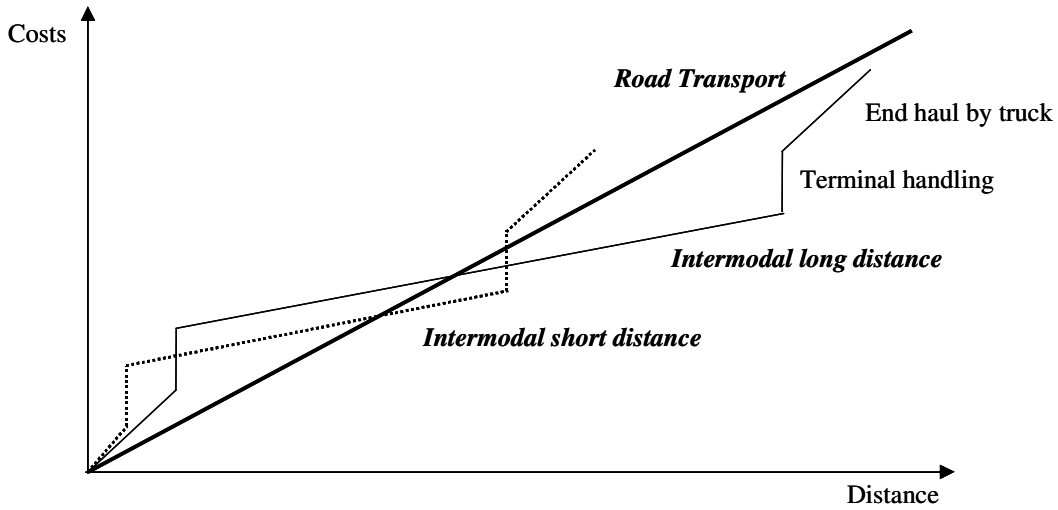
3.1. Poor operational transhipment performance

In the seaports of Rotterdam and Antwerp, Europe's biggest load centres for inland waterway traffic (cf. supra), barge container transport is increasingly being confronted with operational problems hampering its image as a reliable transport mode. Due to the enormous increase in deepsea container traffic in those two ports (as a result of the so-called 'China effect' they

registered double-digit growth in the last two years), coupled with the fact that deepsea vessels are granted priority over barges when they have to be handled alongside the same quay, barge container transport is confronted with increasing waiting times (recently, waiting times of up to 48 hours were no exception). This results in the disruption of barge's sailing schedules and unexpected costs (cf. supra). Another problem faced by barge container transport is the fragmentation of container flows in seaports. Barge operators sailing between Rotterdam/Antwerp and terminals along the Rhine typically call at a large number of terminals in both seaports (so-called 'terminal shopping'), which results in a low number of container moves per terminal and a significant amount of time spent in port.

On the Rotterdam/Antwerp market, on the other hand, the number of terminals called at is lower, resulting in higher call sizes and a lesser amount of time spent in port (CBRB, 2003a). A possible solution to the problem of low call sizes and time losses in seaports is the bundling of barge container flows at a limited number of seaport terminals. This, however, increases inter-terminal transport and handling costs for the stevedore. Given the fact that handling costs take up a large share of the total *port-to-door* transport costs, particularly for short port-to-door distances (see Figure 3), this would significantly hamper inland navigation's competitive position *vis-à-vis* other transport modes.

