PINE

Prospects of Inland Navigation within the enlarged Europe

Final Concise Report

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Contents

Page

Chapter 1 Introduction

1.1 Background and goals of the PINE project

The common transport policy of the European Union attaches major importance to the development of ***inland waterways*** as a mode of transport. Inland waterway transport represents not only a genuine alternative to road transport but also a real possibility of linking up with other modes of transport. Its development may contribute significantly to the attainment of transport policy objectives, in particular shifting the balance between modes of transport and integrating inland waterways into the intermodal transport chain. The enlargement of the European Union as well as the integration of the inland waterway networks in the Accession Countries into the existing Community inland waterway market represent an immense challenge for the Community inland waterway sector in the years ahead.

In order to meet these challenges, it was necessary to analyse the existing and future situation and the prospects in the inland waterway sector, in order to enable the common transport policy to develop appropriate medium and long-term measures. Therefore, the Commission decided in 2002 to commit a study on the current situation in the inland waterway sector and future prospects in the enlarged Union.

Early 2003, a consortium of four organisations experienced in Inland Waterway Transport[1], started their work on the project ***'Prospects for Inland Navigation within the enlarged Europe' (PINE)***. The consortium consisted of the following companies:

- Buck Consultants International (The Netherlands)
- ProgTrans (Switzerland)
- VBD – European Development Centre for Inland and Coastal Navigation (Germany)
- via donau – Development Agency for Telematics and Danube Navigation (Austria)

With the PINE project, the European Commission has aimed to ***acquire a complete and up-to-date overview*** of the European inland waterway infrastructure and the inland navigation sector. The other main target of the project has been to map the ***potentials*** of IWT, against the background of the Enlargement of the Union with ten new countries in 2004 and two additional countries in 2007. In addition, PINE should clearly indicate possibilities for

[1] To be referred to as 'IWT'

promoting the growth of IWT so as to make a significant contribution to the Commission's policy targets.

This ***Final Concise Report*** summarises the main findings, conclusions and recommendations and is an abridged version of the Full Final Report, which includes all previous deliverables. The structure of this report is explained in Section 1.4.

1.2 Method of working

For the period of one year, the consortium has been working on the gathering and analysis of data and information. During its course, the project has yielded an extensive overview of the state of affairs in IWT in the study area, formed by the EU-15 plus the twelve Accession Countries, as well as an overview of future developments. This has included the ***supply side*** (infrastructure, fleets, and human resources) as well as the ***demand side*** (present and expected transport volumes). Also, the framework regarding policy and legislation, intermodal and intramodal competition and the potentials of IWT have been thoroughly analysed.

These subjects have been studied in various ways. A wide variety of existing sources was used. At the end of the report, a reference list is included (literature, statistics and internet sources). In addition, the partners have consulted many experts in the field, both internally (within the consortium partner organisations), as well as in many external interviews. This work ranged from (written/telephone) requests for statistics and other inputs to personal talks with national and international experts.

An extended data assembly exercise was held. As part of this, authorities that are responsible for IWT in all countries concerned were approached.

An important role has been played by the ***Advisory Group,*** a body convened by the European Commission, to enrich the project with inputs and advices. The Advisory Group was made up of the following organisations/persons:

▪ Central Commission for Navigation on the Rhine (CCNR)	Mr. H. van der Werf
▪ Danube commission	Mr. D. Nedialkov
▪ European Federation of Inland Ports (EFIP)	Mr. J. Sturm
▪ European Shippers Organisation (ESO)	Mr. H. van der Velde
▪ European Transport Workers' Federation (ETF)	Mrs. B. Hertogs
▪ European Transport Workers' Federation (ETF)	Mrs. B. Paas
▪ Inland Navigation Europe (INE)	Mrs. K. de Schepper
▪ European Barge Union (EBU)	Mrs. T. Hacksteiner
▪ European Barge Union (EBU)	Mr. G. Poppelaars
▪ Union of Industrial and Employers' Confederations of Europe (UNICE)	Mr. M. Plötzke

Apart from attending a number of official meetings and reacting on deliverables, they have been helpful by giving additional interviews. Both the European Commission and the Consortium would like to thank these organisations for their valuable contributions.

Shortly after the finalisation of the PINE project the Enlargement of the EU will take place. This report and other PINE reports have therefore used the following abbreviations, specifically in view of varying data availability:

- EU-15 for the member states up to 1st May 2004
- EU-25 for the member states between 1st May 2004 and 2007
- EU-27 for the presumed member states after 2007, so including Romania and Bulgaria

Information on Switzerland and Norway is, where appropriate, included. Furthermore this report will only use the term ‘shipper’ for a party supplying freight (e.g. industry), and the term ‘skipper’ in its meaning of boatmaster/captain.

1.3 Structure of the project

The project consisted of nine Work Packages, each (WPs) dealing with a separate element. The first five Work Packages had been structured to represent the basic components of the IWT system:

- Transport Supply: including
  - networks & Infrastructure (WP1),
  - fleets & Crews (WP2), and
  - present Traffic Volumes and Performance (WP3)
- Transport Demand: Transport Analyses and Forecasts (WP4)
- Framework & Competitive Conditions (WP5)

Subsequently, these outcomes were used to perform a series of SWOT analyses (Strengths, Weaknesses, Opportunities and Threats) in WP6. This was followed by an analysis of the potentials for modal shift towards IWT (WP7). The final results were summarised in WP9, which includes conclusions and recommendations.

Of all Work Packages, interim deliverables have been provided. These have been compiled into the Full Final Report. Main results from the Full Final Report are integrated in this concise report. The next section gives an overview of the structure of this report.

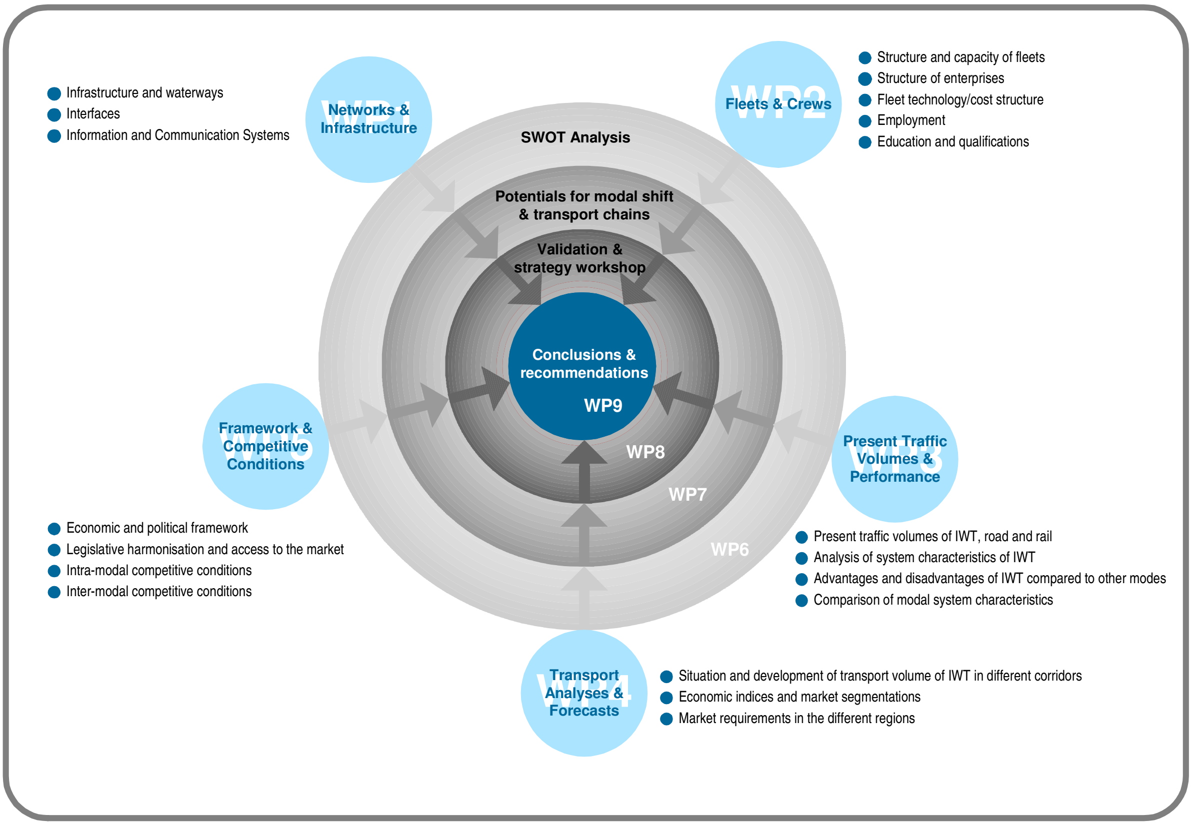


Figure 1. Structure of the PINE project

1.4 Structure of the report

This Final Concise Report provides a compact overview of the PINE project. It does so by reporting on three aspects: ***main results, conclusions and recommendations.***

First, an overview is presented of the main findings of the project work.

This is summarised in ***Chapter 2***.

- Section 2.1 Introduction
- Section 2.2 Main results on the supply side
- Section 2.3 Main results on the demand side
- Section 2.4 Main results on policy and legislation
- Section 2.5 Main results on modes and competition
- Section 2.6 Main results on the potentials of IWT

The conclusions that have been drawn throughout the project are put together in ***Chapter 3***. This chapter is structured in the same way as the previous one, namely:

- Section 3.1 Introduction
- Section 3.2 Conclusions on the supply side
- Section 3.3 Conclusions on the demand side
- Section 3.4 Conclusions on policy and legislation
- Section 3.5 Conclusions on modes and competition
- Section 3.6 Conclusions on the potentials of IWT

Finally, the report is concluded with recommendations in ***Chapter 4***. In this chapter, recommendations are categorised per item. Furthermore, actors responsible and priorities are indicated. The recommendations are divided over the following items.

- Section 4.1 Introduction
- Section 4.2 Recommendations on legislation
- Section 4.3 Recommendations on waterway infrastructure
- Section 4.4 Recommendations on ports and interfaces
- Section 4.5 Recommendations on information systems
- Section 4.6 Recommendations on human resources
- Section 4.7 Recommendations on the IWT fleet
- Section 4.8 Recommendations on the market
- Section 4.9 Recommendations on the IWT sector
- Section 4.10 Recommendations on the IWT image
- Section 4.11 Recommendations on knowledge on IWT

Lastly, there are lists of abbreviations and references.

Chapter 2 **Main results**

2.1 Introduction

In this chapter, the main results are presented of the work carried out during the course of the project. In a number of Work Packages (WPs), studies and analyses were made of the supply and demand side of IWT, the political, legal and economic framework and of competitive conditions within the mode and with other modes. Of course, special attention was paid to the potentials of IWT.

Where appropriate, the findings are summarised and grouped according to a classification of four main waterway corridors:

- ***Rhine Corridor*** comprising the Rhine confluence and the canals in the western part of Germany, Belgium, the Netherlands, Switzerland, the eastern part of France and in Luxembourg
- ***Danube (South East) Corridor*** including the entire Danube confluence with all tributaries and navigable canals as well as the Main-Danube Canal,
- ***East-West Corridor*** with the Mittelland Canal (MLK) in northern Germany, the confluences of Elbe, Oder and Wisla and the connections to the West
- ***North-South Corridor*** covering the major rivers, navigable tributaries and linking canals extending between the lower Rhine area and the Mediterranean, practically throughout France including the links to the Belgian/Dutch network.

Clearly the corridors have some overlap at their extremes, as Figure 2 shows.

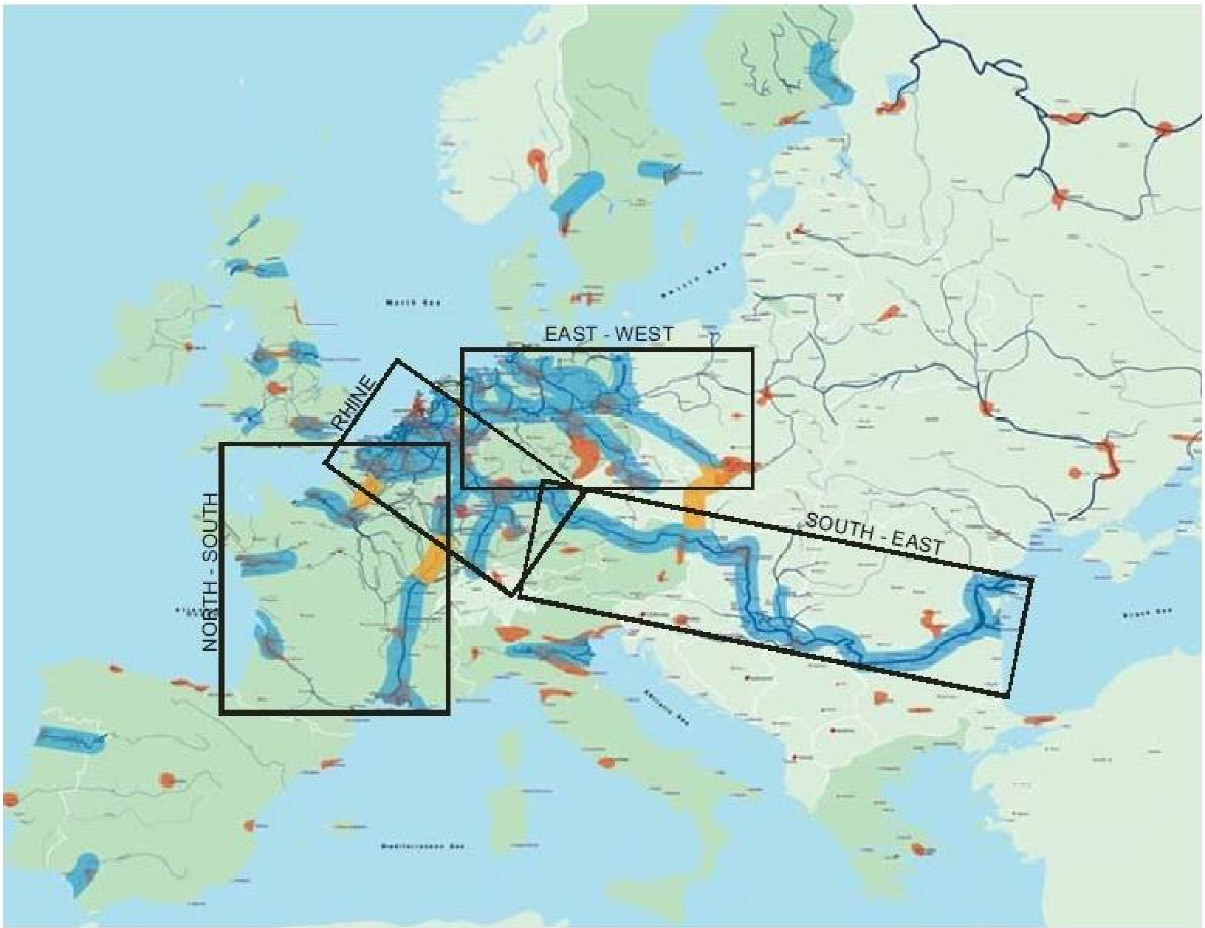


Figure 2. Inland Waterway corridors in Europe
Source: INE/via donau

The enlargement of the European Union is specifically treated because it will significantly influence IWT policies. The Accession Countries' IWT infrastructure will provide additional potential for the mode, both nationally and internationally.

2.2 Main results on the supply side

2.2.1 Performance and characteristics of IWT

Performance

In the present European Union, IWT ranks third in freight transport after road and rail with a market share of some 3.5% in volume (tonnage) and 6.5% in performance (tonne-kilometres, tkm). Although it could not keep pace with the fast expanding road sector and therefore gradually lost its modal share (12% since 1970 in terms of tkm), IWT did grow in absolute figures by some 20% since 1970 (in tkm). This contrasts with an absolute decline of the railway sector during that same period by some 15%. The enlargement causes the sector to grow by some 3.5% in terms of tkm at the EU level.

Characteristics

In inland navigation, operational costs per tonne-kilometre are low compared to other surface transport modes. This goes hand in hand with the bulk character of IWT: a push-convoy with two barges can carry over 5,000 tonnes of dry bulk. This equals approximately 125 railway wagons of 40 tonnes each, or 250 road trucks of 20 tonnes payload each. The largest container ships can today load over 400 TEU. However, there is one main feature of IWT, which can undo some of the cost advantages: the relatively low network density. The current total length of inland waterway in the European Union is 29,500 km of classified rivers and canals, increasing to 36,500 km in the enlarged Union. Compared to the existing railway lines in the same areas, inland waterways make up less than one fifth. For a majority of shipments, pre- or end-haulage by road and/or rail will therefore be necessary.

Given the comparatively low congestion within the IWT system, inland navigation is highly punctual and therefore capable of supporting scheduled and just-in-time delivery services. This has resulted in a significant modal shift of containers on the Rhine corridor and in countries as the Netherlands and Belgium. Concerning bulk goods, most volumes carried by inland navigation consist of traditional bulk goods like ores, metal wastes, solid and liquid mineral products and building materials. Supply chains of these goods increasingly rely on the punctuality of the IWT system by implementing floating stock concepts. Moreover, due to its high punctuality and cost-effectiveness inland navigation has entered new and demanding markets in the past decades, including chemicals and container transport. Provided that sufficient transport volumes are available – or that the bundling of different shipments is guaranteed – IWT can be an attractive mode within these market segments. Different load factors in upstream and downstream operations must therefore not always be a precondition for successful IWT-shuttles, as transport on the Rhine clearly demonstrates: two-thirds of tonnage moves upstream whereas only one third is transported downstream. Transporting empty containers back to seaports can set off a part of this imbalance.

Another major advantage of IWT compared to other modes is its relatively low external costs. Accidents tend to be rare within IWT, due to the high safety levels. Furthermore, energy consumption per transported unit is lower than for truck and rail transport (Table 1).

	1985	1990	1995	1996	1997	1998	1999	2000	Share 2000 (%)
Rail	7.0	6.9	7.5	7.6	7.6	7.5	8.0	7.6	2.5
Road	170.2	212.3	229.0	234.5	238.5	246.0	251.3	252.3 p	81.6
Air	21.1	27.8	32.5	34.2	36.0	39.5	42.1	43.8	14.2
Inland navigation	4.4	6.4	6.7	6.9	6.5	6.5	6.1	5.3	1.7
Total transport	202.6	253.3	275.6	283.2	288.7	299.4	307.5	309.1	32.5

Table 1. Final Energy consumption (all products) of the transport sector – EU15 (million t)
P: Provisional figure
Source: Eurostat, Transport in figures (2002)

IWT's emission of CO_2 is also lower than that of road and air transport. The emission levels of rail transport are comparable with those encountered in IWT (Table 2).

	1985	1990	1995	1996	1997	1998	1999	2000	Change 1985 – 2000 (%)
Rail[1]	11.1	8.9	8.5	8.5	8.5	8.1	9.3	7.8	-30
Road	500.4	626.3	677.5	694.2	706.5	729.1	745.7	749.5	50
Air	62.5	82.3	96.2	101.5	106.6	117.0	124.8	129.9	108
Inland Navigation	13.4	19.5	20.5	21.2	20.1	20.0	18.7	16.4	23
Total transport sector	587	737	803	825	842	874	899	904	54

Table 2. EU-15: total emission of CO_2: share by transport mode (million t of CO_2)
[1] Without fossil fuel for electricity production
Source: Eurostat, Transport in figures (2002)

2.2.2 Enterprises

The IWT industry has undergone a decade of major changes leading to a reduction in the number of enterprises, vessels and employment in virtually all countries. In this context, larger companies (mainly the formerly state-owned companies in Eastern Europe) have been split into smaller units.

A large part of the European IWT sector is characterised by vertical disintegration: the IWT supply chain is formed by a series of separate functions performed by different companies. For instance, large forwarding companies are responsible at the logistics level, whereas many small and medium-sized broker companies act as intermediary between shippers and skippers. This can – theoretically and practically – lead to sub-optimisations within the supply chain.

One of the basic problems in studying trends in the enterprise structure of the IWT sector is the lack of comparable and reliable data. Different statistical sources often report different figures, mostly due to varying definitions. Having said this, however, some general observations can be made.