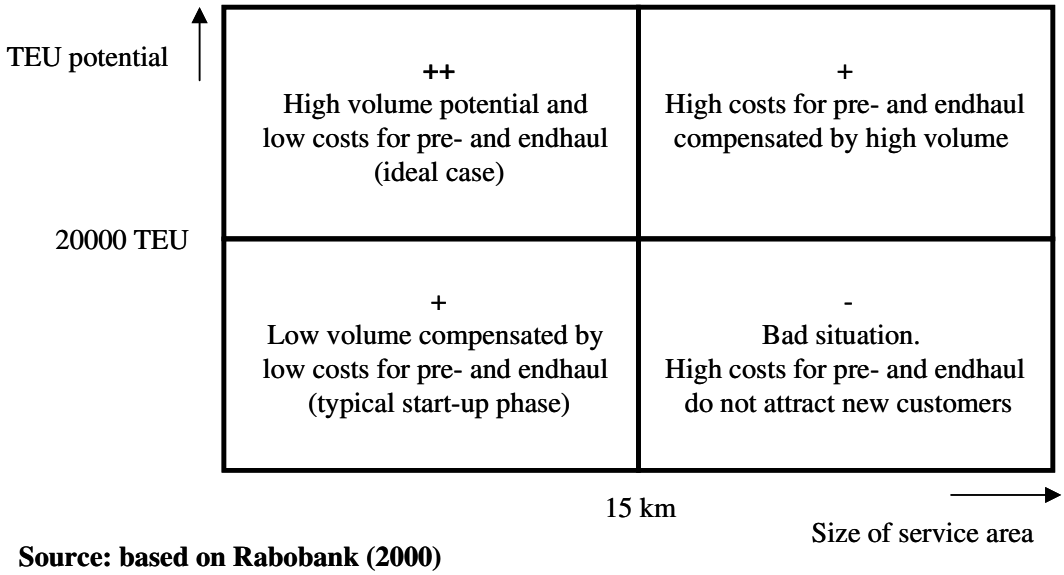
Figure 3: 'Out-of-pocket' cost structure: road transport versus intermodal transport



The profitability of an inland container terminal typically depends on two factors, namely its throughput and the size of its service area (Rabobank, 2000). As far as throughput is

concerned, a certain minimum volume is required in order to be profitable. A high throughput enables a quick recovery of fixed investment costs (in infrastructure, superstructure and ICT systems), which take up a large share of the total terminal handling costs (Rabobank, 2000). The size of the service area has a large impact on the competitiveness of an inland terminal. In case the inland terminal is located in the vicinity of the seaport, the service area of the inland port often covers a range of 10 km or less around the terminal. Far away from the seaports (>300 km), service areas of inland terminals in some cases stretch up to a range of 60 km. Larger service areas imply high costs of pre- and end-haulage (which seriously hampers a terminal's ability to attract new business) and increase the risk of competition with other inland terminals. All this impedes the acquisition of possible new customers. The expected terminal profitability is highest for terminals with a high throughput and a small service area (see Figure 4).

Figure 4: Expected profitability of an inland terminal as a function of service area and throughput (case for Dutch inland terminals in relation to Rotterdam/Antwerp)



Source: based on Rabobank (2000)

3.2. Poor quality of hinterland connections

Contrary to the Trans-European Transport Network (which focuses on the major transport corridors in Europe) a harmonised framework for achieving better connections between inland ports and their catchment areas in the hinterland has not yet been developed. However, given

the fact that pre- and end-haulage often represent a significant share of the total supply chain costs (cf. supra), the importance of smooth connections between inland ports and their hinterland should not be underestimated.

The most important infrastructural bottlenecks for inland navigation are limited dimensions of certain rivers and canals (regarding width and depth), limited dimensions of locks and limited bridge heights (air draft). As these elements determine the maximum dimensions of barges that can be deployed on a certain route (including the maximum stacking height of the containers onboard the vessels), they have a major impact on the cost efficiency of inland navigation and hence its competitive position.

The infrastructural problems discussed above apply to all three markets discussed in paragraph 1.2, albeit to a different extent. Inland navigation to/from terminals along the Upper Rhine is affected by limited air drafts (e.g., the inland port of Strasbourg can only be reached by vessels stacking maximum three-high). The same problem is encountered on certain regional rivers/canals in the Benelux. Moreover, the capacity on some of those canals is negatively affected by limited opening hours of locks and waiting times in front of bridges. Finally, barges sailing on the Rotterdam/Antwerp route can stack containers 4-high, provided that they ballast and that no high-cube containers are involved (otherwise they have to make a detour).

3.3. Port capacity: limited expansion opportunities versus overcapacity.

On the one hand, mainly because of environmental regulations, several inland ports exist that are confronted with a lack of spare capacity. This results in longer waiting times on terminals, which in turn leads to a reduced operational efficiency of inland vessels and crews. On the other hand, numerous inland ports exist that are faced with unused capacities, resulting in the need for either higher charges per cargo unit or increased public financial support. It is clear that both the problem of limited expansion opportunities and the problem of overcapacity will eventually result in a worsening of the competitive position of inland ports and the commercial viability of multi-modal transport services.

The industrial activities of inland ports are increasingly coming under pressure from other activities such as housing, recreation and nature development. This implies that measures

have to be taken in order to reduce, e.g., noise and air pollution, which obviously results in higher costs. Moreover, the pressure from other activities reduces the likelihood of port extensions or new investments *tout court*, which has a negative impact on the attractiveness of inland ports for possible new businesses. This could eventually lead to relocation of industrial activities or even closing of activities altogether (TNO INRO/a&s management, p. 4).

Therefore, many inland ports in Europe are forced to find a trade-off between proximity to the economic centres (services areas) on the one hand and land availability and public support on the other. Similar to the situation in seaports, socio-economic conflicts related to inland port development are emerging. A large part of the community takes inland ports for granted and is ignorant of how inland ports are organized and operated and to what extent they contribute to global trade and local economies. More attention is given to the fact that these inland ports generate local negative effects, such as local road traffic, the use of scarce land and potential pollution. In the whole discussion on the development of inland ports the argument increasingly concentrates on the environmental criteria (for example, emissions into the air, water pollution, congestion, loss of open space, light and noise externalities, potential conflicts with recreational uses of area waters, etc.). Inland ports must demonstrate a high level of environmental performance in order to ensure community support.

Community groups are often guided by local rationality and opportunistic behaviour. Local pressure groups often defend their local interests in such a fierce way that the individual well-being of a few people is becoming an even bigger driving force than the well-being of the greater community. For instance, the NIMBY syndrome ("not in my backyard") can seriously hinder the development of inland ports and inland infrastructures, even if these infrastructures will generate a positive impact on the modal shift from road to environment friendly transport modes such as rail and inland shipping. When this situation escalates, the further development of inland ports and multimodal transport as a whole would be seriously hindered.

3.4. Strengthening the role of inland ports in logistics processes

Containerisation is going hand in hand with dramatic changes in the organisation of logistic chains and networks. Global logistics and door-to-door solutions are now the name of the game. Manufacturers are looking for global logistics packages rather than just straight shipping or forwarding. Most actors in the transport chain have responded by providing value-

added services in an integrated package. The transport chain is viewed as a totally integrated system, where the international consignment is based on the whole journey from point of origin to destination of which the sea leg forms a part. This increases the pressure not only on the maritime haul and port operations, but also on inland distribution.

With the expanding hinterlands of seaports, economic and logistic reasons emerged that justify the establishment of such inland ports. Inland container centres have two important functions from a logistics point of view. First of all, inland terminals are consolidation centres in extensive transportation networks at two levels: the consolidation of containers into intermodal shuttles and the consolidation of consignments into containers. Secondly, many inland ports can be considered as logistics zones, as they have attracted logistical services.

3.4.1. The consolidation of containers into intermodal shuttles

Inland ports allow to extend the transportation network inland far beyond the seaports, thus relieving some pressure of the collection and distribution networks in the immediate vicinity of seaport areas. Direct shuttles on a frequent basis in most cases are the most economical form of barge operation. But where there are insufficient volumes for full barges, bundling concepts in hinterland networks might provide the answer. Nowadays, new bundling concepts are developed and experimented with in inland navigation. The container barge services from the Benelux ports to the Rhine are traditionally organised as line bundling networks. This means that an inland vessel loads containers in a Benelux seaport and then sails to a specific navigation area (e.g. lower Rhine) to load and discharge its cargo at various inland terminals before returning to the seaport. Operators tend to co-operate in services offered to the various areas in the Rhine basin (e.g. the Fahrgemeinschaft Oberrhein for the upper Rhine area). Up to now, none of the container terminals along the Rhine serves as inland hub for other river ports. In the near future we might see the emergence of barge service networks in the Rhine basin that are built around river-based hub-and-spoke networks. This means that a few river ports in the Rhine basin could develop into inland hubs for services to other river ports.