The four countries with the highest numbers of IWT-enterprises are the Netherlands, Germany, Belgium and France. With nearly 3,700 enterprises the Netherlands have the highest number in Europe, representing on its own almost half (47%) of total IWT enterprises in the EU-15. In this respect, it is essential that the vast majority of enterprises only possess one vessel (see Figure 3). The share of one-vessel enterprises exceeds 70% in most countries. In Germany, Belgium and Luxembourg this type of enterprise even accounts for 80% of all companies. Conversely, in Austria, the share of owner-operators is less than 50%, resulting in a rather high share of bigger enterprises (20 vessels and more).

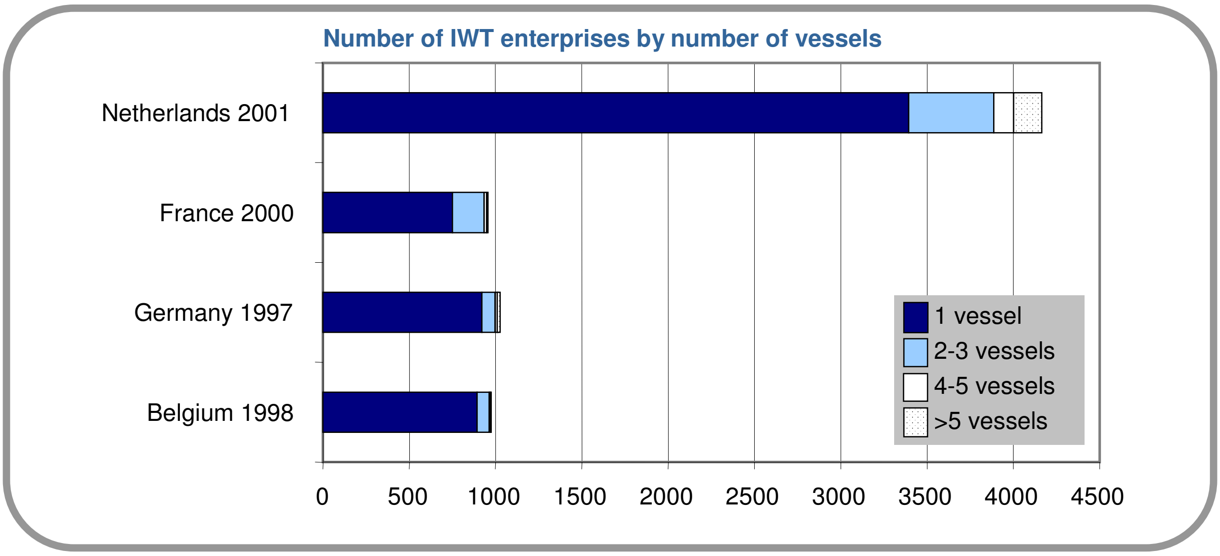


Figure 3. Countries of major importance in IWT
Source: Eurostat, (NewCronos 2003); DESTATIS data for Germany

An overall trend within Europe's largest IWT nations is the relative ***increase in scale***. In the Netherlands the high number of single-employee enterprises has been considerably reduced since 1993, whereas the share of enterprises with 2 to 4 employees actually increased. During the eight-year period between 1990 and 1998, the number of enterprises declined by almost half in France, by one third in Germany and by one quarter in Belgium.

In Germany, the largest decline in the number of vessels per enterprise took place in the dry bulk sub-sector. The carrying capacity of small enterprises (1 vessel) has declined, while the total carrying capacity was almost constant. This suggests that the 'new for old' scrapping/replacement system has worked in favour of larger companies, rather than owner-operators. This is probably caused by their reduced ability to raise funds for new investments. In France, the steady decline of recent years seems to have come to an end in 2000. Like its German and Dutch counterparts, the French IWT sector is also characterised by the domination of 'owner operators' – about 80% of its 1,121 enterprises have less than 6 employees.

In most ***Accession Countries,*** especially along the Danube, an opposite trend has taken place. Before the collapse of the communist system (around 1990), there were usually 1 to 3 national shipping organisations per country. Since that time, a reduction in scale has taken place – albeit at a relatively slow pace. For instance, in Poland the total number of vessels in 2002 was 809, of which about 20% belonged to small enterprises. In the Slovak Republic, the market has been relatively stable since 1989: one big enterprise (formerly state-owned, today private) still dominates. In Hungary, over 80% of the international performance is still in the hands of the state-owned 'Mahart'.

Judgements on the ***financial situation of IWT enterprises*** are hardly possible, with only limited data on turnover published. The EU-15 total turnover in IWT in 2000 was estimated at €4.15 billion: the four largest IWT countries – Germany, the Netherlands, Belgium, and France – are responsible for nearly 80% of this turnover figure. Operating costs vary significantly from one area to another and from one trip to the next, depending on navigation conditions and on the type of vessel. For reasons of commercial confidentiality and the expense of collecting and transmitting – especially for small enterprises –, data and statistics are rarely available. Where available, they often do not appear to be comparable.

2.2.3 Human resources

The existence of sufficient and well-qualified personnel is necessary for safe and efficient inland navigation. The development within the last years however shows that the number of 'domestic' employees tends to decline, especially within the Rhine corridor.

Because company structures and registrations have changed during the past decades (e.g. so-called 'flagging out'), the monitoring of the origin of inland navigation crew has become rather difficult. Facilitated by liberalisation, each company devises its own strategies to save costs and entrance efficiency. This might or might not involve the moving of headquarters (with employees disappearing from statistics), the flagging out of vessels, or both.

In addition, the scarcity of statistical data complicates a differentiated analysis. Above all, comparable data are missing as a result of the different national definitions. The PINE consortium has developed an approach for a calculation model that deals with this problem of incomplete and inconsistent employment figures. The model starts with the national fleets and the respective (estimated) share of vessels per fleet actually being in operation (active fleet). Subsequently, the average number of crew members per running vessel is estimated. Compared to the application of employment statistics this procedure yields comparable international data and at the same time benefits from the availability of more complete and homogeneous fleet databases.

In the course of the first exemplary calculation the nautical personnel in the inland navigation sector of the whole investigation area has been estimated at 35,000 persons. Of this total figure, some 23,000 belong to the Rhine corridor, about 5,000 to the Danube corridor, 3,000 to the East-West corridor and about 4,000 to the North-South corridor.

Despite the data problem, it can be observed that the labour market for crew members has decreased. In many cases the traditional generation-to-generation succession within family companies is interrupted because the potential successors have decided to leave the IWT-industry. Additionally, trainee numbers tend to sink in several countries, which means that input of newcomers to the sector is also limited.

In the Netherlands, the number of the persons employed in the IWT sector decreased by approximately 3% from 1995 (11,776 persons employed) until 1998 (11,389). Germany witnessed a more dramatic decrease during that period: IWT employment decreased by 14% (from 5,858 to 5,018). However, more recently, Germany saw an increase of the trainee numbers after years of decline. This was the result of a national promotion program, supported by attractive wage conditions ('Ausbildungsinitiative'). In several cases, the interest was even higher than the number of training vacancies. This example shows that there are several chances and potentials to reverse the existing trend, provided that suitable strategies and attractive incentives are initiated.

In the past years the decrease of 'domestic' personnel in the inland navigation sector of the Rhine countries had been balanced by the inflow of personnel from the Accession Countries. In particular, people from Poland and the Czech Republic started work on Rhine ships. The main incentive for this shift was the difference in wage levels. In West European countries, like the Netherlands, Belgium and Germany, labour costs used to be approximately 3 to 4 times higher than those in Slovakia, Hungary or Poland. These wage level differences are expected to be increasingly levelled out after the accession of the new member states – a process that already started in the last decade.

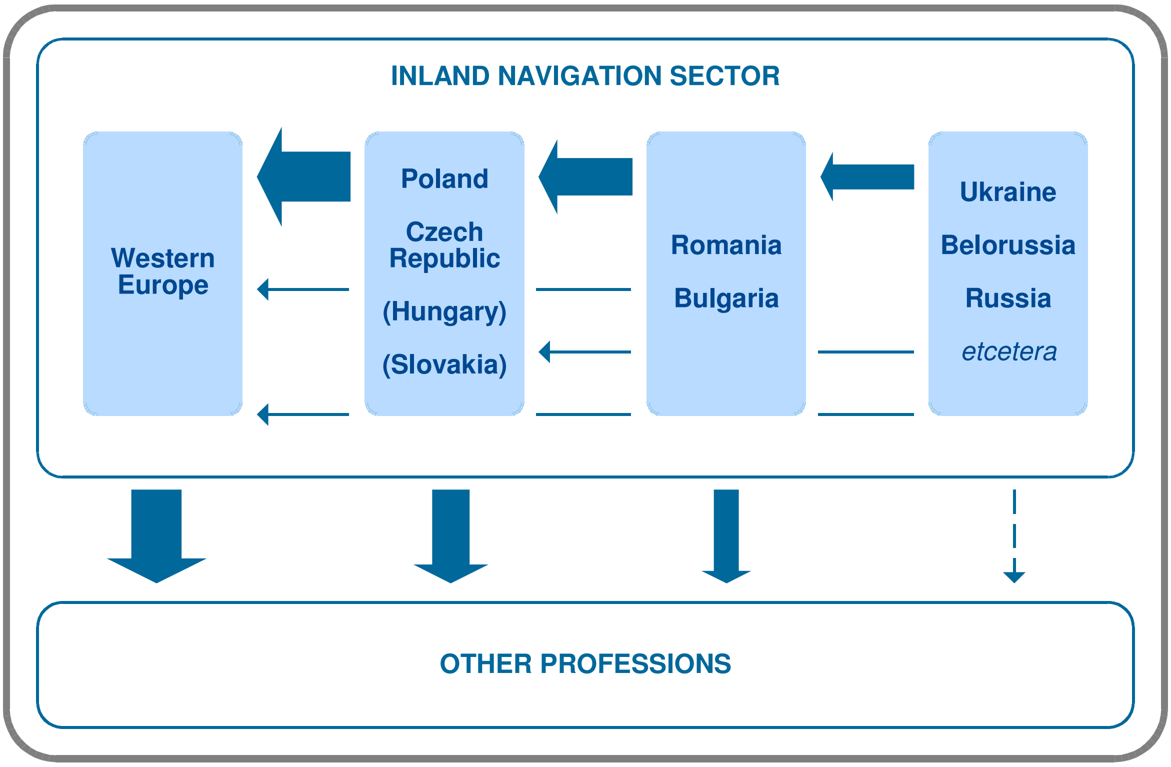


Figure 4. Labour migration process in the European IWT sector

It is estimated that the shortage of skilled personnel amounts to 40 to 60 per year in Germany. Germany thereby represents a country with the largest labour shortages. In countries such as the Netherlands, the decrease in domestic employment is clearly smaller and the age structure of personnel is substantially more balanced. The same structural problems of occupation, as already pointed out for German inland navigation, also apply to some of the Accession Countries, e.g. Poland and the Czech Republic. Even if the extent and temporal development of employment in inland navigation in these countries cannot be measured in detail, it can be assumed that also in these countries, employment bottlenecks will arise. If this would continue, crew members from countries such as Romania and Bulgaria, but also Ukraine and Russia, will be recruited to compensate part of the labour shortage. The overall trend is illustrated in Figure 4. Figures are provided for in the 'supply' part of the Full Final Report (pages 37-40).

2.2.4 Fleet

General characteristics

The European inland navigation fleets are characterised by a large variety of vessels. Two main technologies can be identified: single self-propelled vessels and push boat technology, both in different sizes and variations. The general characteristics of particular units of a technology (e.g. self-propelled vessels) in different corridors are comparable and relatively similar. Differences in design details and equipment level are mostly caused by nautical conditions (e.g. draught), typical transport distances, etc.

Nautical conditions of the operation areas influence the size of vessels. Rhine and Danube barges are considerably larger than those designed for Elbe and Oder. For instance, Elbe and Oder barges are constructed so that their maximum allowed draught does not exceed two metres, given the limited usual water depths on these rivers. The following tables specify this relation between operation area and fleet dimensions. Table 3 lists the main types of self-propelled vessels and in Table 4, the technical specifications of typical pushed barges are displayed.

Vessel type	**Dimensions (L x B)**	**Tonnage capacity at a draught of**				
		1,50m	*2,00m*	*2,50m*	*2,80m*	*3,50m*
Large river motor ship	110,00 m x 11,40 m	600 t	1200 t	1800 t	2100 t	3000 t
Europe ship	85,00 m x 9,50 m	570 t	930 t	1350 t	-	-
'Johann Welker'	80,00 m x 9,50 m	600 t	940 t	1280 t	-	-
'Gustav Koenigs' (extended)	80,00 m x 8,20 m	500 t	800 t	1100 t	-	-
'Gustav Koenigs'	67,00 m x 8,20 m	420 t	670 t	1000 t	-	-
'Kempenaar'	50,00 m x 6,60 m	400 t	600 t	650 t	-	-
Peniche	38,50 m x 5,00 m	250 t	300 t	400 t*	-	-
BM-500	56,50 m x 7,60 m	415 t	475 t	-	-	-

Table 3. Standard sizes of self-propelled river ships in Europe

Figure 5. Dry cargo ship 'Irene'
Source: http://www.informatie.binnenvaart.nl/

Barge type	Dimensions (L x B)	Tonnage capacity at a draught of				Area of use
		2,00m	*2,50m*	*2,80m*	*4,00m*	*River or corridor*
Europe Type I	70,00 m x 9,50 m	940 t	1240 t	-	-	Rhine, MLK
Europe Type II	76,50 m x 11,40 m	1250 t	1660 t	1850 t	-	Rhine, MLK, Danube
Europe Type IIa	76,50 m x 11,40 m	1140 t	1530 t	1800 t	2800 t	Rhine
Europe Type IIb	76,50 m x 11,00 m	1100 t	1500 t			Danube
GSP-54	54,00 m x 11,00 m	900 t				Elbe, Oder
SP-65	65,00 m x 8,20 m	900 t				Elbe, Oder
SP-35	32,50 m x 8,20 m	415 t				Elbe, Oder
LASH	18,70 m x 9,50 m	250 t	335 t	385 t		Weser, Rhine
See-Bee	29,75 m x 10,70 m	490 t	640 t	730 t		Weser, Rhine
Interlichter	38,25 m x 11,40 m	585 t	775 t	900 t		Danube
OBP-500	45,50 m x 9,60 m	480 t	-	-	-	Oder

Table 4. Standard sizes of pushed barges in Europe

The load capacity of self-propelled vessels within the four corridors amounts to approximately 7,5 million tonnes; the large majority of them is encountered in the Rhine corridor with approximately 84% of the registrations. The North-South and West-East corridors cover approximately 6% each, while around 4% belong to the Danube corridor. Pushed barges represent a load capacity of approximately 6,4 million tonnes. Their spatial distribution is less uneven: the main share is covered by the Danube fleet with approximately 44%, followed by the Rhine fleet with 34%, and the West-East and North-South fleets with some 13 and 8%, respectively.

Fleets per corridor

Waterways in the ***Rhine corridor*** are characterised by much higher nautical standards than other waterways in Europe. These high standards – combined with the strong economy and high transport demands – have significantly influenced the development of the operational fleet. The entire fleet of self-propelled cargo vessels, licensed to operate on the Rhine river and hence within the entire corridor, is manifold larger, both in number of units and in total carrying capacity, than all the corresponding fleets of all other corridors together.

According to the available statistics there are some 5,500 dry cargo self-propelled ships licensed for the Rhine with an average capacity of about 1,000 tdw (tonnes-deadweight) and a little over one thousand tankers with an average capacity of about 1,500 tdw. The barge pushing technology has remained relatively limited on the Rhine. Some 1,100 pushed barges for dry cargo with an average unit capacity of about 2,000 tonnes are nowadays certified for the service on Rhine.

A typical cargo ship on the Rhine has a length between 80 and 110 m, a beam of 9.5 to 11.4 m and a design draught that allows a loading of up to 2.8 m. The average age of dry-cargo self-propelled ships on the Rhine was about 46 years in the year 2000. Thereby, German (50 years) and Dutch (47) vessels were slightly older than average.

The persistent organisational structure of the IWT sector in the ***Danube corridor*** – until the late 1980s mainly state monopolies – has caused the dominance of the pushed barge over the self-propelled vessel. Some 10 years ago, the share of cargo space on non-self-propelled units was even higher than 90%. In recent years (after 2000) this has been reduced to about 75%.

Taking into account both towed and pushed units, there were more than 2,650 dry cargo and some 330 tank barges in the Danube corridor at the end of 2000. A considerable number of towed barges (several hundreds) have been re-equipped for the pushing technology and not decommissioned yet. Pushed barges are available in many sizes and capacities. Only after the mid-1970s, the newly-built pushed barges tend to comply with the recommended standard 'Danube-Europe IIb' type. These barges have an average capacity of between 1,350 and 1,500 tonnes at a draught span between 2.3 and 2.5 m. Opposite to this, the self-propelled fleet with only about 200 units, prevailingly assigned to dry cargo, is still relatively modest.

The average age of the self-propelled Danube vessels varies between 18 years (Croatia, Ukraine) and 32 years (Slovakia, Moldova). Since about ten years the newly established private ship operators on the Danube have been purchasing second-hand vessels from the Rhine corridor. As a result, nowadays around 100 units – aged on average about 25 years – are registered in Accession Countries such as Slovakia, Hungary, Romania, and Bulgaria.

The fleet designed and built to operate on the ***East-West corridor*** (Elbe, Oder and linked waterways) is considerably smaller than the Rhine and Danube fleets. The total number of self-propelled inland cargo vessels (both tankers and dry-cargo) in Poland and the Czech Republic was about 170 at the end of the year 2000. The German fleet operating on the Elbe, Oder and the surrounding waterways consisted of about 570 cargo motor ships at the end of 1996. However, in the meantime it is likely that this has decreased.

The average deadweight of Polish ships is limited to about 450 tdw. This is due to the unfavourable local navigable conditions of the Oder and the (other) Polish domestic waterways. Therefore, the typical design draught for Polish ships is only 1.6 m. German and Czech units are based prevailingly on the Elbe conditions and, with on average slightly more than 900 tonnes, are about twice as large. The age of Czech self-propelled fleet is about 30 years. Figures for Polish vessels and the German of the Elbe/Oder fleets are unavailable but it is estimated that these ships are considerably older than those under Czech flag.

Six new EU countries located within the East-West (Poland, Czech Republic) and Danube Corridor (Slovakia, Hungary, Romania, Bulgaria) have a considerable share within the investigated fleet. Of approximately 22,000 units a total of some 4,500 vessels are registered in these countries. Upon the accession of these countries to the European Union, their vessels raise the number of units and total carrying capacity of the EU fleet of inland vessels by about 20%.

In general, the average sizes of self-propelled vessels and barges operating on large rivers of the ***North-South corridor*** (Seine and Rhône/Saône) fully correspond to those on the Rhine. On the other side, the large majority of fleet units operating on the remaining (smaller) rivers and canals of the North-South corridor are comprised of small self-propelled dry cargo vessels (over 850 ships) with an average capacity of about 360 tdw. Motorised tankers, pushed dry and tank barges on these smaller waterways averagely have the same size. Within this corridor, self-propelled vessels are on average over 40 years old while the average age of the barge fleet is about 35 years. The push boat fleet is on average more than 50 years old.

Cost structure of the fleets

The fleet technology, the degree of modernisation of the vessels, together with the nautical and operational preconditions, play an important role in determining the cost structure and cost level of IWT. As part of the PINE project an analysis was made of the cost structures of different fleets. This way, insight could be generated in the cost factors, which have a large impact on the mode's competitive position. The analysis was made for different types of ships, using a number of pre-defined reference ships.

The following parameters have been taken into account:

- ship technology, equipment, age and condition of the ship;
- size and ship's capacity utilisation ratio;
- draught or draught restrictions;
- flag, i.e. registration of the ship;
- operator structure (independent ship owner or shipping line);
- operation modus, e.g. operation time of 14-, 18- or 24 hours;
- crew structure (number, qualification and nationality of the crew members).

Cost categories that were included are standby costs (personnel costs and social payments, costs of maintenance and repair, depreciation and interest and insurance costs) as well as operating costs, determined in a simplified way and based on a number of assumptions. The following table presents an overview of the main outcomes. Clearly, these figures are examples based on a limited number of vessels and related to the analysed transport example. Note that the absolute figures may not correspond with actual cost levels; the calculation efforts were mainly aimed at getting an indication about relative cost differences. Further explanations are provided in the Full Final Report.

	Variant	**Standby costs [€]**	**Operating costs [€]**	**Total costs [€]**	**Individual costs [€/t] at a rate of capacity utilization of**		
					90%	**70%**	**50%**
1A	Europe-type ship lic. f. Rhine corridor; skipper (independent owner) + 1 member of family	3,273	1,838	5,111	(1152 t) 4.44	(896 t) 5.70	(640 t) 7.99
1B	Europe-type ship lic. f. Rhine corridor; skipper (independent owner) + 1 employee	4,095	1,838	5,933	(1152 t) 5.15	(896 t) 6.62	(640 t) 9.27
2	Europe-type ship lic. f. Czech Republic; 2 teams (3 pers. each, 30 days shift)	3,193	1,027	4,220	(1071 t) 3.94	(833 t) 5.07	(595 t) 7.09
3	Europe-type ship lic. f. Danube corridor; eastern company with existing ships from the east	2,610	1,838	4,448	(1152 t) 3.86	(896 t) 4.96	(640 t) 6.95

	Variant	Standby costs [€]	Operating costs [€]	Total costs [€]	Individual costs [€/t] at a rate of capacity utilization of 90%	70%	50%
4A	Large cargo mot. sh. lic. f. Rhine corridor; skipper (independent owner) + 1 member of family + 2 employees	7,238	2,948	10,076	(2565 t) 3.93	(1995 t) 5.05	(1425 t) 7.07
4B	Large cargo mot. sh. lic. f. Rhine corridor; skipper (independent owner) + 3 employees	7,914	2,948	10,862	(2565 t) 4.23	(1995 t) 5.44	(1425 t) 7.62
5	Pushed train Danube (license in Romania)	3,850	4,167	8,017	(5400 t) 1.48	(4200 t) 1.91	(3000 t) 2.67

Table 5. Total and individual costs of vessel types in different operation areas (related to the transport example, analysed in the Full Final Report)

The comparison of the variants 1A/B and 3 shows that – in case of the 'Europe'-type ship – a license for the Danube corridor (variant 3) is more favourable in terms of costs than for the Rhine corridor (variants 1A/B). This advantage is caused by lower costs for personnel and insurance within the Danube corridor and can be called the ***'registration effect'***.

The comparison of the variants 1A/B and 4A/B reveals the ***'size effect'***. Under the same circumstances (a license for the Rhine corridor), and despite clearly higher total costs, the larger cargo motor ship (variant 4A/B) shows lower individual costs than the 'Europe'-type vessel (variant 1A/B).

A comparison of the rates of capacity utilisation underlines the correlation between individual cost increases and dropping capacity utilisation rates. Among other things, this is caused by limited draught. For this example, the difference in costs between the rates of capacity utilisation of 50% and 90% is clearly higher than the aforementioned size effect between the variants 1A/B and 4A/B and the registration effect. Therefore this ***'capacity utilisation effect'*** is clearly the dominant cost determinant in this example.

The 'size' and 'capacity utilisation' effects basically concern the ships of all fleets. They appear for instance if a certain ship, suitable for a particular transport task, is not able to operate because of the lower-scale waterway infrastructure or local bottlenecks (e.g. draught limitations). In such cases, either a smaller vessel has to be operated or the ship has to run at a lower rate of capacity utilisation than under normal conditions. Impacts on individual costs are substantial as shown within the model calculations. In addition, infrastructure bottlenecks influence the efficiency and the competitiveness of the entire IWT mode in comparison to the competing transport modes. Altogether, the capacity utilisation effect (and in several cases of the size effect as well) is dominant over the registration effect and the large number of infrastructure bottlenecks.

The registration effect is expected to decrease, in line with the expected alignment tendencies of the cost structures between West and East after the accession of the new member states. However, the capacity utilisation effect will mostly remain unchanged as long as the (main) infrastructure bottlenecks remain unsolved.

2.2.5 Infrastructure

Overview

The investigation on the infrastructure provided an overview of the complete IWT network, categorised according to the previously defined four corridors (see Figure 2). As a first indication, the main characteristics of the four corridors are summarised in the table below.

Corridor	Area (km^2)	Waterway length (km)	Waterway density ($km/1000km^2$)	Population (mill.)	Population density (per km^2)
Rhine	465,308	13,902	30	116	250
Danube	1,077,021	13,068	12	150	140
East-West	748,567	11,323	15	131	175
North-South	574,483	7,170	13	69	120
Rest (with IWT)	1,922,596	10,257	5	185	96

Table 6. Corridor summary (note: corridors tend to overlap, just IWT countries accounted)

As it appears from the table, the Rhine corridor is characterised by the highest population and waterway densities. For further relevant quality characteristics of the various corridors, such as waterway classes and dimensions, we refer to the PINE Full Final Report, containing an extensive investigation of Europe's waterways. Detailed analyses can especially be found in the Appendix of the PINE Full Final Report. The remainder of this section consists of an overview of the main findings of these corridor analyses.

Infrastructure per corridor

It has been explained that the part of the network assigned to the ***Rhine corridor*** is most developed, maintained and utilised. Also, the share of waterways of upper ECE classes is considerably higher in the Rhine corridor than in other corridors. For instance, almost 50% of the large network of Dutch waterways are of class IV or higher. A similar situation can be found in Belgium and on waterways in the western part of Germany merging to the Rhine river. Numerous smaller but well-maintained waterways in Belgium and the Netherlands facilitate efficient feeder (and even door-to-door) services between industrial plants directly located along waterways.

The ***Danube corridor*** is practically the confluence of the Danube river. This is – after the Volga – Europe's second largest river with a navigable length of 2,414 km. The entire course corresponds with the Pan-European Transport Corridor N°VII as the unique TEN waterborne corridor. Nominally, all waterways in this corridor are of a very high class. The Danube itself has at least class Va in its upper range and gradually increases to the highest possible class VII along the last 1,500 km approaching the Black Sea. The major problem in this corridor is the existence of critical spots – bottlenecks – with considerably worse conditions than on adjacent 'average' sections. Also, there are large annual fluctuations in water level. The major bottleneck is located in Bavaria (Straubing – Vilshofen), other significant bottlenecks exist in Austria, Hungary and Bulgaria/Romania.

The ***East-West corridor*** is characterised by relatively stable and favourable conditions on the main link – the Mittelland Canal – especially since construction works took place in recent years. In contrast, the free-flowing stretches of the rivers Elbe and Oder have quite unstable conditions, which largely affect inland navigation. Presently, the large annual water level fluctuations and cold winters with long-lasting ice-related cease of navigation, do not allow IWT operations comparable to those in other corridors.

The ***North-South corridor*** is characterised by a large share (almost 75%) of minor waterways (so-called 'Freycinet' network navigable for small vessels of about 250 t capacity). These minor waterways however interconnect six major waterways: Seine, Dunkirk-Schelde link, Rhône/Saône, Moselle, Rhine and Garonne. The navigability of the Seine and Rhône meets the highest standards as regards nautical capacity (high ECE classes Vb), maintenance and safety standards. Except these two major rivers, almost all other waterways are of considerably lower capacity. Moreover, the condition and maintenance level of some locks and stretches remains sub-optimal.

Isolated waterway systems are mostly found in:

- The United Kingdom, with the entire country covered with a dense canal network totalling some 5,000 km in length of prevailingly lowest ECE classes 0 and I.
- Italy, where the network (mostly ECE classes Va and IV) is concentrated in the Po Valley with its high seasonal water level fluctuations.
- Finland and Sweden, where a relatively large part of inland navigation is carried out on interconnected lakes (many of class Va).

The potential for river-sea services is evident from the map of Europe (Figure 6), schematically showing the hinterland reaches of direct services along the nautically suitable and economically interesting confluences (red areas). Nowadays, the most advanced and regular liner river-sea services are developed between ports in the Rhine corridor (the Netherlands, Belgium, western Germany) and the British east coast, Sweden and Finland.

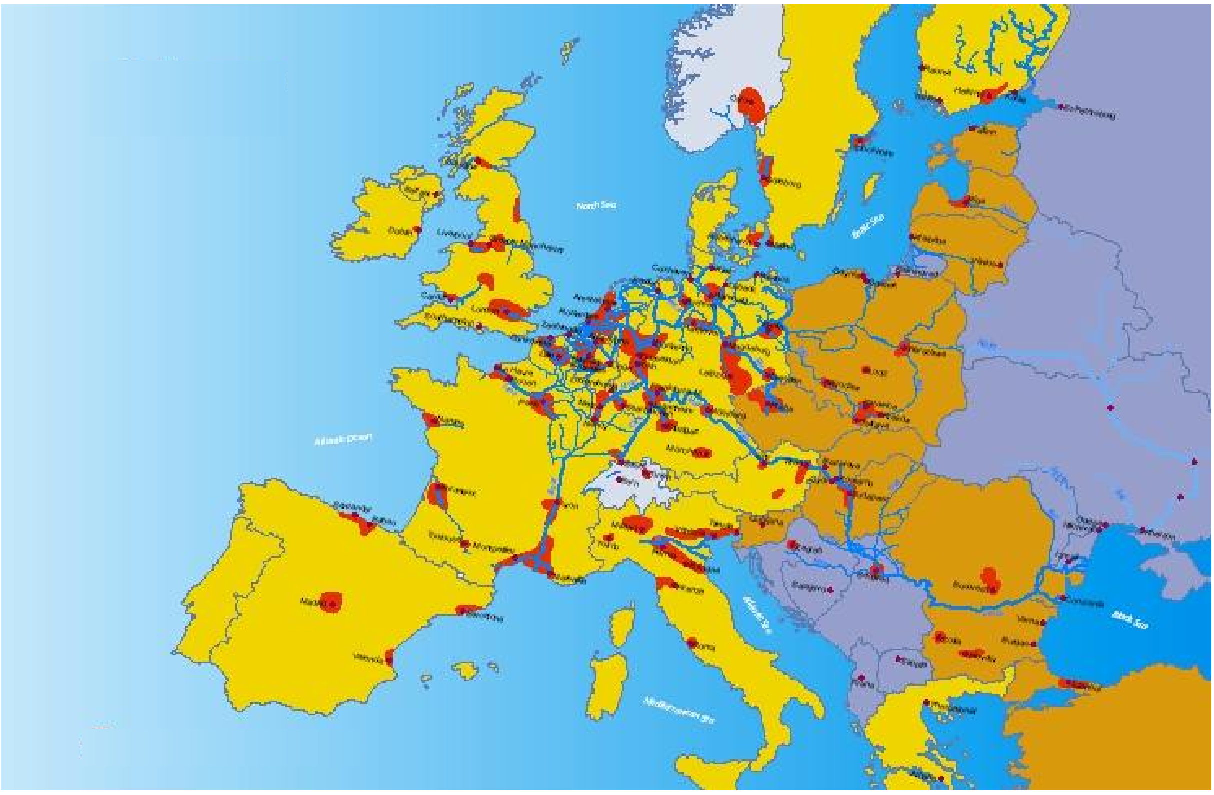


Figure 6. European Waterways versus economic core areas
Source: http://www.europa.eu.int/comm/transport/iw/en/site_map_en.htm

Improvement of infrastructure

The quality of the waterway infrastructure varies strongly in the different waterway basins. The UN/ECE has defined a list of shortcomings of the infrastructure, where missing links and bottlenecks have been defined. The PINE project has described the effects of resolving major missing links or the removal of severe bottlenecks by means of three concrete case studies, to be summarised below. For details, see the PINE Full Final Report.

Case I: the Seine-Scheldt project

The first case is the ***Seine-Scheldt*** link. In December 2003, the decision has been taken to realise the large-scale upgrading of this connection.

The reasons for this extensive project include:

- the connection of France to the IWT networks of Belgium and the Netherlands as a connection between Paris and major European core areas;
- extra IWT opportunities are opened up (in particular for container transport and chemicals);
- IWT can play an extra role in transport and therefore reduce (growth in) road transport;
- IWT could give a considerable contribution to the internal accessibility of the north-south corridor;
- the connection would give an answer to several main logistics trends (intermodal transport, containerisation, volume growth, scale enlargement, internationalisation etc.);
- the connection could give a more balanced spatial-economic development.

A map of the project is provided as Figure 7.

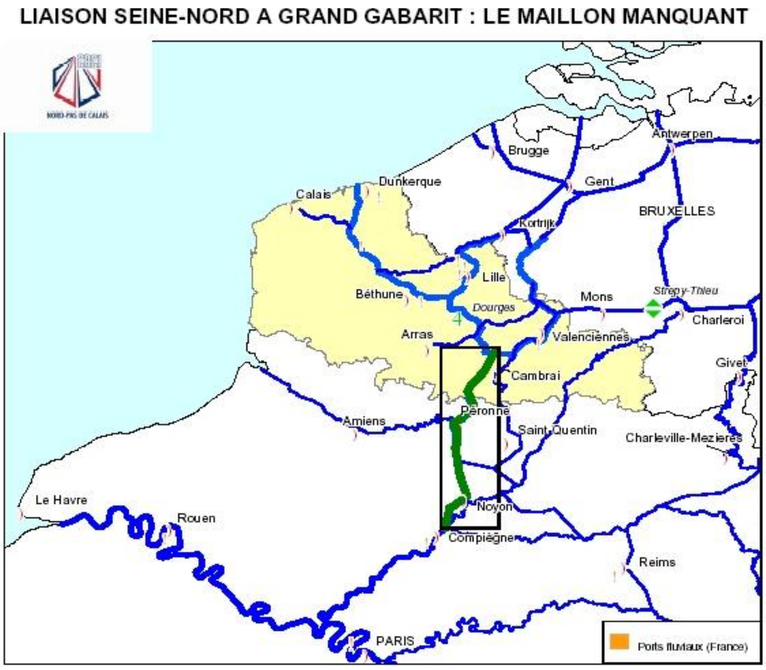


Figure 7. The Seine-Scheldt project
Source: VNF

Case 2: Upper Danube

Some stretches of the Upper Danube are typified by insufficient and strongly fluctuating water levels. There are four major bottlenecks that need to be improved: Straubing-Vilshofen (Germany), Melk-Dürnstein (Austria), Vienna-Bratislava (Austria) and Gabcikovo-Budapest (Hungary). The bottlenecks limit the cost-efficiency of inland navigation on the whole transport route concerned.

A detailed analysis showed that – even under comparable fleet circumstances – the average utilisation rates of the same Dutch fleet are about 30% lower at the border section of Passau on the Danube than at the border section Perl-Apach on the Rhine. The fairway depths on the Rhine (2.1m at LNRL[2]) and the Upper Danube (Pfelling: 2.0m at LNRL) are only slightly different. The lower average utilisation rates on the Upper Danube can only be explained by the problem of unpredictable water levels, especially during long transport trips.

Sufficient fairway conditions on the Upper Danube (2.5m draught measured against LNRL) would have the following benefits:

- savings on investments in the road system;
- savings on external costs of transport:
  - reduction of accident costs;
  - reduction of congestion costs;
  - reduction of CO2-emissions (Kyoto-objective);
  - reduction of noise;
  - reduction of space consumption.

Case 3: Elbe river

The deficits of the waterway infrastructure of the Elbe consist of insufficient draughts and strong water level fluctuations. If existing infrastructure bottlenecks were eliminated, the potentials could be high. According to the results of an enterprise investigation, the inland navigation transport volume on the river Elbe and the adjacent waterways could be more than doubled up to the year 2010.

Should the minimum standards not be realised, negative trends may result:

- the hinterland connection of the port of Hamburg would be impaired;
- it would be questionable, if rail and road capacities were sufficient against the background of increasing transport demand;
- the intermodal competition and its ‘disciplinary’ effects on prices of road and railway transport would remain quite limited;
- the economic development of the corridor as well as the connection of the acceding Czech Republic to the EU-core area would be affected.

These case studies have further been worked out in the Full Final Report.

[2] LNRL = Low Navigation and Regulation Level is the water level that corresponds to the flow available for 94% of the duration of the navigable season, i.e. excluding the winter periods of break of navigation affected by ice.

2.2.6 Interfaces: ports and transhipment sites

Definitions

Transhipment interfaces are crucial parts of almost any IWT chain, and often determine the success or failure of the entire supply chain. For the purpose of the PINE study four different types of inland ports have been determined with regard to their specific role, activities and special services they provide:

- ***Conventional inland ports*** providing ship-to-shore transhipment services almost exclusively to inland vessels (no calls of river-sea ships), using prevailingly traditional Lo-Lo (vertical) transhipment technologies for various kinds of dry cargoes including containers (ports not specialised in some ‘unconventional’ commodity or technology).
- ***River-Sea ports*** as inland ports (located deeply in the hinterland) on major waterways of higher ECE classes providing water transhipment services both to inland and river-sea vessels running directly to the port of call located overseas (sea port or another river-sea port on other waterway).
- ***Deep-sea ports*** with a considerable role in inland navigation services and maritime shipping (deep-sea, short-sea, coastal) and acting as an interface between all inland modes (inland navigation, road and rail, and possibly pipeline)
- ***Inland ports*** providing only special services or using unconventional technologies in transhipment and/or other activities.

Besides the above listed types of ports it is necessary to explain the meaning of the terms ‘terminal’ and ‘transhipment site’.

- A ***terminal*** (‘end station’ for a certain means of transport) is a part of a port or a separate transhipment/temporary storage entity dealing with special kinds of commodities, as e.g. ‘oil terminal’, ‘grain terminal’, ‘container terminal’ or ‘Ro-Ro terminal’. The terminal itself is in no case the final destination of a shipment but just the place where goods change the mode of transport. A port can contain a number of (specialised) terminals.
- A ***transhipment site*** is an appropriately arranged and fitted, usually compact location on the waterway bank (‘wet transhipment site’) used by industrial companies or service operators for transhipment of cargoes transported to and from the site by inland vessel. Transhipment sites are not necessarily called ‘ports’.

The PINE Full Report contains a detailed overview of the key characteristics of a representative sample of 32 ports distributed over Europe. The characteristics include throughput, berth lengths, storage area, as well key indicators such as crane density, structure of goods. This section contains an excerpt with the main findings of the analysis.

Figure 8. Neokemp vessel at Container Terminal Utrecht
Source: BCI

Ports per corridor

According to the AGN – 'European Agreement on main inland waterways of international importance' of 1998, a total of 334 so-called 'E-Ports' are identified along the European waterways.

Some 150 out of these 334 so-called 'E-ports' are located in the ***Rhine corridor***, which represents a share of about 45%. This is approximately the same share as of all three remaining corridors together. Within the Rhine corridor, there is an average distance between two ports of only 20 km ('port density'). It can be assumed that the Rhine corridor additionally comprises of a number of public ports not classified as 'E-ports', as well as several hundreds of private (industrial) ports and wet transhipment sites. These assumptions are based on the fact that in the Netherlands alone, there are 341 identified wet transhipment sites of which more than more than 70 have access to the railway network.

With 45 'E-ports', the ***Danube corridor*** only has 13.5% of major inland ports within the PINE area. The fact that the corridor is rather a single line than a surface network partly explains this relatively small share of larger ports. Given the total length of the Danube corridor of about 4,000 km, the average mutual distance between two E-ports is relatively large with 90 km. Industrial ports and transhipment sites do not play a significant role in the Danube corridor. There are, however, some large private ports – such as for instance the port of the Voest-Alpine steel plant in Linz (A) – and a few thermo-electric power plants and cement factories with their own transhipment sites, but this is not typical of the corridor. During the investigations, port efficiency in the Danube corridor (e.g. measured as crane efficiency) has turned out to be much lower than in the Rhine corridor (estimated 2.5 times lower crane efficiency) even though the crane density is slightly higher. On the other hand, recent years have shown that exceptional efforts have been made to improve the services in a number of Danube ports.

More than 20% of ‘E-ports’ within the PINE investigation area are located within the ***East-West corridor***, along the Mittelland Canal and waterways within the Elbe and Oder confluences. The average mutual distance of E-ports in this corridor is about 40 km. Ports in the western part of the East-West corridor are often characterised by a strong presence of specialised storage equipment of high capacities, mostly reservoirs for liquid commodities and silos for cereals.