There is a clear interest and market need to better valorise the complementarity between inland navigation and rail. At this moment only few examples exist of inland ports that tranship containers from barges to rail with destinations in the more distant hinterland (e.g. Duisburg and Basel).

3.4.2. The consolidation of consignments into containers (stuffing & stripping)

An inland terminal may serve as a cargo consolidation and deconsolidation centre, where containers are stuffed and stripped. More and more shippers use inland terminals in the vicinity as a calling point for import cargo that is fully synchronised with the production line. Inland terminals have also acquired an important position with respect to export cargo, as many inland terminals reveal to be good sources for getting empty containers fast.

The function of an inland terminal as empty depot can also ease one of the most difficult and wasteful problems of container transportation, that is, the empty leg. Generally speaking, the concept of inland terminals has become an important tool for shipping lines to optimise box logistics. This aspect needs however be developed further.

3.4.3. Logistics zones

Many inland ports have become or are striving to become important logistics centres. Contemporary trends in logistics have led to a greater spatial centralisation of distribution activities and Value-Added Logistics in fewer, larger and more specialised distribution centres. The rise of European Distribution Centres (EDC) and/or National Distribution Centres is an outcome of this tendency towards centralisation. These ongoing developments in logistics are favouring the function of inland terminals. Many inland ports have become broader logistics zones, because they not only have assumed a significant number of traditional port functions and services, but also have attracted many related services. These include a.o. distribution centres, shipping agents, trucking companies, forwarders, container-repair facilities and packing firms.

The strong growth of logistics zones in the hinterland makes clear that foreign production companies in many cases opt for locations in the vicinity of the seaports or in the hinterland. Shortage of industrial premises, the high land prices, congestion problems, the inland location of the European markets, severe environmental restrictions are some of the well-known arguments for companies not to locate in a seaport. This can result in processes of so-called spill-over and subharborisation of logistics sites. For Rotterdam the spill-over zones are located in Moerdijk/Dordrecht and Flushing. The subharborisation regions are located along the east-west corridors from Rotterdam to Germany.

The interaction between seaports and inland ports leads to the development of a large logistics pool consisting of several logistics zones. Seaports are the central nodes driving the dynamics in such a large logistics pool. But at the same time seaports rely heavily on inland ports to preserve their attractiveness. The availability of fast, efficient and reliable intermodal connections in the logistics pole is one of the most important prerequisites for the further logistical development of inland terminals.

3.4.4. A growing interest in inland ports

Many logistics actors recognise the multitude of functions of modern inland terminals and inland ports. This is why many market players are involved in the operation of inland terminals. The market players may have different reasons for doing so.

Some of the large stevedoring companies in Europe are expanding their activities to include terminal operations in other seaports, but also in inland terminals. This allows stevedoring companies to offer a more differentiated product to the customer. In fact, the inland terminals in many cases serve as extended gates for the deepsea terminals. Inland barge operators have always showed interest in the exploitation of inland terminals. About two thirds of all terminals in the Rhine basin are run by inland barge operators or the logistics mother company of a barge operator. The inland terminals function as key nodes in the logistic strategy.

3.5. Potential role of inland terminals to reduce container dwell times at seaport terminals

Given recent investments of terminal operators in inland barge terminals (e.g. stakes of ECT in TCT, Willebroek – Belgium and DeCeTe, Duisburg – Germany, stake of P&O Ports in DIT, Duisburg – Germany, etc.), these inland terminals can be incorporated in their strategies as 'extended gates' to their seaport terminals and as such can help to reduce container dwell times on seaport terminals. Next to the investments made by terminal operators and the consequent expansion of the network of inland terminals, the recent success of inland container barging in the ports of Antwerp and Rotterdam offers possibilities for dedicated shipments to and from their hinterland hubs. Notteboom and Konings (2004) presented this evolution in a spatial development model for a hypothetical port-linked container barge network. As such terminal operators have to make the strategic decision "whether their core

business is to store containers or to load, unload and forward containers fast and reliable" (Ilmer, 2004:12).