There are 32 ‘E-ports’ or 9.6% of the total number in the area conditionally assigned to the ***North-South corridor*** (entire France except the river Moselle and parts of the Belgian network). The average distance between ports in this corridor is estimated at about 35 km.

A comparison of annual throughputs and some conditional quality indicators for the selected sample of ports shows that, in almost every category, the interfaces within the Rhine corridor are ranked much higher than those in other corridors. This, however, is the result of numerous factors such as the general level of economic development, population density, quality and density of the waterway network, and performances, qualities and potentials of fleet units. Only some ports in other corridors achieve the same level of efficiency as the average in the Rhine corridor. The investigated samples of ports located in the eastern parts of the Danube and East-West corridors show, although exceptions exist, in general lower productivity indicators.

Inland ports in isolated subsystems very often have a ‘river-sea character’. This is explained by their relatively short distances and waterway length and within these smaller waterways. Internal services with larger units would probably not pay off, even under favourable waterway conditions. To a certain extent, Italy is the only exception in this matter.

2.2.7 Information systems

Modern logistics management requires extensive information exchange between the supply chain partners. The integration of information and communication technology (ICT) within the operational processes of the inland waterway sector has not developed to the same level. However, as a consequence of the possibilities and opportunities that are connected to ICT – increased efficiency of logistics operations, increased safety, improved environmental protection – so-called River Information Services (RIS) have emerged within Europe. These services have to be seen as a major step forward, turning inland navigation into a transparent, reliable, flexible and easy-to-access transport mode. Together with its cost-effective and environmentally friendly logistics operations, the development of RIS makes inland navigation attractive to modern supply chain management. In addition to the meaning of RIS for commercial logistics actors, RIS have proven to be invaluable for waterway authorities (e.g. supporting traffic management tasks, dangerous goods monitoring, etc).

RIS are expected to produce four types of strategic benefits (see Figure 9):

- increased competitiveness of inland navigation;
- optimised use of public infrastructures and funds;
- improved safety;
- increased environmental protection.

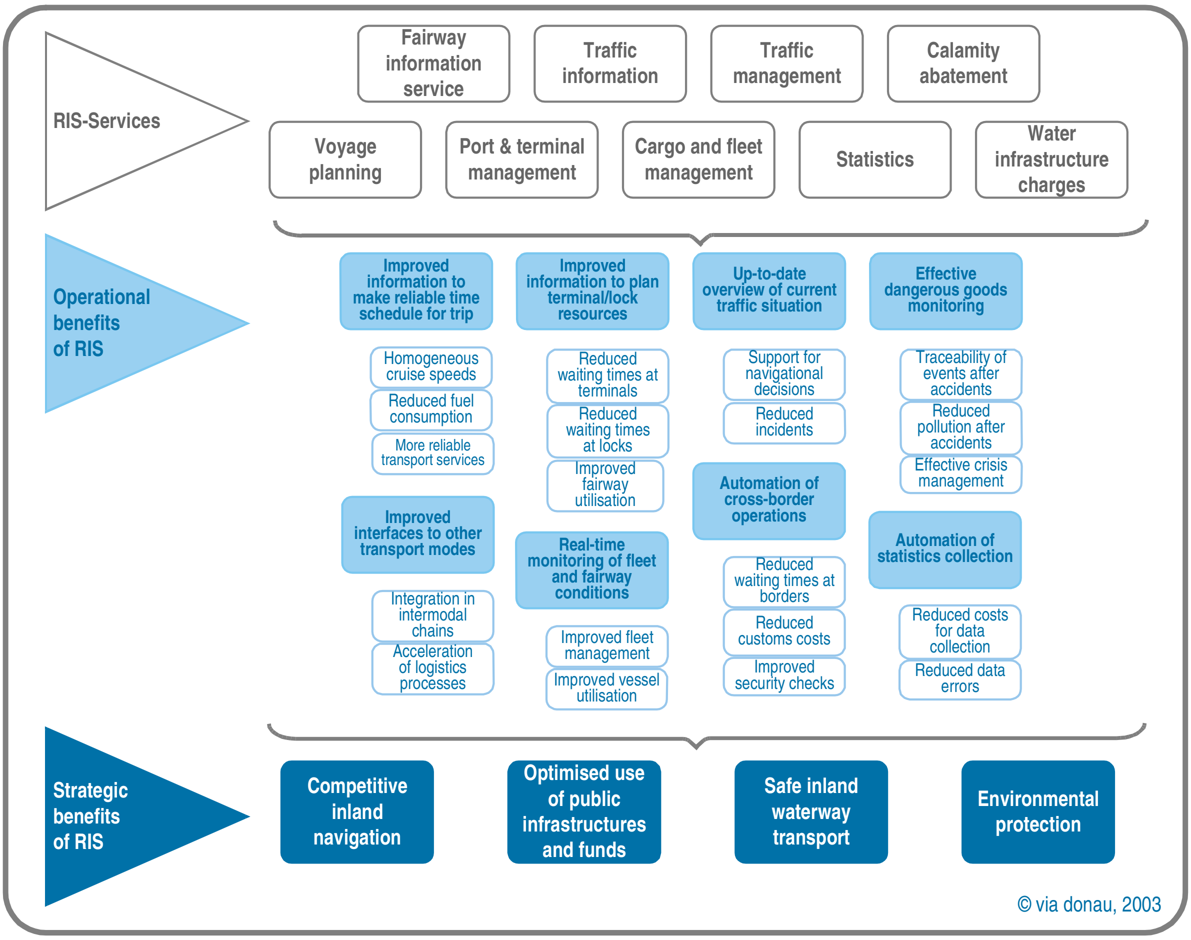


Figure 9. Benefits of River Information Services

RIS enable the establishment of competitive inland navigation transport services and have numerous important advantages:

- First, RIS provide up-to-date information that can be used to plan voyages and calculate more reliable time schedules. This way, these services comply with the information needs of modern supply chain management, since they allow optimised use and monitoring of resources and possibilities for flexible reactions in case of any deviation from the original planning.
- In addition, RIS enable the automated collection of statistical and customs data. Traditionally, this is connected with paper work, which is time-consuming and prone to data errors. RIS make the automatic collection of required data possible in an efficient way, which ultimately results in lower public expenditure.
- Moreover, detailed monitoring of dangerous goods transports is enabled, which helps prevent shipping accidents. Additionally, automated and more efficient customs procedures and security checks – supported by RIS – also contribute to increased safety and security in inland navigation.

- RIS lead to a reduction of fuel consumption as a consequence of better voyage planning and more reliable time scheduling.
- In addition, RIS contribute to a modal shift of cargo from road to waterway, leading to a reduction of exhausts such as CO_2 and NO_x but also of noise nuisance. RIS therefore support the reduction of emissions caused by transport activities in a direct and indirect way.

Within the PINE study, a review was made of almost 30 existing applications/pilot services. The most important findings are summarised in Figure 10, which shows the mentioned RIS applications together with the service levels offered. The main characteristics are displayed: services offered, user groups and technologies used. Some observations can be made on the basis of this overview.

First, among the selected applications, the most common existing services include fairway information services, voyage planning tools and the gathering of inland waterway statistics. Only a limited number of applications deal with port/terminal management and water infrastructure charges.

Secondly, as regards the users groups, shipmasters are obviously the most targeted user group. Almost every application involves information exchange between some actor in the logistic chain and the shipmaster. Other user groups addressed relatively often are fleet managers and waterway authorities. The relative lack of applications and river information services that are aimed at shippers and logistics service providers could prove to be a limiting factor in trying to stimulate the further growth potential of IWT. RIS applications for these user groups need to be developed further in order to support logistics decision-makers in their modal choices in favour of inland navigation.

Finally, considering the technologies used for the various RIS applications, it can be stated that the majority of applications use the cellular phone and the internet as their basic technologies, followed by GNSS and Inland ECDIS. The use of other promising technologies, such as electronic ship reporting and AIS, should be analysed and promoted when appropriate.

	ARGO	ASS-Online	Bargelink	BICS	BICS-BOS	BIVAS	BintraS	Container 98	COPIT	DeskWater	DoRIS	ELWIS	GINA	IBIS	IVS90	MIB	MOVES	NIF	OrcaMaster	PC Navigo	RADARpilot 720	RSOE	Saimaa information system	Ship@Sight	STIS	Tresco ECDIS Viewer	VNF2000
	DE	DE	DE NL	NL FR LU DE CH AT	NL	BE	DE	NL	DE	NL	AT	DE	BE	BE	NL	DE	DE	DE	DE	NL	DE	HU	FI	NL	NL	BE	FR
RIS-Services																											
Fairway information services	●	○	○	○	●	○	○	○	●	●	○	●	○	○	○	○	○	●	●	●	●	○	●	○	○	●	○
Traffic information	○	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	●	○	●	○	●	○	●	●	○	○	●
Traffic management	○	○	○	○	○	○	○	○	○	○	●	○	●	●	●	○	●	●	○	●	○	○	●	●	●	○	○
Calamity abatement	○	○	○	●	○	○	○	●	○	○	●	○	○	○	●	●	○	●	○	○	○	●	●	○	●	○	○
Voyage planning	●	○	○	●	●	○	○	○	○	○	○	●	○	○	●	●	○	●	●	●	●	○	●	○	●	●	○
Port / terminal management	○	○	○	○	○	○	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	●	○	○
Cargo / fleet management	○	○	●	●	○	●	●	●	●	●	○	○	○	○	○	●	○	○	○	○	○	○	●	○	●	○	○
Statistics	○	●	○	●	●	○	○	○	○	○	●	●	●	●	●	●	●	○	○	○	○	○	●	○	●	○	●
Water infrastructure charges	○	●	○	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	●	○	○	○	●
Main users																											
Waterway authorities	●	●	○	●	●	○	●	○	○	○	●	●	●	○	●	●	●	●	○	○	○	●	●	○	●	○	●
VTS operators	○	○	○	●	○	○	○	○	○	○	●	○	○	○	●	●	●	○	●	○	●	●	●	○	○	○	○
Terminal operators	○	○	○	●	○	○	○	●	○	○	●	○	●	●	○	●	○	○	○	○	○	○	○	○	●	○	○
Lock/bridge operators	○	○	○	●	○	○	○	○	○	○	●	○	●	●	●	●	●	○	○	○	○	○	●	○	○	○	○
Shipmasters	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Fleet managers	○	○	●	●	●	●	●	●	●	●	●	●	○	○	○	●	●	○	○	●	○	○	●	●	●	○	●
Freight shippers	○	○	●	●	○	●	○	○	●	○	●	○	○	○	○	●	●	○	○	○	○	○	●	○	○	○	○
Main technologies																											
Visual aids to navigation	○	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	●	○	○	○	○	●	○
Radar reflecting aids to navigation	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○
Light signals	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Cellular phone	●	○	●	●	●	●	○	○	●	●	●	●	○	○	●	●	●	○	●	●	●	○	○	○	●	○	○
GNSS for vessel positioning	●	○	○	○	○	○	○	○	●	○	●	○	○	○	○	○	●	○	●	●	●	○	●	●	●	●	●
VHF radio	○	○	○	○	○	○	○	○	○	○	○	○	○	○	●	●	○	●	○	○	○	●	●	○	○	○	○
Internet	●	●	●	●	●	●	●	○	●	●	●	●	●	●	○	●	●	○	○	●	○	○	○	●	○	○	●
Vessel based radar	○	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○
Shore based radar	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Inland ECDIS	●	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	●	○	●	●	●	○	●	●	○	●	●
AIS	○	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	●	○	●	○	●	○	●	○	○	○	○
Electronic ship reporting system (incl. EDI)	○	○	○	●	○	○	○	●	○	○	○	○	○	●	●	●	○	○	○	○	○	○	○	○	○	○	○

Figure 10. Overview of RIS-services, users and technologies

2.3 Main results on the demand side

2.3.1 Present volumes

General overview

The total volume of IWT in the year 2000 was 438 million tonnes, of which 215 million were domestic and 223 million international (intra-EU-15) freight. These volumes represent a modal share of 3.5% of total freight volumes (in tonnes).

As regards the transport performance (measured in ton-kilometres) it is worth noting how the modal share has changed over the past decade (see Table 7). From 1990 to 2000 IWT in the EU-15 increased modestly by 17-bn tkm, but its share fell from 8 to 7%. By way of comparison, its nearest competitor, rail freight transport, decreased slightly in tkm but fell sharply in modal share from 19 to just over 14%. Road transport increased by as much as 410-bn tkm, reflected in a modal share increase from 73% to almost 79%.

	EU-15 (tkm)		**Accession countries (tkm)**	
	% Change of tkm 1990-2000	Modal share	% Change of tkm 1990-2000	Modal share
IWT	+17%	1990: 8.0% 2000: 7.1%	-39%	1990: 2.8% 2000: 2.0%
Road	+41%		+6%	
Rail	-5%		-31%	
Total	+31%		-14%	

Table 7. Development of modal share between 1990-2000 in EU-15 and Accession Countries (tkm)
Source: EU Energy and Transport in Figures 2003

For the Accession Countries a more dramatic picture has evolved: transport performance has decreased between 1990 and 2000 by -14%, and the IWT-sector has faced the largest relative losses. The IWT market share measured in tkm dropped from 3% in 1990 to 2% in 2000. Part of this loss was caused by the war in former Yugoslavia in the early and mid-1990s.

Development of IWT in EU

The ***total inland transport*** performance (road, rail and IWT) ***for the EU-25 plus Bulgaria and Romania*** was about 2,100 billion tkm in 2000. Of this, 1,750 bn tkm (84%) were performed in the EU-15 and about 350 billion tkm (17%) in the Accession Countries (including Bulgaria and Romania).

IWT exists in nine of the EU-15 Member States. IWT performance exceeds 1 billion tonne-kilometres p.a. in five countries:

- Germany 66.5 billion tkm., representing over half of total EU performance
- The Netherlands 40.5 billion tkm., close to 1/3 of the EU total
- France 7.3 billion tkm.
- Belgium 6.4 billion tkm.
- Austria 2.4 billion tkm.

In the Netherlands, IWT accounts for 43% of total goods transport performance. This is the highest modal share in the Union and in all of Europe. The 66.5 billion tkm moved in Germany represent a modal share of 14% in Germany (see Figure 11). These figures demonstrate that in the Rhine corridor, where sufficient fairway and infrastructure conditions exist, IWT can play a significant role in terms of modal share.

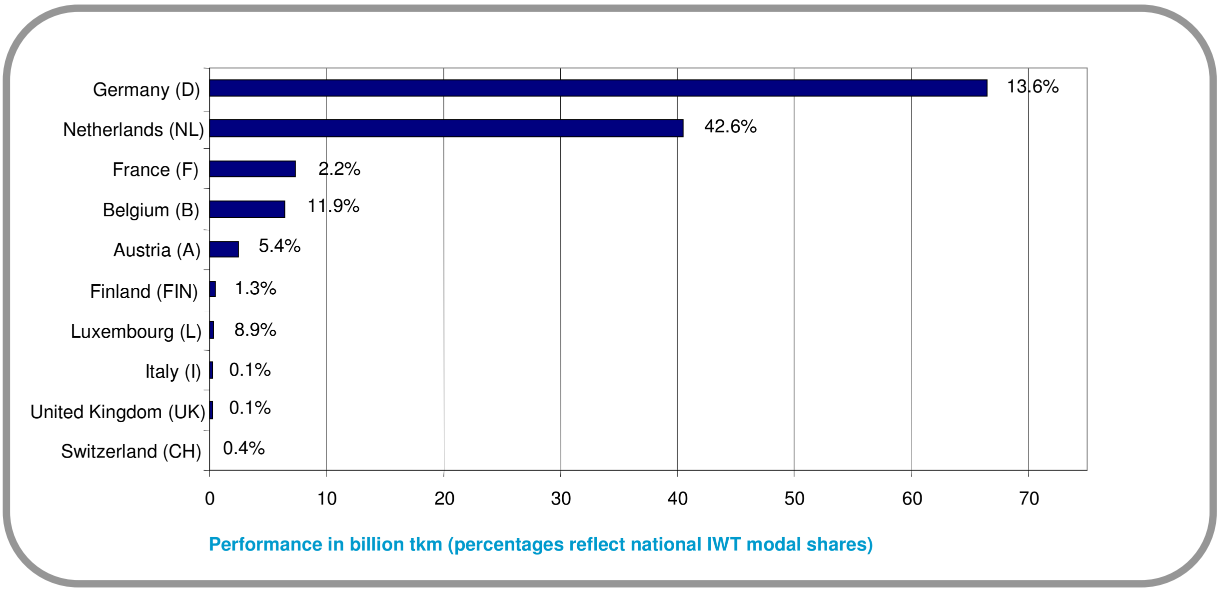


Figure 11. Performance of Goods Transport by IWT in Western Europe 2000, bn tkm (share of IWT performance in percent figures)
Source: PROGNOS European Transport Report 2002

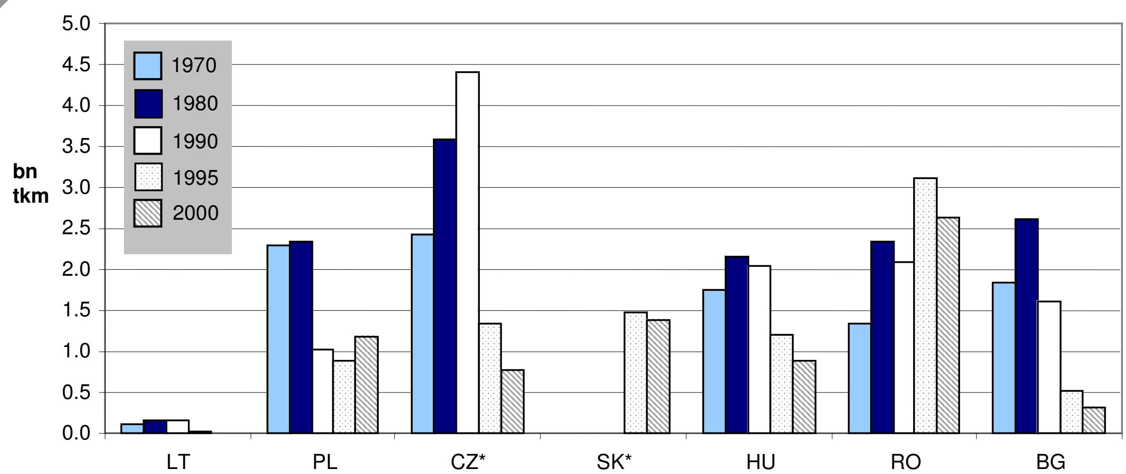
The largest international flows are between four countries Germany, Netherlands, Belgium and France (tonnes per year):

- Germany – the Netherlands 108 million
- Belgium – the Netherlands 56 million
- Belgium – Germany 26 million
- France – Germany 10 million
- France – the Netherlands 10 million
- Belgium – France 8 million

The volumes transported between these four countries represent 97% of all international IWT.

Development of IWT in Accession Countries (tkm)

In the EU Accession Countries, a total of 7.1 billion tkm was transported by IWT in 2000. Romania ranks first with 2.6 billion tkm, followed by Slovakia and Poland with 1.4 and 1.2 billion tkm respectively. Hungary, the Czech Republic, and Bulgaria remain below 1 billion tonne-kilometre p.a. IWT volumes in the Baltic states are practically negligible.



	EE	LV	LT	PL	CZ*	SK*	HU	RO	BG	Total
1970	0.01	0.05	0.12	2.30	2.43	CZ	1.76	1.35	1.83	9.85
1980	0.01	0.09	0.15	2.33	3.59	CZ	2.15	2.35	2.61	13.28
1990	0.00	0.29	0.16	1.03	4.42	CZ	2.04	2.09	1.61	11.65
1995	0.00	0.00	0.02	0.88	1.35	1.47	1.21	3.11	0.53	8.57
2000	0.00	0.00	0.00	1.17	0.77	1.38	0.89	2.63	0.31	7.17

**Note: CZ represents till 1990 the figures for Czechoslovakia*

Figure 12. Development of Inland Waterway Transport in Accession Countries 1970-2000, in billion tkm
Source: European Commission (Energy and Transport in Figures 2003, Table 3.4.24)

Transport volumes and commodity categories

The ***total volumes*** of IWT as presented above, are subdivided by ***commodity type*** in the next figure. The figure shows volumes of six EU-15 countries.