As such the inland container terminals act as a bridgehead in order to reduce container dwell times at seaport terminals. More research is needed to analyse the economic viability of using inland terminals as satellites to reduce container dwell times at seaport terminals. The following issues need to be addressed in this respect:

- How to reconfigure the inland terminal networks so as to optimise container transit from seaports to satellite terminals ?
- What about the cost distribution among the market players involved, both in terms of transport costs and additional handling costs (extra moves) ?
- Who should/can take the lead in establishing a network of satellite terminals (port authorities, terminal operators, etc..) ?
- How to bring about more transparency in the market so that the flows of loaded and empty containers in the port-hinterland relationship can be optimised ?

4. Policy recommendations

1. Although the dry and liquid bulk markets are by far inland navigation's most important markets in absolute volume terms, the market for container transport undeniably poses the biggest challenges for the future. Container transport by barge has developed very rapidly over the last decade, and it can be expected that this will continue in the future. As a result, the future needs of the barge container transport sector including the associated inland terminal networks deserve particular attention in the EU transport and infrastructure policy.
2. As a result of growing international container trade, the infrastructure in and around Europe's major seaports is increasingly coming under pressure. The barge container transport sector is being confronted with increasing waiting times, hampering its image as a reliable transport mode for shipments to and from major industrial production and consumption centres in the hinterland. In order to cope with future traffic growth, significant investments in additional infrastructure are an absolute necessity. In this respect, the EU should play a facilitating role by supporting initiatives in seaports aimed at the optimisation of both inter-terminal transport in seaports and the link between seaport and their satellite terminals in the hinterland. This will eventually have a positive impact on both logistics processes and the environment.
3. Given the fact that the profitability of an inland container terminal is largely dependent on two factors, namely its throughput and the size of its service area, the EU can facilitate in (1) creating a framework for the development of a sustainable inland terminal network, (2) creating a level playing field to ensure the sound development of and fair competition among inland terminals, (3) safeguarding that inland terminals can develop on greenfield and brownfield sites near major cargo centres so as to limit truck movements and maximize the cargo potential of the terminal. The success of inland navigation continues to rely on generating the necessary volumes to allow cost savings through economies of scale. Systems to bundle cargo in inland terminals therefore demand continuous attention. Moreover, further research is needed to analyse the economic viability of using inland terminals as satellites to reduce container dwell times at seaport terminals.
4. Given the high share of transhipment costs in the total cost structure of inland transport by barge, the EU should continuously encourage research into new transhipment technologies in inland terminals and seaports that limit transhipment time and costs. Major innovations in this field could make hub-and-spoke type of barging networks more feasible in the

future and could as such optimise existing barge equipment and terminal network configurations.

5. One should be aware of the diverse roles inland terminals can fulfil. For example, end-to-end terminals are completely different from pure transit terminals. Hence, the needs of both terminal types are significantly different and this should be taken into account in policy initiatives.
6. The complementarity between inland navigation and rail has not been developed to the full. Given the rather limited geographical coverage of the European inland waterway network and the recent accession of new member states in the east, initiatives to link up barge services to rail shuttles with destinations in the more distant hinterland could be a welcome addition to the intermodal market. The EU should help to initiate/facilitate combined barge/rail services in view of extending the market potential of intermodal transport.

References

Blauwens, G., P. De Baere and E. Van de Voorde (2002), Transport Economics, Antwerp, De Boeck Editions, 475 pp.

Buck Consultants International, ProgTrans, VBD European Development Centre for Inland and Coastal Navigation, and via donau (2004), PINE – Prospects of Inland Navigation within the enlarged Europe – Full Final Report, 636 pp.

Dullaert, W., H. Meersman, F. Moglia and E. Van de Voorde (1998), "Regulation and deregulation in inland navigation", in: Meersman, H., E. Van de Voorde and W. Winkelmans (eds.), Selected proceedings of the 8th World Conference on Transport Research – Volume 1: Transport modes and systems, Oxford, Pergamon Press, pp. 321-334

European Commission (2001), White Paper European transport policy to 2010: time to decide, Luxemburg, Office for Official Publications of the European Communities, 119 pp.