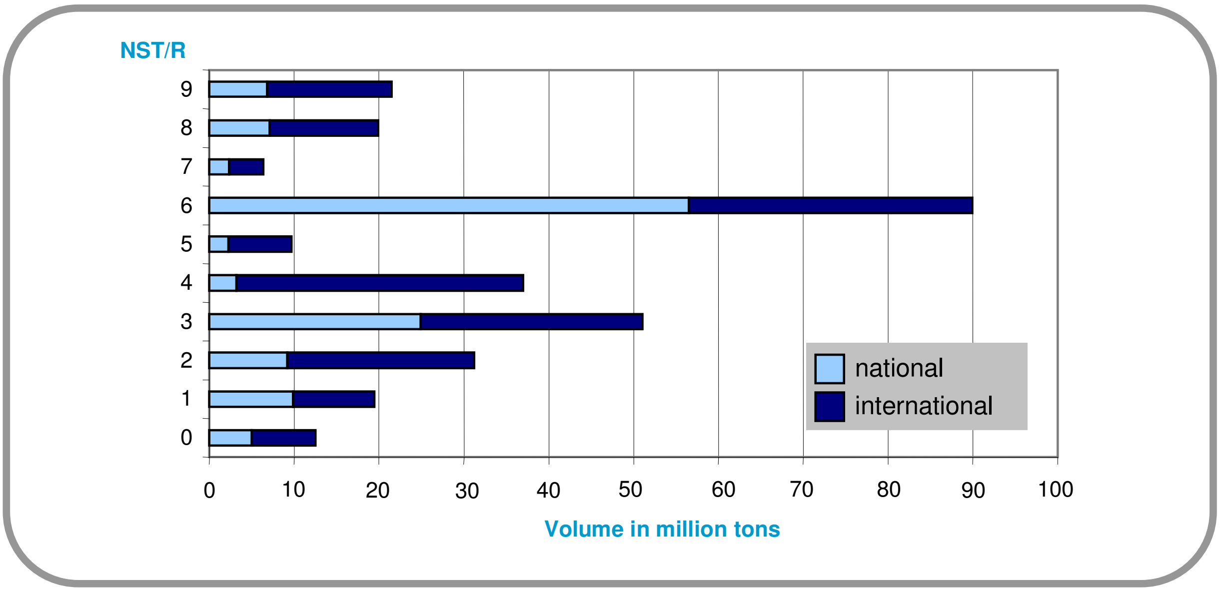


Figure 13. Inland waterway transport by group of goods 2001
(reporting countries: NL, DE, FR, BE, AT, LU)
Source: NewCronos, Eurostat 2003

The NST/R chapters represent:

0 agricultural products and live animals
1 food stuffs and animal fodders
2 solid mineral fuels
3 petroleum products
4 ores and metal wastes
5 metal products
6 crude and manufactured minerals, building materials
7 fertilisers
8 chemicals
9 machinery, transport equipment, manufactured articles, others

The figure shows that the main commodity types shipped by IWT are minerals and building materials with 90 million tonnes loaded in the 6 EU reporting countries. Of these, over a third comprises international shipments. All other commodity types have a much higher share of international shipments, mostly above 50%. Indeed, in metal products, ores and metal wastes (NST/R 4 and 5) international shipments account for over 90%.

The results of the corridor-specific data are somewhat different. Minerals dominate the Rhine transport but not the Danube transport. For metal, the opposite is the case. In the ***Rhine-corridor,*** petroleum products, ores and minerals dominate the transport, but it should be noted that petroleum products and ores declined in 1998 and 1999. Container transport is one of the sectors with the biggest growth rates. On the Rhine, since 1995 there has been a growth from 700.000 to around 1.200.000 TEU (A&S, 2003). This remains unchallenged in the other corridors. The transport volumes on the Danube river in the ***Danube corridor*** are about the same size in both directions, but the dominant goods categories are different. In West-East direction the NST/R chapters 1 and 4 (food stuffs and animal fodders, ores and metal) are dominating, whereas from Danubian countries the NST/R chapters 5 and 7 (metal products and fertilisers) are transported towards the West.

For the ***North-South corridor*** and ***East- West corridor*** no proper corridor data is available.

Transport volumes and distance classes

Within the territory of the present 15 EU member states, the average distance of both domestic *and* international IWT lies at approximately 280 kilometres. This is only slightly higher than for rail (250 kilometres), but 2.5 times the average distance of road trucking (110 kilometres). This is not surprising, as one of road transport's greatest advantages lies in the distribution of goods over short distances.

The total volumes of IWT showed already that IWT is mainly used for international transport, meaning long distances. But there are some exceptions to mention. In the Netherlands, IWT is used for domestic traffic originating from the seaports. Partly these are direct shipments to Dutch industry in the hinterland, partly these shipments do not end in the Netherlands itself but are transhipped to other modes. The Netherlands profits from its dense waterway system, which connects the industrial centres with the seaports, and with each other.

In France, IWT has the highest domestic share. On the one hand, this is caused by the isolated infrastructure system, which is not linked with neighbouring waterways. On the other hand, a trend towards strengthening domestic transport, can be noticed, especially of raw materials, oil products, building materials and agricultural products.

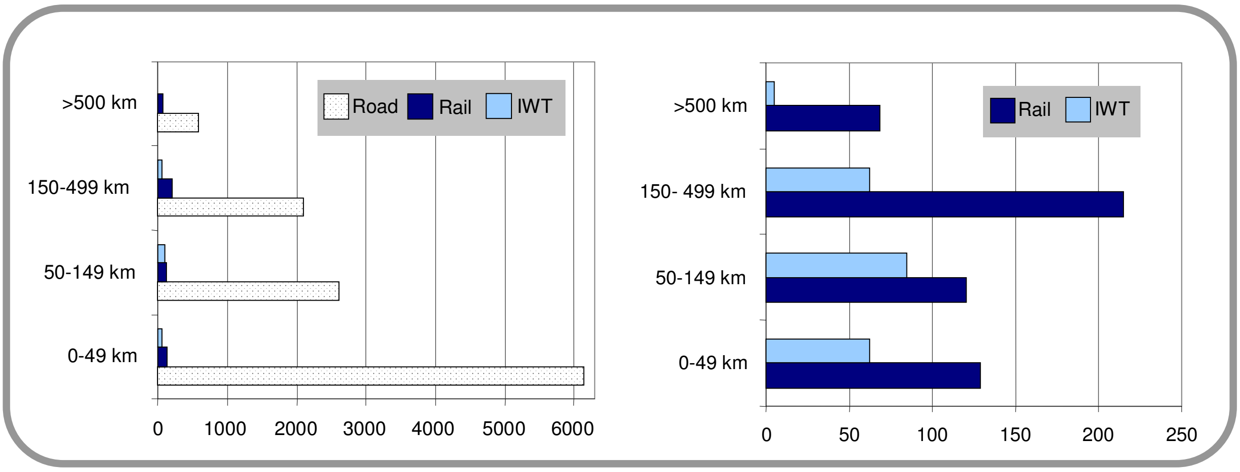


Figure 14. Distribution of transport volumes by distance classes and modes in EU15 in million tonnes for 2001 (domestic rail and IWT transport and international road transport only); Note the difference in scale when road transport is added.
Source: European Commission (Energy and Transport in Figures 2003, Table 3.4.4)

The two pictures in Figure 14 demonstrate the modal shares of the surface transport modes in each distance class. The ***split by distance classes*** (only domestic transport) shows a well-balanced mix for IWT (0-49 km: 28%, 50-149 km: 39%, 150-499 km: 30%, ≥ 500 km: 3%).

2.3.2 Socio-economic developments

In many European countries a close relationship can be observed between the development in demand for freight transport and socio-economic growth figures. This socio-economic development is – together with logistics changes – a main driver behind (development of) freight transport demand. This section therefore provides a description of population forecasts, economic growth (GDP) and foreign trade (exports and imports) figures, as a basis for an outlook towards future transport demand development.

The ***population*** in the EU-15 has almost been stagnant in the 1990s, increasing from 366 million inhabitants in 1991 to just 376 million in 2000, with an estimated annual growth of 0.3%. Several of the Accession Countries including Bulgaria, Czech Republic and Hungary have known a marginal to significant drop in population. The enlargement will add some 75 million inhabitants in 2004, after which the EU-25 will have some 450 million inhabitants. When Bulgaria and Romania join, another 30 million are added in 2007. After that, population growth is expected to come to a (Europe-wide) standstill.

Notwithstanding the present stagnation of GDP in the European Union Member States, an average growth of slightly over 2% annually is expected between 2000 and 2010.

Country	1995 – 2000	2000 – 2005	2005 – 2010
Austria	2.6	1.9	2.2
Belgium	2.8	2.0	2.1
Denmark	2.7	2.1	2.3
Finland	5.1	2.1	2.4
France	2.5	2.1	2.1
Germany	1.8	1.9	2.1
Greece	3.3	3.3	2.5
Ireland	9.6	4.7	3.4
Italy	1.9	2.0	1.9
Luxembourg	6.2	3.7	2.7
Netherlands	3.7	2.2	2.2
Portugal	3.6	2.1	2.4
Spain	3.8	2.6	2.5
Sweden	2.9	2.1	2.2
United Kingdom	2.8	2.2	2.2
EU-15	2.6	2.1	2.2

Table 8. Forecast of GDP Growth in EU Member States (constant prices; in % p.a.)
Source: Prognos World Reports 2002 – Industrial countries 2000 – 2010

GDP growth prospects in the EU Accession Countries are anticipated to be close to 4% p.a. In this table, Yugoslavia and Croatia are listed because of their location along the Danube corridor. Therefore they are of importance regarding IWT demand.

Country	1995 – 2000	2000 – 2005	2005 – 2010
Bulgaria	-3.0	3.8	3.2
Croatia	3.7	3.2	3.1
Czech Republic	0.2	3.8	4.4
Estonia	4.4	5.1	4.0
Hungary	3.8	4.8	4.5
Latvia	4.2	4.7	3.9
Lithuania	3.1	3.4	3.8
Poland	5.4	4.2	4.3
Romania	-2.8	2.0	2.7

Country	1995 – 2000	2000 – 2005	2005 – 2010
Slovakia	4.6	3.2	3.6
Slovenia	4.2	4.7	4.2
Yugoslavia	-1.0	3.7	3.2
EU Accession Countries	3.1	4.0	4.1

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Table 9. Forecast of GDP Growth in CEECs (constant prices; in % p.a.)
Source: Prognos World Reports 2001 – Central and Eastern European Countries 1999 – 2010

In addition to GDP, ***external trade*** is an important driving force for international transport demand (Table 10). The 1990s were characterised by a strong growth of international trade in most EU countries. Forecasts for the present decade indicate a slower expansion of both exports and imports for the EU-15. Nevertheless, growth rates are twice the anticipated GDP growth. The big countries such as Germany, France, the UK and Italy are close to average; growth remains strongest in peripheral countries such as Ireland, Spain, Portugal, Greece and Finland.

Country	Exports			Imports		
	1995 – 2000	*2000 – 2005*	*2005 – 2010*	*1995 – 2000*	*2000 – 2005*	*2005 – 2010*
Austria	8.5	5.2	4.3	7.8	4.9	4.2
Belgium	5.8	4.0	4.1	5.7	4.0	4.1
Denmark	6.0	4.6	4.0	6.6	4.2	3.9
Finland	10.2	2.7	4.8	8.6	2.9	4.8
France	8.0	4.3	4.1	7.7	4.2	4.1
Germany	8.4	4.5	4.4	7.7	4.1	4.2
Greece	9.5	5.5	4.8	9.3	5.5	4.8
Ireland	16.2	6.3	5.5	15.9	6.3	5.7
Italy	4.1	4.6	4.2	6.3	4.7	4.2
Luxembourg	9.3	5.6	4.6	8.6	5.5	4.6
Netherlands	7.1	4.2	4.0	7.6	4.1	4.0
Portugal	6.4	4.6	5.1	8.5	4.0	5.1
Spain	10.2	4.9	5.2	11.4	5.0	5.2
Sweden	8.2	3.4	4.4	8.1	3.2	4.4
United Kingdom	6.2	4.2	4.1	9.0	4.5	4.1
EU-15	7.5	4.4	4.3	8.0	4.4	4.3

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Table 10. Forecast of Foreign Trade in EU Member States (constant prices; in % p.a.)
Source: Prognos World Reports 2002 – Industrial countries 2000 – 2010

Trade expansion in the 1990s was in part due to the transformation process in the Central and Eastern European countries (CEECs) with high import needs, but also strong export growth. All Accession Countries together registered annual growth of exports of 8.5% p.a. and of imports over 11% p.a. Foreign trade of the Accession Countries will continue to show sustainable growth until 2010, although in the next 5 years it will decline gradually to 7% p.a.

Country	**Exports**			**Imports**		
	1995 – 2000	*2000 – 2005*	*2005 – 2010*	*1995 – 2000*	*2000 – 2005*	*2005 – 2010*
Bulgaria	-3.1	7.9	5.3	-0.6	7.0	5.3
Croatia	5.4	6.6	6.2	5.4	5.2	5.8
Czech Rep.	8.2	10.2	7.5	8.3	9.9	7.3
Estonia	10.0	12.9	8.0	10.2	11.8	7.7
Hungary	16.0	11.6	7.5	16.2	11.0	7.4
Latvia	7.7	8.0	7.3	11.3	5.9	6.9
Lithuania	3.9	9.8	7.5	8.2	7.4	6.5
Poland	8.8	9.6	7.6	16.8	7.9	7.1
Romania	4.2	7.8	4.9	4.0	7.0	4.5
Slovakia	8.3	8.1	6.3	10.5	7.5	6.3
Slovenia	5.8	7.8	6.8	8.0	6.8	6.5
Yugoslavia	-2.8	2.6	5.1	6.1	5.9	5.7
EU Accession Countries	8.5	9.7	7.2	11.1	8.7	6.9

Table 11. Forecast of Foreign Trade in CEECs (constant prices; in % p.a.)
Source: Prognos World Reports 2001 – Central and Eastern European Countries 1999 – 2010

2.3.3 Future transport demand

The objective of this part of the study was to highlight the prospects of future evolution of goods transport demand in pan-European inland waterway transport, based on a comparative analysis of available sources. To obtain relevant information, data and forecasts, a variety of sources was investigated. The main sources have been:

- the Prognos European Transport Report 2002 (horizon 2015);
- forecasts carried out within the European Commission's TEN-STAC study (horizon 2020) that were obtained by request, courtesy of NEA, the team leader of the STAC consortium;
- forecast data taken from the Ecorys reports for the European Commission on 'Market observation for the inland waterway sector' (Surviway; horizon 2010);
- the ÖIR Study: Transport forecast in light of EU-Enlargement (ÖIR, Austrian Institute for Spatial Planning).

In the following subsections the sources will be described briefly, followed by some summarising remarks.

The Prognos European Transport Report 2002

On the basis of the macro-economic growth prospects highlighted earlier, goods transport demand (all modes) has been forecast by Prognos to grow in the EU-15 area by 2.6% p.a. in the decade from 2000 to 2010 and by 2% p.a. between 2010 and 2015 (Table 12). In total, a growth of 42% (2.4% p.a.) in terms of tkm is forecast for the period between 2000 and 2015.

Country	2000				2015				Share 2015 (%)			Growth 2000-2015 (% p.a.)			
	Total	Road	Rail	**IWT**	Total	Road	Rail	**IWT**	Road	Rail	**IWT**	Total	Road	Rail	**IWT**
Austria (AT)	45'594	25'804	17'346	2'444	64'699	33'902	27'174	3'623	52	42	6	2.4	1.8	3.0	2.7
Belgium (BE)	53'676	39'610	7'674	6'392	73'584	55'777	9'566	8'241	76	13	11	2.1	2.3	1.5	1.7
Denmark (DK)	18'665	16'640	2'025	-	23'692	21'112	2'580	-	89	11	-	1.6	1.6	1.6	-
Finland (FI)	42'111	31'475	10'107	529	51'384	37'767	12'918	699	74	25	1	1.3	1.2	1.6	1.9
France (FR)	334'220	271'472	55'448	7'300	469'158	375'936	82'009	11'213	80	17	2	2.3	2.2	2.6	2.9
Germany (DE)	488'790	346'293	76'032	66'466	690'764	500'113	106'032	84'619	72	15	12	2.3	2.5	2.2	1.6
Greece (GR)	19'103	18'777	326	-	35'053	34'282	771	-	98	2	-	4.1	4.1	5.9	-
Ireland (IE)	7'938	7'447	491	-	11'510	10'831	679	-	94	6	-	2.5	2.5	2.2	-
Italy (IT)	267'025	243'982	22'834	210	376'449	338'541	37'645	264	90	10	0	2.3	2.2	3.4	1.5
Luxembourg (LU)	3'473	2'478	683	312	5'017	3'612	1'003	401	72	20	8	2.5	2.5	2.6	1.7
Netherlands (NL)	94'905	50'629	3'819	40'457	134'161	69'093	8'050	57'018	52	6	43	2.3	2.1	5.1	2.3
Portugal (PT)	15'201	13'018	2'183	-	20'518	17'153	3'365	-	84	16	-	2.0	1.9	2.9	-
Spain (ES)	268'536	256'494	12'042	-	420'266	397'572	22'694	-	95	5	-	3.0	3.0	4.3	-
Sweden (SE)	51'376	31'479	19'897	-	66'046	39'892	26'154	-	60	40	-	1.7	1.6	1.8	-
United Kingdom (UK)	176'500	158'000	18'300	200	234'264	201'936	32'071	258	86	14	0	1.9	1.6	3.8	1.7
Norway (NO)	17'474	14'985	2'489	-	25'623	22'420	3'203	-	88	13	-	2.6	2.7	1.7	-
Switzerland (CH)	33'265	21'949	11'189	127	54'031	33'175	20'640	216	61	38	0	3.3	2.8	4.2	3.6
Czech Republic (CZ)	57'305	39'036	17'496	773	76'567	58'543	16'845	1'179	76	22	2	2.0	2.7	-0.3	2.9
Estonia (EE)	11'478	3'690	7'788	-	20'489	6'925	13'564	-	34	66	-	3.9	4.3	3.8	-
Hungary (HU)	22'315	13'329	8'095	891	32'042	21'180	9'549	1'314	66	30	4	2.4	3.1	1.1	2.6
Poland (PL)	128'158	72'842	54'015	1'301	175'004	116'028	56'666	2'310	66	32	1	2.1	3.2	0.3	3.9
Slovenia (SI)	4'947	2'090	2'857	-	7'627	4'195	3'432	-	55	45	-	2.9	4.8	1.2	-
EU15	1'887'113	1'513'597	249'207	124'308	2'676'565	2'137'518	372'711	166'336	80	14	6	2.4	2.3	2.7	2.0
EU15 + 2	1'937'851	1'550'531	262'885	124'435	2'756'219	2'193'113	396'554	166'552	80	14	6	2.4	2.3	2.8	2.0
CEEC5	224'203	130'987	90'251	2'965	311'729	206'871	100'055	4'803	66	32	2	2.2	3.1	0.7	3.3

Table 12. Goods transport performance by country and mode, 2000 and 2015, billion tkm
Source: Prognos European Transport Report 2002

Demand for inland waterway transport is currently expected to grow in the same period by 35% (2% p.a.), compared to 41% (2.3% p.a.) growth in goods transport by road and 51% (2.7%) by rail.

Growth of transport demand in the Accession Countries is only slightly below that of Western countries (in the selection of five countries – Czech Republic, Hungary, Poland, Slovenia and Estonia), 2.5% p.a. from 2000 to 2010 and 1.7% p.a. from 2010 to 2015 respectively, 2.2% on average. In these countries, inland waterway transport demand is expected to grow well above average at 3.3% p.a., while road freight is anticipated to grow by 3.1% p.a. and rail freight by a mere 0.7% p.a.

The TEN-STAC study

Table 13 describes relevant outcomes of the recent TEN-STAC study.

Coun–tries	Year	Domestic (NUTS 2)				Exports				Imports			
		Road	*Rail*	*Inland water*		*Road*	*Rail*	*Inland water*		*Road*	*Rail*	*Inland water*	
EU 15	2000	2488454	341700	125862	4.3%	587265	76744	147459	18.2%	580866	123986	214756	23.4%
	2020	3937393	620203	205484	4.3%	1137208	153439	284113	18.0%	1197010	247651	418971	22.5%
	% p.a.	2.3%	3.0%	2.5%		3.4%	3.5%	3.3%		3.7%	3.5%	3.4%	
EU 15+2	2000	2534098	349847	125862	4.2%	604510	80083	148686	17.8%	603421	133591	223629	23.3%
	2020	4006241	635740	205484	4.2%	1162286	159382	287061	17.8%	1230782	264840	432322	22.4%
	% p.a.	2.3%	3.0%	2.5%		3.3%	3.5%	3.3%		3.6%	3.5%	3.4%	
CEEC 12	2000	562002	193464	1959	0.26%	54062	80268	6621	4.7%	45427	89375	3386	2.5%
	2020	1036427	172886	3734	0.31%	163741	163285	15972	4.7%	208263	157270	6663	1.8%
	% p.a.	3.1%	-0.6%	3.3%		5.7%	3.6%	4.5%		7.9%	2.9%	3.4%	
EU 15+2 & CEEC 12	2000	3096100	543311	127821	3.4%	658572	160351	155307	15.9%	648848	222966	227015	20.7%
	2020	5042668	808627	209218	3.5%	1326026	322668	303033	15.5%	1439045	422110	438985	19.1%
	% p.a.	2.5%	2.0%	2.5%		3.6%	3.6%	3.4%		4.1%	3.2%	3.4%	

Table 13. Inland Transport Volumes in Europe 2000 and 2020, 1000 tonnes
Source: NEA 2003

In the EU-15, IWT grows with 3.3% p.a. in exports and 3.4% p.a. in imports. For the EU-15+2 and 12 Central and Eastern European countries IWT will grow by 3.4% (export and import).

The Ecorys report

In Table 14, forecasts of Ecorys are displayed.

Commodity type	2000	2005	2010	Growth 2000 -2010	
		million tonnes		*% 10 years*	*% p.a.*
Container	16.9	19.9	23.5	39.2	3.4
General Cargo	91.5	102.4	115.1	25.8	2.3
Liquid Bulk	70.3	74.9	80.1	13.9	1.3
Solid Bulk	261.4	270.8	285.6	9.3	0.9
Total	440.0	467.9	504.2	14.6	1.4

Table 14. Forecast of IWT volume by commodity type, 2000 to 2010, million tonnes
Source: Ecorys 2002

The Ecorys forecast anticipates an annual growth rate of IWT volume (tonnage) of slightly below 1.4% per annum, in contrast to the above mentioned STAC forecast. The interest lies in the forecast broken down by four commodity types: solid bulk freight continues to have the highest share in total volume; its expected growth is, however, far below average. Container traffic has the highest growth potential (3.4% p.a.), followed by general cargo (2.3% p.a.). Growth of liquid bulk is only slightly below average.

ÖIR Study: Transport forecast in light of EU-Enlargement

The upcoming EU Enlargement is expected to have major impacts on transport flows. Road transport is expected to rise, but the EU Enlargement will also affect IWT transport from and to the Accession Countries. The Accession and Candidate countries that are expected to have the largest impact on IWT flows are concentrated along the Danube.

On the basis of ÖSTAT data sets, the Austrian Institute for Spatial Planning (ÖIR, 2004) created a calculation model, which can be used to deduce differentiated conclusions regarding future transport flows from, to and within the Danube corridor. On the basis of the status quo in the base year 2000, a transport forecast for 2015 was made for two scenarios: a base scenario (zero policy) and an optimised scenario. This optimised scenario includes measures for the improvement of the general framework conditions of IWT along the Danube corridor. The removal of the infrastructure bottlenecks on the Danube as well as the increased modernisation of IWT by means of logistics applications and river information services would lead to an average annual growth rate of 7.06%. This means a near threefold increase of current transport volumes: from 9.8 million tonnes to 27.4 million tonnes per year. For comparison, the base scenario 2015 – with no additional measures – shows an average annual growth rate of 2.37%.

Relation	Status Quo 2000	Base scenario 2015		Optimised scenario 2015	
	Transport volume (1000t)	*Transport volume (1000t)*	*Yearly growth rate (%)*	*Transport volume (1000t)*	*Yearly growth rate (%)*
Rhine – Upper Danube	3,991	4,981	1.36	11,202	7.12
Danube internal	5,822	8,769	2.77	13,505	5.77
Rhine – Lower Danube	22	323	19.61	2,663	37.68
Total	9,835	13,983	2.37	27,370	7.06

Table 15. Status quo 2000 and forecasts 2015: Transport volumes and annual growth rates per relation and total (Source: ÖIR, 2004)

Summarising remarks

Conclusions are described in the next chapter. Preliminary findings point in the direction that yearly growth rates in the sources studied vary between 1,4% and 4%, in an optimistic scenario on certain stretches getting as high as 7%. These figures remain prognoses, so it is impossible to point out the most realistic trend. Besides, the Prognos figures are in tonne-kms while the other sources are in tonnes. The varying time horizons further complicate comparability. Overlooking these and other sources, the PINE consortium expects an annual IWT growth rate of around 2%; higher in some areas, lower in others. A more detailed conclusion is given in Section 3.2.3.

2.4 Main results on policy and legislation

2.4.1 IWT policy

An overall review of the role and future of Inland Waterway Transport (IWT) in the Enlarged European Union needs to consider the overall ***economic and political framework*** in which IWT is working. Within that overall economic framework, the role of IWT competing with or complementing other transport modes requires an analysis of EU transport and other policies and the instruments created to implement them. In addition, policies to promote IWT adopted by international institutions other than the EU itself or its Member or Candidate States should be noted and commented upon. This applies particularly to the Rhine (CCNR) and Danube

Commissions, but must also include the ECMT (European Conference of Ministers of Transport) and UN/ECE (United Nations Economic Commission for Europe).

As regards ***deregulation and liberalisation***, the following observations can be made. Access to the market and to the profession, tariffs and prices, as well as State aids, began to be regulated in the 1970s -1980s. These measures were updated in the 1990s, in the wake of the creation of the Internal Market and the resultant introduction of cabotage.

In IWT the following legislation now applies:

- Council Regulation 1107/70/EEC and several amendments up to (EC) 543/97 on granting aids to transport.
- Council Regulation (EEC) 1017/68 on rules of competition.
- Council Regulation (EEC) 1191/69, amended in 1990 and 1991, on public service obligations.
- Council Regulation (EEC) 2919/85 on access to Rhine navigation for Member States not part of the Mannheim Convention.
- Council Directive 87/540/EEC on access to the profession of IWT goods carrier and mutual recognition of evidence of qualifications.
- Council Regulation (EEC) 3921/91 on cabotage (non-resident carriers transporting goods or passengers within a Member State).
- Council Regulation (EC) 1356/96 on providing (greater) freedom for inland waterway transport between and in transit through Member States.
- Council Directive 96/75/EC on chartering and pricing in national/international IWT.

In principle, the IWT market was fully deregulated on 1.1.2000 by virtue of Directive 96/75. However, the Commission set up a detailed market observation system to detect any serious market deterioration in time to allow liberalisation to be temporarily suspended.

On the ***policy towards intermodality***, it can be noted that for many years the EU has encouraged the use of intermodal and multimodal transport, mainly with the aim or shifting transport to less congested and less environmentally harmful modes. Since in the past inland waterways have competed most directly with rail transport, the tendency has been to go for road/rail or road/IWT rather than rail/IWT. From 1997 to 2001, intermodal transport was supported by the European Commission in a series of PACT projects, which essentially assisted SMEs and produced some environmental benefits, though it basically accepted the prevailing market structures. PACT has now been succeeded by the Marco Polo programme. Its main objective is to shift international transport of 12 billion tkm from the road to other modes, using a budget of 75 million € in the years 2003-2006 for the EU-15, with additional prospects for the Accession Member States.

The effect on the inland modes of a harmonised and accurate system of ***charging for the use of infrastructure*** has been thoroughly analysed and commented upon. In the 1960s, charging at marginal cost was first advocated at EU level, but made very slow headway owing to successful resistance by supporters of road transport and the complications of adapting such a system to the prevailing tax structures. However, the complexities of an overall, harmonised system, its political implications (especially in passenger transport) and the relative success of technical regulations in the area of air pollution and noise, led to a reconsideration of this policy area. The latest Commission proposal on road tolls and charges would – if adopted – allow Member States a great deal of leeway in setting such charges.

The calculation of infrastructure costs of IWT was initially attempted in the 1970s and could be revived. Problems mainly arise with the allocation of relevant costs to the transport function. Other than rail or road infrastructure, inland waterways have additional functions, e.g. water management or – occasionally – production of hydroelectric power. There is little doubt that IWT infrastructure charges would, if correctly calculated, be a good deal lower per tonne or tonne-km than for roads, since there are already charges at present relating to locks and the possible additional charges are likely to be small.

As to the inclusion of external costs related to IWT, an ideal system would no doubt include possible costs of air pollution. However, the Commission decided recently to exclude them from its proposal on road transport, in view of conflicting scientific evidence as well as political problems.

Trans-European Transport Networks (TEN-T) are meant to establish better links between national infrastructures. The scheme involves European co-finance to a selection of projects. The TEN-T were followed along a similar line of reasoning by ***Pan-European corridors.*** Here, the Danube was immediately recognised as Corridor No. VII, providing the most important international link with West European systems.

A broad review of overall EU transport policy and legislation shows that wherever possible, the three inland modes have been treated similarly. Where it appears that road and rail have received closer attention, this may be due to more pressing problems in these modes, e.g. on access to infrastructure or restrictions on providing services. In fact, goods transport on inland waterways is largely liberalised, though persistent oversupply remains a delicate problem.

2.4.2 IWT legislation

Different ***organisations*** play a role in determining the transport-related legislative framework of inland navigation in Europe: the European Union (the 'transport acquis' and other relevant legislation), the Inland Transport Committee of the UN/ECE (United Nations Economic Commission for Europe), the Central Commission for Navigation on the Rhine (CCNR), the Danube Commission (albeit in the form of recommendations) and national authorities (also concerned in the few remaining bilateral agreements). Each of these actors is responsible for different areas and different parts of the legislative framework. As a result, regulations are not necessarily harmonised across Europe as a whole.

Regarding the situation of ***traffic rights***, the current inland waterway markets are largely liberalised and will be fully so by the time the candidate countries join in 2004, with Romania and Bulgaria presumably acceding in 2007. Cabotage on the Danube is currently restricted to the national fleets, whereas cabotage on the Rhine is allowed for member countries of the CCNR and the EU, but in practice restricted through technical regulations. Nearly all EU member states had bilateral agreements with CEEC/Candidate Countries. At the time of the

Accession, these have automatically been superseded by the European transport acquis, which forbids such restrictions in transport rights among Member States.

As regards the ***technical requirements for vessels***, the Regulations on Inspection of Rhine Vessels (RVBR) can be considered a key publication. A revised version of these regulations entered into force on 1 January 1995 [UN/ECE, 1996b].

For the licence of vessels to navigate ***on the Rhine,*** the RVBR defines:

- technical requirements;
- stability and strength of equipment;
- manoeuvrability and stopping quality;
- requirements for the machinery space and the steering gears, manning and crew and safety in the working spaces.

If the vessel conforms to the regulations, a so-called ‘ship’s attest for the Rhine’ (i.e. ship's certificate) is issued.

The technical regime on the EU waterways ***outside the Rhine*** is based on EU Directive 82/14/EEC, laying down technical requirements for inland waterway vessels. The Directive is currently under revision to bring its technical rules into line with those of the RVBR [UN/ECE, 2002b]. The Danube Commission publishes the Recommendations on Technical Requirements for Inland Navigation Vessels, based on resolution No. 17 of the UN/ECE. The differences between the various technical regulations are probably not so significant that it is financially impossible for ship-owners from outside the Rhine basin to satisfy the Rhine requirements. The real problem seems to be that a relatively small number of countries – the five CCNR member states – determine the safety standards to which the inland water operators from other countries have to conform, without these other countries having a voice in the establishment and the development of these standards.

It is of imperative importance that ***manning and working hours regulations*** are harmonised in order to combat unfair competition. In the current situation, it is easy to find loopholes in the different national laws. Shipping companies can register their company in country A, hire crew members from country B, charter vessels from country C, and make contracts for captains in country D. As a result, checking and monitoring vessel and crew requirements is very complicated. In inland waterway transport, labour inspection is not allowed to undertake checks on foreign vessels. In practice, the flags on vessels can thus be changed during border crossings, in order to circumvent the regulations or to make use of the most favourable legal regime. As a result, tax payments and contributions to social and pension insurance funds can relatively easily be avoided. In order to provide a level-playing field for all companies in the IWT sector, regulations should be harmonised and enforced.

An EU ***boatmaster’s licence*** covering all EU territory does not exist to date. However, the European Commission is considering further steps in this field [European Commission White Paper on Transport, 2001]. The ‘Rheinpatentverordnung’ (Rhine License regulation) which is incorporated in the national legislative body of the member states of the CCNR defines all requirements needed to attain the five different boatmaster's certificates needed for Rhine navigation[3]. The Danubian Commission countries recognise each other's national licences. The DC has adopted Recommendations on the Establishment of Boatmaster's Licences on the Danube, but it is uncertain to what extent the member states actually follow those recommendations. It is claimed that the CCNR and the DC have made progress in terms of reciprocal recognition of boatmaster licences and patents. Based on a comparison, the requirements posed on boatmasters in the Rhine and Danube areas appeared not to fundamentally differ.

Liability rules and contract laws both are still mostly based on national regulations, and are therefore not harmonised on an international level. This relative legal uncertainty entails a number of practical obstacles to the further development of inland navigation. First, it may cause unnecessary litigation and may raise the insurance costs of transport operations. Second, as uncertainties exist about rights and obligations in case of differences or damage, inland waterway carriers could be prevented from accepting transport jobs offered, and shippers from using the services of IWT industry. Steps to improve this situation have already been taken or are currently under consideration, in the form of the CLNI and CMNI Conventions. In addition, the UN/ECE studied the possibilities for reconciliation and harmonisation of civil liability regimes governing intermodal transport.

2.5 Main results on modes and competition

The capabilities and performance of IWT are on the one hand determined by its own intrinsic qualifications and abilities, and on the other hand by its relative position compared to the other modes, especially road and rail transport. This section centres on ***the factors which determine the choice of shippers for a certain mode.*** It mainly focuses on theoretical aspects. An extensive, all-encompassing analysis of factors that determine modal choices can only be made on the basis of concrete case studies (with given transport distances, specific goods characteristics, certain geographic patterns, etc.). Examples of these more specific case studies are therefore provided below. This section also describes whether IWT is able to meet shipper's demands and where there are still gaps to be overcome.

2.5.1 Modal choice criteria: demand side factors

The position of IWT is largely determined by its ability to meet the transport demands of shippers. A shipper, if aware of all possibilities and limitations of the different modes, will make his modal choice based on a number of criteria.

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3 E.g. 'Grosses Patent' for all vessel types; 'Sportpatent' for sports boats smaller than 25m; 'Behördenpatent' (authority patent) for steering boats of the waterway administration and fire squads.

The determinants of modal choice can be divided into ***hard and soft factors***. Hard factors are based on rational calculations like speed, capacity, safety, loading structure, frequency, weighing up costs and quality aspects etc. Soft factors reflect individual preferences of persons: decision makers, operators, etc. These preferences need not be the results of rational processes, but may well arise from prejudices, ignorance of facts or they may just be a matter of traditional history. Soft factors thus pertain to customer-carrier relationships, whereas rational choice addresses efficiency, reliability, organisational aspects (door to door service, just in time). In addition, there are some cargo-related constraints affecting rational decision-making, like the need for specific transport units (secure vehicles, refrigerated boxes) or handling equipment. Finally the batch quantities and the speed of delivery do influence modal choice.

A number of European studies have been carried out that look into this subject, e.g. SPIN, Shifting Cargo and Confetra. For a further differentiation of ***modal choice factors,*** the results of these studies can be summarised as follows:

- cost/price is the most important decision criterion;
- reliability (just-in-time) is the most important quality criterion;
- frequency of transport services, in combination with small batch quantities, is the criterion meeting the requirements of industry logistics best, as well as high availability of carriers and shipping space;
- regularity of shipments is a prerequisite for using intermodal transport;
- door-to-door service is an important criterion for optimisation of logistic chains and clear responsibility.

These decision criteria should however not be evaluated as individual factors. It is the trade-off of all of them that ultimately determines the attractiveness of a transportation mode. To what extent a transport mode is able to meet the ***requirements of customers,*** therefore mainly depends on its specific mix of characteristics.

Figure 15 shows a simplified example of the basic trade-off underlying a shipper’s modal choice, i.e. the confrontation between supply of and demand for transport services. On the one hand, the dotted lines reflect the value-of-time or the willingness-to-pay for transport services (the demand curve). The steeper these lines are, the more time-critical shippers are. In many industries, such a shift has actually taken place, explaining the increased modal share of road transport in these industries. On the other hand, the relative logistics performance of the various modes of transportation is also shown as a cost versus time supply curve. Air and road transport generally provide faster services, but charge higher tariffs. Rail transport and inland navigation are usually slower but require lower prices in turn.

The point where both lines intersect determines the actual modal choice: the shippers that are willing to pay more for faster services will opt for air transport, whereas less time-critical customers might choose inland navigation. An improved competitive position of inland navigation is shown by the different grey dots in the lower part of Figure 15: by offering faster services – possibly combined with higher tariffs – inland navigation could capture a larger market share.