European Commission (2003), EU Energy and Transport in Figures – Statistical pocketbook 2003, Luxemburg, Office for Official Publications of the European Communities, 208 pp.

European Commission (2004), EU Energy and Transport in Figures – Statistical pocketbook 2004, Luxemburg, Office for Official Publications of the European Communities, 220 pp.

European Commission (2005), The Marco Polo Programme, detailed information to be found at http://europa.eu.int/comm/transport/marcopolo/index_en.htm

European Council (1996), Directive 96/75/EC of 19 November 1996 on the systems of chartering and pricing in national and international inland waterway transport in the Community, Official Journal L 304, 27/11/1996, pp. 12-14

INFRAS/IWW (2000), External costs of transport – accident, environmental and congestion costs in Western Europe, Zürich/Karlsruhe, 305 pp.

Merckx, F. and T. Notteboom (2002), "ICT as a means to improve the logistic performance of the inland navigation sector", in: Notteboom, T. (ed.), Current issues in port logistics and intermodality, Leuven, Garant, pp. 69-88

Notteboom, T. and Konings, R., 2004, "Network dynamics in container transport", Belgian Journal of Geography - BELGEO, Vol. 5, No. 4, pp. 461-478

Planco Consulting GmbH (2003), TEN-Invest – Final Report, Essen (Germany), 113 pp.

Rabobank (2000), Waterlogistiek: Vaart in de ruimtelijke ontwikkeling van logistieke dienstverlening, 20 pp. (in Dutch)

Stichting Projecten Binnenvaart, DLD, a&s management (2003a), Basisdocument Containerbinnenvaart, 55 pp. (in Dutch)

Stichting Projecten Binnenvaart, DLD, a&s management (2003b), Kanshebber in de keten – toekomstperspectief containerbinnenvaart, 59 pp. (in Dutch)

TNO INRO/a&s management (s.d.), Blueports: knooppunten voor de regionale economie – Onderzoek naar de economische belangen van de Nederlandse Binnenhavens, 53 pp. (in Dutch)