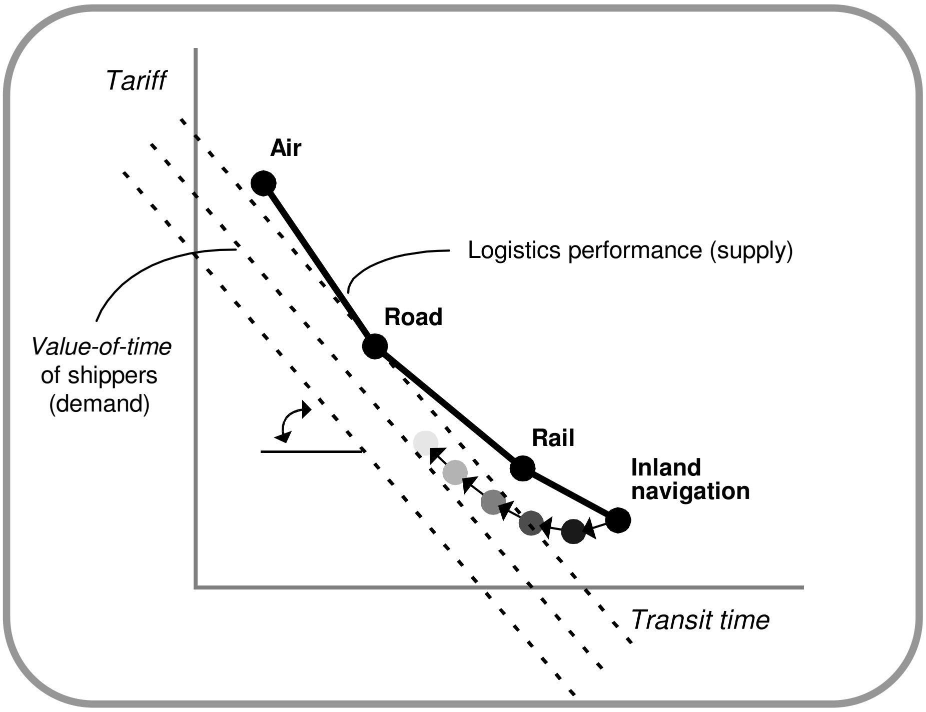


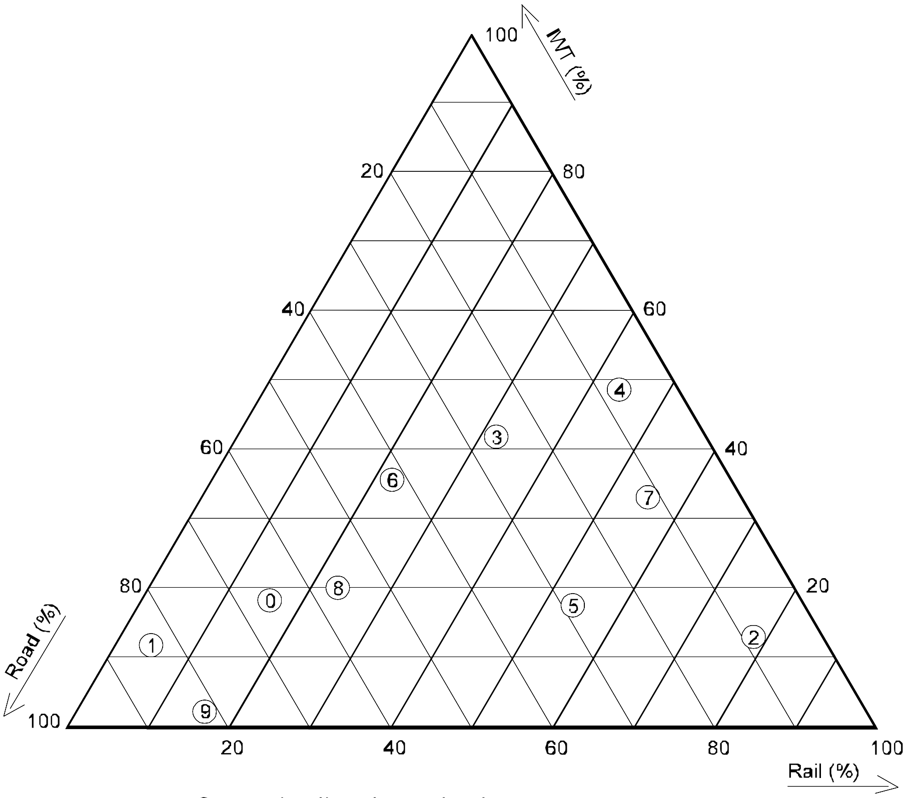
Figure 15. Modelling modal choices (for illustrative purposes only)

Note that the figure only displays the trade-off between transit time and costs for transport services. Modal choices are of course not only determined by these two factors, but also by logistics performance requirements such as on-time reliability and frequency of services, or 'soft' factors such as the customer's experiences with specific modes of transportation. Section 3.4 contains examples of the price/time trade-offs with real-life data.

Drivers behind changing customer requirements

The above logistics customer requirements do not emerge autonomously. Customer requirements – in terms of costs, reliability, speed, etc. – can be the result of a number of driving forces. The European freight transport market has undergone structural changes in the last decades. They have resulted in the first place from the implementation of the EU's Internal Market which has led to more international traffic and a shift from primary and secondary industrial production to the services sector and to higher-value goods which has affected the preferred modes of transport. These developments have been accompanied by a general rationalisation of distribution networks, increased outsourcing of logistics services (production companies concentrating on their core business), supply chain integration (e.g. inventory reduction schemes), and time compression (e.g. just-in-time, efficient consumer response).

Hence the system characteristics (company and product characteristics, the competitive field, etc.) define the affinity of modes for particular commodity groups. Figure 16 shows an affinity diagram, which places NST/R chapters in a three-mode triangle where each mode has a scale from 0 to 100% affinity. The closer a commodity type is to a corner of the triangle, the stronger its affinity to a certain mode. From the number of commodities, which define an area of affinity, conclusions can be drawn firstly on its suitability and secondly on how flexible a mode is to differentiated demand.



0 agricultural products
1 foodstuffs and animal fodder
2 solid mineral fuels
3 oil and petroleum products
4 ores, metal waste
5 metal products
6 building minerals and materials
7 fertilizers
8 chemicals
9 machinery and other manuf. products

Figure 16. Affinity diagram
Source: Shifting Cargo 1998, Chapter 5

We learn from the diagram that there must be shipper's requirements in the categories of agriculture, foodstuffs, manufactured products, processed chemicals, solid mineral fuels and metal products, which are not sufficiently fulfilled by inland navigation. As we know well from previous analyses, this does not mean that there is any commodity type which can absolutely not be carried by IWT. Nevertheless the affinity concept means there are goods which shippers consider to be more or less suitable for transport on inland vessels.

To weigh the relative quality criteria for specific commodities an earlier but valid Prognos study provides some answers (see below).

Demand	Agricultural products, foodstuffs	Solid mineral fuels	Crude oil, petroleum products	Ores, metal, build. mat., fertilisers	Chemicals	Machinery, manufact. goods
A Network density and infrastructure capacity	+	-	+	+	+	++
B Transport speed	+	--	-	-	+	++
C Supply of information and communication	+	-	+	-	++	++
D Just-in-time transport and flexibility	+	+	+	+	++	++
E Flexibility of transport supply	-	-	-	-	++	++
F Securing of goods value	+	--	--	--	+	++
G Security	-	+	++	-	++	+
H High capacity transport units	-	--	--	--	+	++
I High payloads	+	++	+	++	-	-
K Attractive transport prices	+	++	+	++	-	-

Demand is relatively -- insignificant - less important + important ++ very important

Table 16. Demand profiles of commodities
Source: Prognos (1992), Ost-West-Güterverkehr, Arbeitsheft 5, Endbericht

We can derive from this table that chemicals and manufactured articles (NST/R chapters 8 and 9) are the categories in which most of the criteria mentioned are of high importance. On the other hand, liquid and dry bulk goods do not call for many quality aspects, reflected in the need for attractive transport prices. As no distinction is made between agricultural products and foodstuffs, this sector shows most of the criteria to be of relative importance. A further division of this sector into bulk goods (animal fodder, cereals) and foodstuffs (perishable goods etc.) would allow quality needs to be better distinguished. We can conclude that nearly all goods categories require reliability, both in the expectation that a shipment will be delivered in time and in infrastructure conditions.

2.5.2 Characteristics of IWT: supply side factors

The degree to which inland navigation is capable of meeting the above logistics customer requirements largely depends on the system characteristics of the IWT mode itself, in comparison with other modes.

The waterway network

The main infrastructure of inland waterway transport – and in particular its bottlenecks – has a direct impact on its daily operational performance: the larger the draught, the more cargo can be transported and unit costs per tonne-cargo reduced.

Figure 17 shows an example of standby costs[4] increases caused by low water levels on the Rhine for a typical vessel (self-propelled dry cargo with a maximum draught of 2.70 m). Such a vessel can be used 100% on 270 days per year. In the remaining time, utilisation is reduced due to low water conditions. In the worst possible case it may drop to as low as 57%, thus increasing standby costs per cargo unit by about 76%. However, this cost increase only applies where 'transport volume guarantees' are given, i.e. shipments for which a fixed cargo volume needs to be transported at specified times, regardless of the fairway conditions. During low water periods, additional ships must be used in order to transport that cargo volume, thus causing additional operating costs. Transport volume guarantees are not necessary for less time-critical goods, which can wait for the fairway conditions to improve (compare also section 2.2.4 'Fleets/cost structure of the fleet').

[4] Standby costs = fixed costs of a shipping operator (personnel costs, maintenance/repair costs, depreciation, interests, insurance), see part A Supply, chapter 4 Fleets.

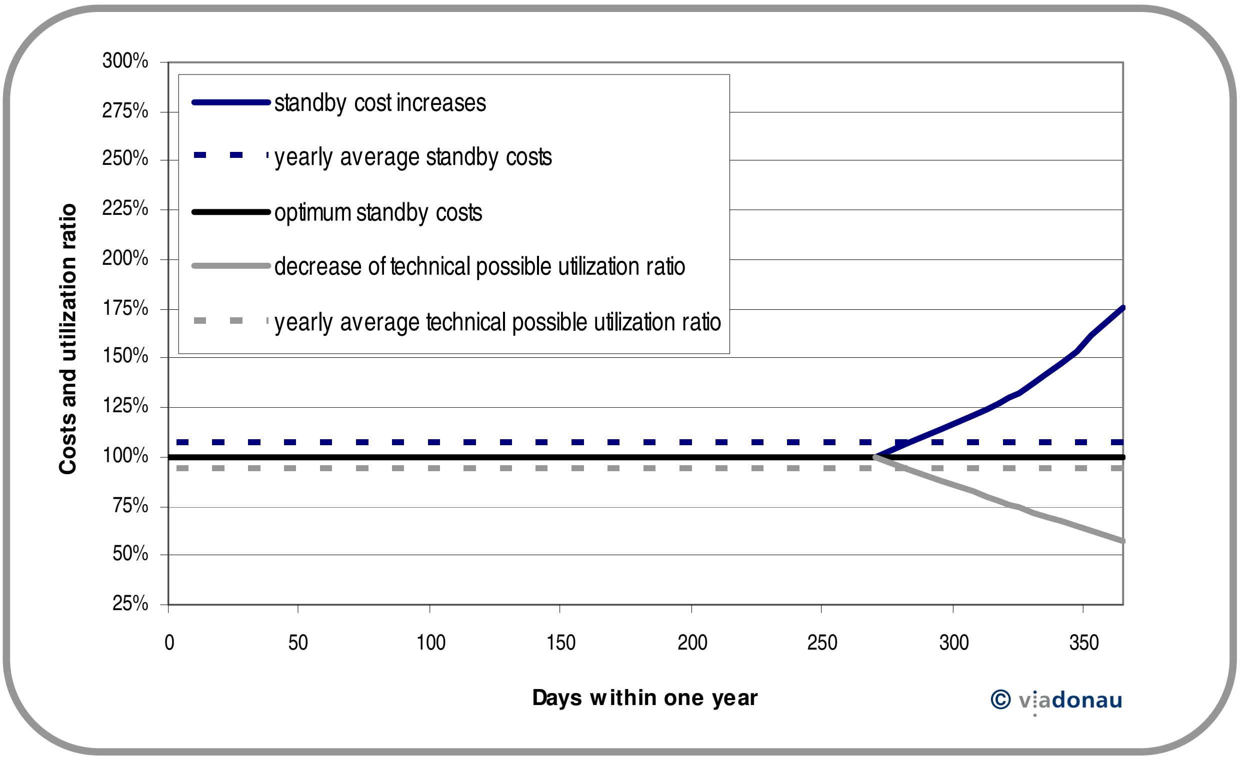


Figure 17. Low water induced standby cost increases for transports with guaranteed transport volumes on the Rhine, self-propelled dry cargo vessel with maximum draught of 2,70 m

A 'transport volume guarantee' can be an important criterion for shippers: it can provide a reliable transport service even during unfavourable water conditions. The conditions on the Rhine are very stable: the yearly average utilisation ratio is 94% and operating costs are only about 8% higher than the 'ideal'. This leads to calculable transport costs and homogenous transport prices throughout the year. Such reliability (which is a major customer requirement) clearly enhances IWT competitiveness in relation to road or rail.

Transhipment facilities

As expected, availability (length of berths and number of cranes) and throughput of the major port facilities is higher in the Rhine corridor than elsewhere. Rhine ports also lead in the number of different functions and value-added services. Conventional inland ports in the Danube corridor have lower average throughputs and crane utilisation rates. Most Danube ports in Germany and Austria achieve high quality standards but, for example, container liner services hardly exist at present in ports located in the middle and lower Danube. Nevertheless, the establishment of such services on the Danube as a whole is in preparation, for example reach stackers, which can handle up to 45 TEU per hour, are now available in most Upper Danube ports, though in south-east Europe, they are usually still confined to the larger ports. As with the quality of the waterway network, the efficiency of port infrastructures largely determine the efficiency of the entire logistic chain involving IWT.

Crew and fleet

Larger ships obviously enjoy economies of scale. Nevertheless the operation of smaller ships is technically and economically justified on waterways with less favourable nautical conditions. The expected degree of utilisation of ships may be decisive for the selection of a certain ship type and size in a waterway area (see Table 5, section 2.2.4).

As far as intra- and intermodal competition is concerned, total costs and cost structure of inland vessel operators are also determined by the registration of the ship owner. Beside the important aspect of the operator structure (family skipping vs. skipper with employees vs. shipping line with economies of scale) the crew structure differs significantly in East and West, having a great impact on crew costs. To reduce crew costs the Western operators today often hire Eastern personnel as described earlier.

IWT chain organisation

The three main cargo segments of inland navigation (dry and liquid bulk and general cargo) are all organised differently. For bulk flows, the system mainly functions on demand. In the dry bulk sector, private shipping companies usually work for the same customer on a contract basis, whilst specialised shipping companies take care of liquid bulk transportation. Shippers play a more dominant role in the liquid bulk sector than in the dry bulk sector. Contrary to the full loads in the bulk sector, container transport by barge is based on scheduled services usually offered by an association of ship-owners or ship-owning companies exploiting a fleet of vessels.

Container transport by IWT often involves multimodal transport chains, whereas bulk cargo is mostly transported to facilities located in the direct vicinity of the waterway. A typical aspect regarding the shipping of containers is the large number of parties involved. In addition to consignors and consignees, five or six different companies may be involved. Forwarders, stevedores, brokers, barge operators, truck operators, rail operators and private skippers may all take care of one or more parts of the logistical chain. This obviously creates co-ordination problems. Waiting times – and consequently additional costs – between links of a logistical chain often represent insufficient co-operation between the different partners. Although closer co-operation between container lines is feasible, the problem still figures as an important limitation on container transport via inland waterways. These organisational obstacles are generally caused by the accent on individual interests and a low degree of organisation.

IWT market organisation

Nowadays, IWT companies still act more as a ‘carrier’ than as a ‘transport organiser’ as is largely the case in the road transport sector. New markets, especially ‘general cargo’, can be attracted only if the service potential of IWT is promoted to shippers and forwarding companies. Marketing, sales and other organisational factors play an important role as well in determining performance criteria such as costs, reliability and transport speed. Several studies conclude that there is a need for organisational improvements of the IWT sector. In several studies [AVV, 1996; EU, 1996], some important market organisation requirements for the future development of inland navigation were identified:

- abandoning of regulated markets;
- flexibility and accuracy;
- continuity in services;
- transparency as regards prices and tariffs;
- marketing of integrated door-to-door services and not of separate modes.

In these studies, the low degree of internal IWT organisation was thought to hamper innovative initiatives, as it was not clear how investment and risk management would take place. Since then, improvements have been accomplished.

2.5.3 Competitive position of IWT: practical examples

In addition to the general overview of characteristics of customer requirements and the comparative performance of IWT (as presented in the previous sections), the specific circumstances of real business cases often are decisive for the competitiveness of IWT (e.g. the length of the transport relation, the operator's efficiency, etc.). Within the PINE study, three such cases have been analysed in more detail, to show opportunities for IWT in different business industries.

Case I: Containers from Rotterdam to Heidelberg

The first case is based on a NEA study of the shipment of one 1.44 TEU on average from Rotterdam to Heidelberg for three modes, direct road as well as IWT and rail requiring a road end haul. The inland navigation solution is 30% cheaper than rail and 27% cheaper than direct road on this route. The short end-haul by road, including the terminal costs required, is more expensive than the long IWT haul. On this relation, and given the costs calculated, the rail alternative is hardly competitive with road and IWT, whilst the good starting position of inland navigation is negatively affected by the cost and waiting times of the intermediate processes (e.g. terminal transhipment).

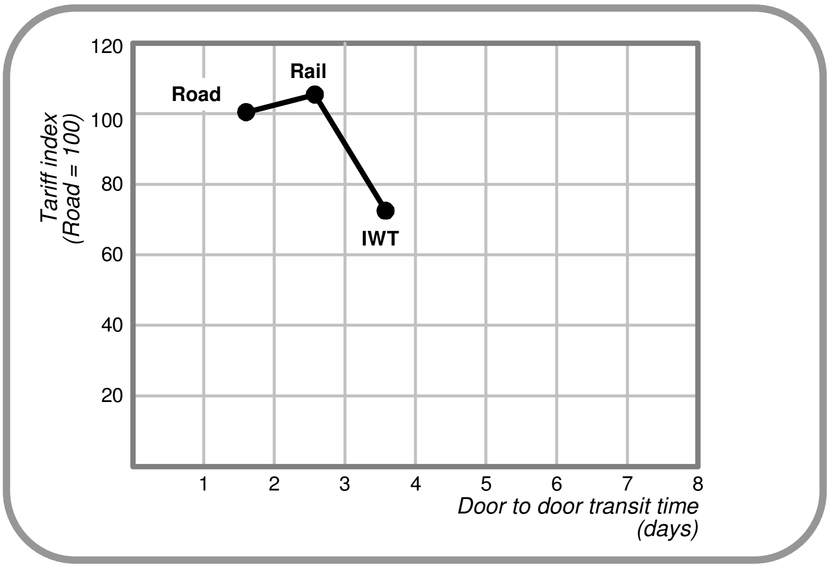


Figure 18. Modal comparison for one container from Rotterdam to Heidelberg
Source: NEA, 1995

Case II: Liquid bulk from Rotterdam to Vienna

This case deals with the shipment of dangerous liquids from Rotterdam to Vienna (see Figure 19).

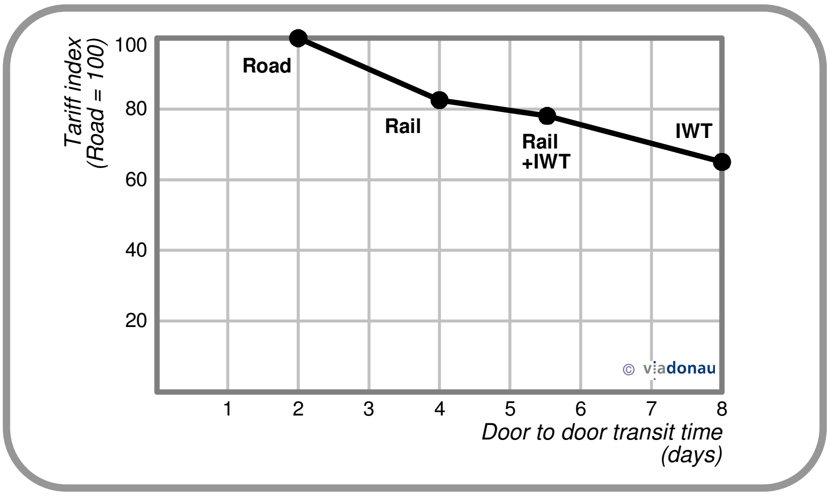


Figure 19. Modal comparison for shipment of dangerous fluids from The Netherlands to Austria
Source: via donau, 2004

The current road journey with tanker trailers was obviously the most expensive (index = 100), but also the fastest (two days door-to-door transit time). Rail transport using standard tanker containers would last four days, and cost around 80% of the road solution, whereas IWT only would be the cheapest but also the slowest option (eight days) because 66 locks would have to be passed. A combination of rail and IWT could be an interesting combination on this relation: if the first stretch (using the Rhine) were carried out by inland waterway, and transhipment made to rail for the second stretch, this option would avoid lower fairway capacities, delays caused by locks on the Main and Upper Danube, and shipping tolls on the

Main and Main-Danube Canal. The total transit time would be approximately 5.5 days and the price only marginally lower than the rail-only alternative.

Case III: Passenger cars from Austria to Romania

The third example deals with shipments of passenger cars from Austria to Romania (distance approx. 1,250 km). Currently, these passenger cars are distributed by truck (trailers carrying eight cars at a time).