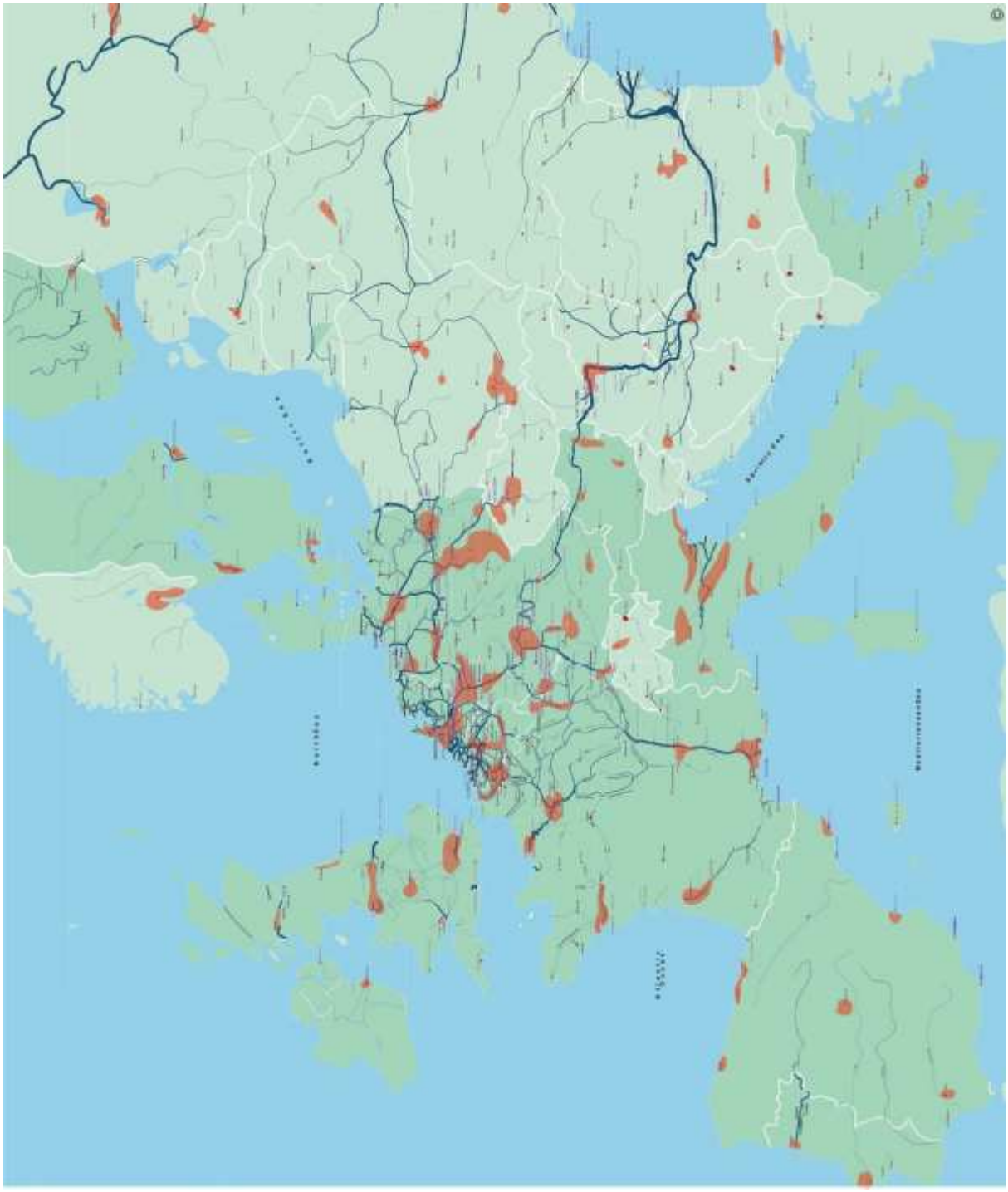
Appendix

Table A1: Freight transport modal split (excluding shortsea shipping) in the current EU-25 Member States (2002)

	Road transport	Rail transport	Inland navigation	Pipeline transport
Austria	51.3 %	29.7 %	4.9 %	14.0 %
Belgium	70.0 %	12.9 %	14.3 %	2.8 %
Denmark	74.1 %	7.7 %	-	18.2 %
Finland	74.4 %	24.8 %	0.8 %	-
France	77.8 %	14.0 %	2.3 %	5.8 %
Germany	69.7 %	14.5 %	12.8 %	3.0 %
Greece	98.1 %	1.9 %	-	-
Ireland	96.1 %	3.9 %	-	-
Italy	86.3 %	9.1 %	0.1 %	4.5 %
Luxemburg	77.3 %	15.2 %	7.5 %	-
Netherlands	44.9 %	4.4 %	44.2 %	6.5 %
Portugal	87.0 %	13.0 %	-	-
Spain	89.3 %	6.4 %	-	4.3 %
Sweden	62.6 %	37.4 %	-	-
United Kingdom	84.1 %	10.0 %	0.1 %	5.8 %
EU-15	**75.5 %**	**12.9 %**	**6.9 %**	**4.6 %**
Cyprus	100.0 %	-	-	-
Czech Republic	70.7 %	25.6 %	0.9 %	2.8 %
Estonia	31.3 %	68.7 %	-	-
Hungary	59.9 %	27.2 %	5.8 %	7.1 %
Latvia	22.4 %	54.7 %	-	22.9 %
Lithuania	42.2 %	38.5 %	-	19.3 %
Malta	100.0 %	-	-	-
Poland	52.1 %	32.5 %	0.8 %	14.6 %
Slovak Republic	66.4 %	30.8 %	2.8 %	
Slovenia	59.8 %	40.2 %	-	-
EU-25	**72.2 %**	**16.3 %**	**6.0 %**	**5.6 %**

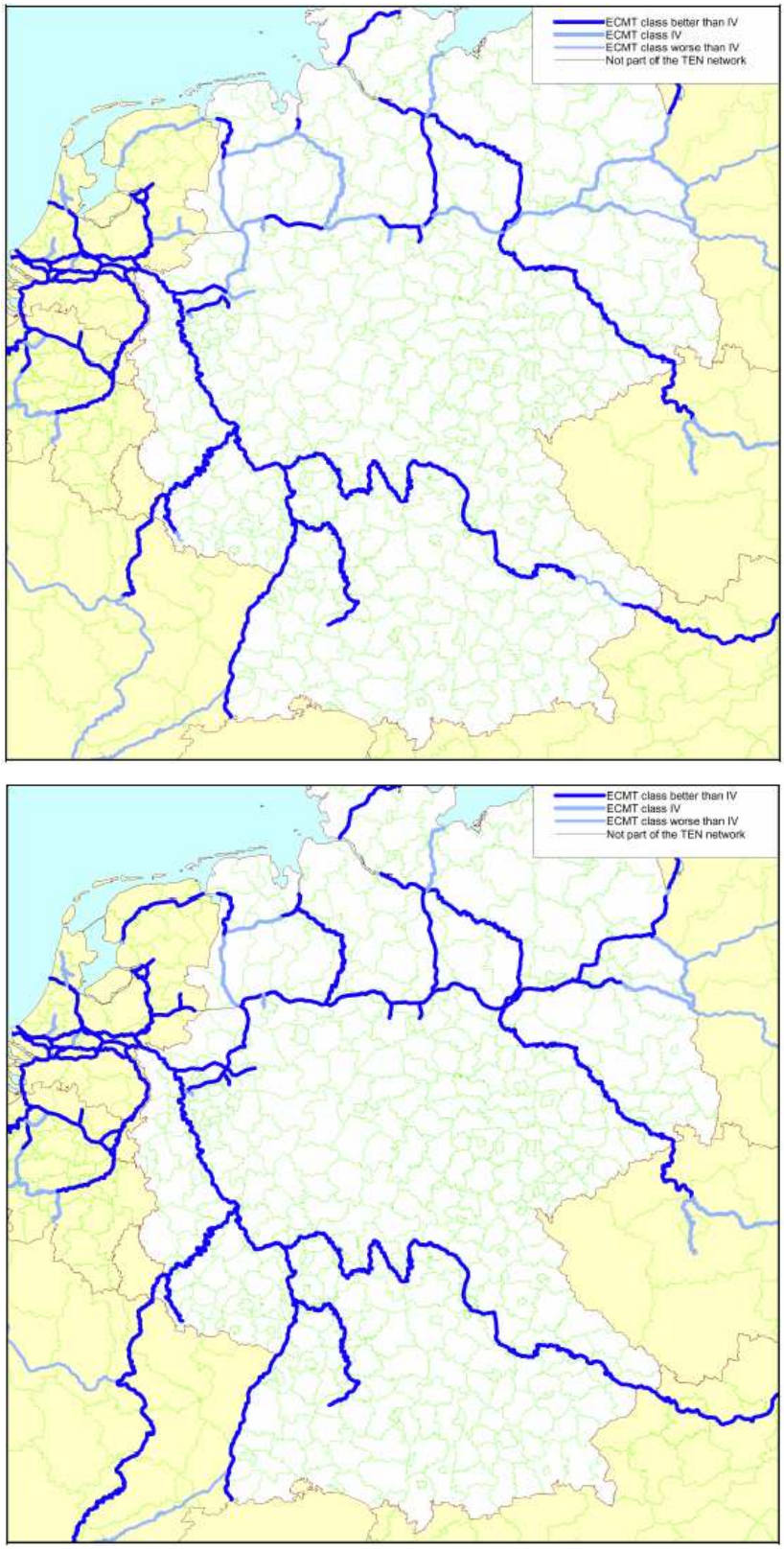
Source: European Commission (2004)

Figure A1: The European Inland Waterways network



Source: Inland Navigation Europe

Figure A2: The TEN-T inland waterway network in Germany and neighbouring countries in 1996 (above) and 2015 (below)



Source: Planco Consulting (2003)