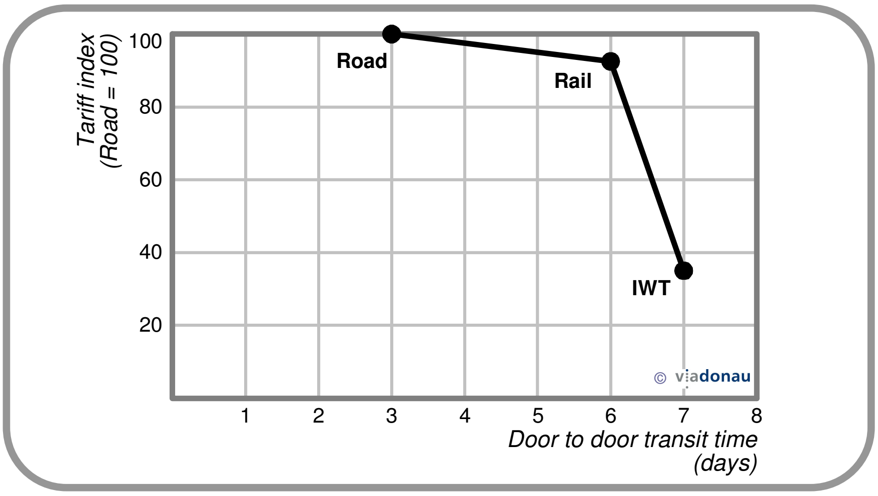


Figure 20. Modal comparison for shipment of passenger cars from Austria to Romania
Source: via donau, 2004

IWT is by far the cheapest alternative (measured in door-to-door costs), but cannot compete with the door-to-door transit times that are offered by road. Some of the additional time needed is consumed by transhipment processes between the modes. The main question in this case will be whether the worse time performance can be fully traded-off against the lower costs and the loss of part of the flexibility (reduced frequency of shipments).

2.6 Main results on the potentials of IWT

Although characteristics of inland navigation itself, as well the capacities of the competing modes road and rail, limit the market share of IWT, there are sufficient potentials for the mode to strengthen and enlarge its position. This section presents an indication of the future potentials that can be expected in the four corridors, based on existing forecasts. Furthermore, an overview is presented of potentials in additional markets, that have no or low IWT affinity at present.

2.6.1 Potentials per corridor and commodity type

To present estimations of the future potentials per corridor, NEA data from the TEN-STAC project are used and modified. As regards future potentials of IWT in Europe, the NEA forecasts by NST/R chapters and countries are indicative. Note that the corridors often represent only parts of these countries so that the growth rates listed in the following tables should be interpreted carefully.

Prospects for the ***Rhine corridor*** are shown in the table below.

	NSTR chapter										
Rhine corridor: Annual growth of total IWT Import 2000-2020											
Country	0	1	2	4	5	6	7	8	9	10	ALL
Belgium + Luxembourg	1.61	2.07	1.07	1.11	2.98	1.43	1.25	2.45	3.82	1.54	1.60
Netherlands	1.48	2.28	1.09	1.12	2.16	1.57	1.14	1.95	6.23	1.74	1.52
Germany	1.56	2.20	1.04	1.10	2.88	1.50	1.17	1.88	3.37	1.50	1.41
Switzerland	1.42	1.84	1.04	1.22	2.26	1.58	1.10	2.30	3.19	1.30	1.52
ALL	1.53	2.19	1.07	1.11	2.76	1.51	1.20	2.08	3.97	1.55	1.49
Rhine corridor: Annual growth of total IWT Export 2000-2020											
Country	0	1	2	4	5	6	7	8	9	10	ALL
Belgium + Luxembourg	1.53	2.04	0.96	1.24	2.60	1.70	1.00	2.83	3.45	1.62	1.86
Netherlands	1.69	2.48	1.01	1.09	2.16	1.54	1.06	1.87	2.57	1.31	1.40
Germany	1.72	1.97	0.99	1.19	2.29	1.34	1.15	2.50	3.37	1.37	1.80
Switzerland	1.67	2.29	1.14	1.23	2.37	1.24	1.00	2.78	3.29	1.42	2.42
ALL	1.70	2.28	1.01	1.11	2.36	1.49	1.07	2.34	3.29	1.38	1.60

Note that crude oil (NST/R chapter 3) is not treated but petroleum products as chapter 10

Table 17. Growth rates 2000-2020 in IWT by NST/R segments in the Rhine corridor, in % based on tonnes
Source: NEA (TEN-STAC) 2003

The growth rates in import and export do vary in some fields but in the weighted average the difference is limited. The highest growth potentials are seen in NST/R chapter 9 as expected but it starts from a low level as Table 17 clearly demonstrates. More than a doubling is expected for the chapters 1, 5 and 8 as well. To conclude, the main growth is with manufacturing products, furthermore with chemicals, metal products and foodstuffs. These commodities largely fall in the category of middle and high value products, often carried by intermodal loading units. Coal, ores (and fertilisers) tend to stagnate in the future though their volumes are rather high. The overall growth on the Rhine transport will not exceed 50 to 60% between 2000 and 2020.

As can be seen in Table 18, there are sometimes larger differences between import and export growth rates in the ***Danube corridor*** than in the Rhine corridor. Also the growth rates themselves are much higher. For example for chapter 5, 8 and 9, NEA expects between 4 and 5 times higher volumes in 2020 compared to 2000 (some countries do reach even more than seven times higher volumes). Note that these are the same commodities with high growth expected as for the Rhine corridor. In some countries there are also other commodities with high growth expectations, e.g. the import of agricultural products (and foodstuff) in Romania and Hungary, or the export of petroleum in Romania.

	NSTR chapter										
Danube corridor: Growth of total IWT Import 2000-2020											
Country	0	1	2	4	5	6	7	8	9	10	ALL
Austria	1.31	1.78	1.03	1.95	4.97	2.09	1.29	4.46	2.42	2.52	2.30
Hungary	3.01	1.91	-	1.18	4.77	3.29	1.08	4.00	1.52	2.37	1.84
Romania	3.67	3.00	1.00	2.71	3.00	3.25	-	-	7.50	-	3.42
Bulgaria	1.90	1.39	1.20	3.51	4.30	2.58	2.62	-	4.42	3.00	1.80
Slovakia	2.56	2.41	-	0.85	7.67	2.20	-	-	7.00	2.16	2.35
ALL	2.36	1.90	1.17	1.75	4.75	2.27	1.38	4.44	2.43	2.49	2.16
Danube corridor: Growth of total IWT Export 2000-2020											
Country	0	1	2	4	5	6	7	8	9	10	ALL
Austria	1.32	1.77	-	1.48	3.28	1.82	1.00	4.33	4.75	2.08	3.45
Hungary	1.66	2.10	1.05	0.26	4.46	2.38	2.33	6.29	2.17	2.10	2.48
Romania	-	2.33	0.92	2.67	5.62	-	-	4.31	3.00	4.00	3.32
Bulgaria	-	2.21	1.00	2.33	5.94	1.59	1.74	4.00	3.08	1.72	2.41
Slovakia	2.20	2.11	1.59	-	4.52	1.69	1.79	3.00	3.67	2.87	2.76
ALL	1.55	2.10	1.12	1.06	4.44	1.95	1.76	4.76	4.57	2.45	2.79

Note that crude oil (NST/R chapter 3) is not treated but petroleum products as chapter 10

Table 18. Growth rates 2000-2020 in IWT by NST/R segments in the Danube corridor, in % based on tonnes Source: NEA (TEN-STAC) 2003

For the ***East-West corridor*** the consortium could not find any corridor-specific statistics. We therefore can only have a view on the countries' figures of Poland, Czech Republic and Germany. But as the IWT volumes of Germany are dominated by the Rhine (85%) they are not meaningful to this corridor.

Especially for Poland, the metal products and chemicals do have a high expected growth which means in export 11 to 12 times higher volumes, in import 5 to 7 times higher volumes than today. This is much less the case for the Czech Republic but in chapter 9 there is also a solid growth potential for IWT. The other growth figures are in line with those of the Danube. To conclude, the classic segments of IWT will stagnate or will only have a small growth potential. This trend is quite similar in East and West Europe.

					NSTR chapter						
East West corridor: Growth of total IWT Import 2000-2020											
Country	0	1	2	4	5	6	7	8	9	10	ALL
Poland	2.13	2.02	3.00	0.50	5.00	2.68	-	6.67	-	1.25	2.45
Czech Republic	2.31	1.90	1.67	1.65	5.00	2.77	1.23	2.74	2.00	-	2.10
East West corridor: Growth of total IWT Export 2000-2020											
Country	0	1	2	4	5	6	7	8	9	10	ALL
Poland	2.50	2.83	0.98	1.33	11.30	2.15	1.94	12.00	2.70	2.00	2.17
Czech Republic	1.57	2.27	1.03	2.29	3.99	2.00	1.74	2.93	3.88	-	2.31

Note that crude oil (NST/R chapter 3) is not treated but petroleum products as chapter 10

Table 19. Growth rates 2000-2020 in IWT by NST/R segments in the East West corridor, in % based on tonnes
Source: NEA (TEN-STAC) 2003

There is no ‘corridor’ related data for the ***North-South relations*** either. Therefore, the French IWT data are chosen as representative for this corridor. Growth rates do resemble Western European standards and the highest growth is expected in chapter 9 and partly in 5.

					NSTR chapter						
North South relations: Growth of total IWT Import 2000-2020											
Country	0	1	2	4	5	6	7	8	9	10	ALL
France	1.62	2.33	1.07	1.11	3.90	1.38	1.10	2.44	5.73	1.59	1.60
North South relations: Growth of total IWT Export 2000-2020											
Country	0	1	2	4	5	6	7	8	9	10	ALL
France	1.50	2.06	1.03	1.53	2.00	1.38	1.04	2.92	5.66	1.68	1.62

Note that crude oil (NST/R chapter 3) is not treated but petroleum products as chapter 10

Table 20. Growth rates 2000-2020 in IWT by NST/R segments in the North South relations, in % based on tonnes
Source: NEA (TEN-STAC) 2003

Figure 21. Additional markets: building materials
Source: http://www.informatie.binnenvaart.nl

2.6.2 Additional IWT markets

The growth potentials for IWT can be found in different market segments:

- expansion in sectors with a traditionally high IWT affinity;
- penetration in niche markets;
- penetration in promising sectors (where IWT plays no significant, or a mere modest role).

In these promising market segments, the position of IWT can be stimulated in various ways, which will be described below. Each of these segments will be reviewed shortly.

Expansion in sectors with a high IWT affinity

In a number of sectors, IWT is already intensively used as a transport mode. In these sectors, often low-value bulk products (e.g. ores, agricultural bulk products, building materials) no major changes are to be expected. However, for IWT it is necessary to keep its strong position there.

To stimulate IWT, or to reach a modal shift with a considerably larger share for IWT, the establishment of regional transhipment centres could help. A regional transhipment centre is an inland terminal for bulk, which is used by several shippers at a regional scale. As, up till now, the IWT of bulk is mainly company-based, use of the mode is only interesting for companies with adequate volumes. However, the current logistic trends point in the direction of individual companies needing more frequent, smaller batches (reduction of stocks). By building regional transhipment centres for bulk products it will be possible for companies with smaller volumes to use IWT as well. This could include non waterway-based companies as well, necessitating endhaulage.

For the future, there are limited potentials for further growth as in a number of IWT affiliated sectors (foodstuffs, metal products, chemicals and machinery), growth percentages of one or two percent are expected. These sectors often use intermodal loading units as pallets and containers, which will be described later.

Penetration in niche markets

Apart from expansion in the current market, new markets are coming up. Waste and recycled goods and car distribution are examples of rising niche markets.

An example of a new market for IWT is ***waste materials and recycled goods.*** Increasing ecological awareness results in the diversification of flows of waste materials, the growth of recycling, an increase in scale of the waste collection activities and therefore more transport flows over longer distances. The logistics of waste materials and recycled goods differs greatly from other branches of logistics.

The most important differences are:

- it concerns ‘reverse logistics’;
- there are many providers and few receivers: converging in stead of diverging patterns;
- waste/garbage has a negative value;
- there is more emphasis on the regularity of the flow than on the punctuality of delivery;
- however, frequency of collection does bear importance as the party, which disposes of waste does not have unlimited storage possibilities;
- environment and safety aspects play an important role.

Furthermore, waste and recycling materials have characteristics rendering them even more appropriate for IWT:

- often, the materials are bulky, and therefore suitable for IWT;
- the materials do not require handling with care;
- the materials can be transported with containers (ISO or non-ISO) or other loading units.

Another example is the ***car distribution*** within the automotive sector. Supply flows within the automotive sector are mainly JIT deliveries, which rely on punctual transport services. Whereas punctuality is a strong point of IWT, its delivery speed normally does not meet the requirements of the automotive sector. However, for the distribution of manufactured cars, IWT might be a solution. As car distribution from the production plant often involves long-distance shipments of large volumes to locations throughout Europe, intermodal transport can be a solution. Rail is often used for car transportation but IWT can be used as well. Ford, Renault and Nissan have already incorporated IWT in their logistics policy.

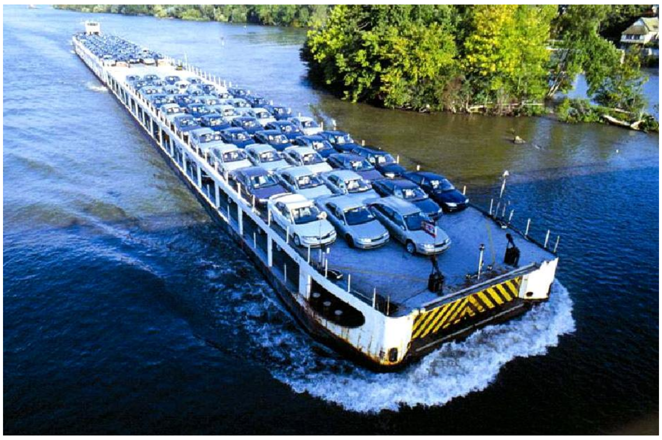


Figure 22. Cars transported by inland ship
source: VNF

Penetration in promising sectors

Of course, there are a lot of economic sectors where IWT, due to its characteristics, only plays a minor role and has a limited market share. Fortunately, the last decades, a number of developments has provided and is providing opportunities to change this situation. These are:

- containerisation;
- the use of new logistic concepts;
- modal shift policy.

Since more and more products are transported in containers, ***containerisation*** increases the possibilities for inland navigation. In contrast to bulk products, which is common in a limited number of economic sectors, almost all economic sectors use containers. As global containerisation is still growing, so is the potential market share for IWT.

By building inland container terminals, more companies can use IWT as a mode. The containers can be collected at a container terminal and from there be transported, by ship to their destination. Since the largest part of transport costs is caused by transhipments to other modes, this solution is only cost-efficient as the number of transhipments can be limited.

Figure 23. Tank containers, Source: www.vanhool.com/downloads.asp?ID=5

Because of its characteristics, IWT is not suitable for all kinds of products. Introducing ***new logistic concepts*** could change this. New markets could be opened up; existing ones could be expanded. Three concepts are highlighted:

- ***Floating Inventory:*** this concept consists of large batches being shipped, before it is actually clear who the buyers will be. The sender holds limited storage capacity and the large quantities of products 'on their way' are regarded as – floating – inventory. The character of IWT (slow, large batches, safe) renders it excellent for using it this way.
- IWT of ***palletised goods:*** one main example of a logistic concept for palletised goods is the 'Distrivaart' concept (NL). The bundling of goods flows, previously transported by truck, plays an essential role in this concept, which concerns flows of non-perishable goods between suppliers and distribution centres of large retailers. For this concept ships, modified for transport and transhipment of palletised goods, are needed, as well as close co-operation within the logistic chain.

- ***Collecting goods in logistic networks:*** logistic developments like the decrease in volumes transported and the need for faster and more frequent deliveries are the main reasons for shippers *not* to choose IWT. By collecting the goods of different companies in a logistic network, it can be possible to optimise logistic chains and to include IWT.

Over the past decade, there has been a growing interest for the concept of ***modal shift,*** transferring goods flows from one mode to another. Usually it concerns goods flows, previously transported via road haulage. This 'shift' is believed to be beneficial for two main reasons: improvement of the accessibility of the economic and logistical centres (road congestion relief) and reduction of the negative effects of road transport on the environment. Within the EU several projects and studies have been carried out to map the possibilities of modal shift. Two IWT-related conclusions from earlier projects can be mentioned:

- inland waterway transport is well-equipped for modal shift;
- the shifting of bulk cargo demands that both sender and recipient are situated near waterways. Any further pre- and post-transport of bulk by road usually turns out to be both expensive and inefficient. Here also, building of inland terminals could enable companies to use IWT.

Chapter 3 **Conclusions**

In this chapter, the main conclusions of the PINE project are described. This is divided over five sections:

- Conclusions on the supply side (section 3.1)
- Conclusions on the demand side (section 3.2)
- Conclusions on policy and legislation (section 3.3)
- Conclusions on modes and competition (section 3.4)
- Conclusions on potentials for IWT (section 3.5)

Recommendations are dealt with separately in Chapter 4. Every section of this chapter ends with a compact SWOT analysis[5] table. The SWOT analyses define the strengths, weaknesses, opportunities and threats of inland waterway transport (IWT) systems in Europe, based on the PINE findings. A full description of the SWOT tables can be found in the Full Final Report, part F.

3.1 Conclusions on the supply side

3.1.1 Characteristics and performance

The large carrying capacity of inland navigation is one of its main system advantages, resulting in – compared to other modes of transportation – low unit costs and low external costs. Additionally, punctuality is seen as a main characteristic, which makes IWT attractive not only for traditional bulk cargo, but also for 'neo-bulk' such as Roll-On-Roll-Off, containers or other intermodal shipments.

A basic shortcoming of inland navigation is the inland waterway network's limited geographical scope. This causes IWT to be dependent on the efficiency of transhipment interfaces for a majority of shipments. Additional costs are caused by transhipment activities and further road or rail haulage to link the waterways to shippers or freight storage sites. Another negative aspect are the changing nautical conditions with severe impacts on the reliability (mostly in terms of price stability) of IWT.

[5] SWOT: Strengths, Opportunities, Weaknesses, Threats

As IWT can often not match other system characteristics of road transport (speed, flexibility, door-to-door capability, and in some cases reliability), these disadvantages must be reasonably compensated by carrying large quantities at low transport prices per tonne or per unit. Transhipment costs (regular transhipment as well as shipments involving reliability guarantees) must be absorbed by competitive freight rates. Altogether, the characteristics of IWT show more similarity to rail services than to road services. This concerns the transportation/loading structure defined by commodity types, transport distances, origin-destination relations, size of shipments and – in the case of general cargo – loading units. Nevertheless, modal shift from road or rail transport (e.g. as a result of congestion on motorways and capacity limits for freight transport on certain rail stretches) offers new opportunities.

The enlargement of the European Union offers opportunities to the IWT sector. However, at the same time new challenges have to be faced. This goes for the EU-15, but also for the accession countries. Some 7,000 km of waterways are added, primarily in Poland, the Czech Republic, the Slovak Republic and Hungary as well as in Romania and Bulgaria later on. The enlargement will lead to an accelerated growth in East-West trade from which the IWT sector on both sides will benefit. At the same time, operators in the 'old' member states will be better able to hire qualified workforce from the accession countries. At the same time, cost structures that are hardly compatible will have to be attuned, to get to a well-balanced IWT sector to take on the challenges at hand.

3.1.2 Enterprises

Eurostat statistics (based on NACE classification) indicate for the EU-15 a total of almost 8,000 enterprises and 28,000 people working in the IWT sector. On average one sees 3.5 employees per enterprise, compared with 5 in the road freight sector. Accession countries could unfortunately not provide data for a comprehensive picture of enterprise structure and employment to compare with the IWT-relevant EU-15 member states.

As regards the development of the number of European IWT enterprises in the last decades, two countertrends have been observed: limited concentration in the Western European countries on the one side and, the splitting up of larger companies (former national monopolies) into smaller entities in the accession countries.

In Western Europe there is a trend that 'large IWT-operators' are converting into operators who are canvassing cargo and who are organising the transport, whereas the transport is carried out by 'single-vessel-operators'. In fact, these 'single-vessel-operators' have poor direct contact to shippers (cargo owners) and thereby largely depend on freight forwarders to get cargo. Such dependency forces them to offer low prices.

This will, however, not be enough. Apart from the different cost structures between western and eastern companies already referred to, small IWT companies will increasingly need to persuade demanding shippers by means of new and attractive services. In this context, the dominating enterprise structure of single companies and distributed responsibilities has proven to be a barrier to increased supply chain integration (door-to-door services) and the dissemination of technological and organisational innovations.

This is the result of the fragmentation of the IWT industry and its representations, and insufficient efforts to present convincing facts and be sufficiently transparent to shippers, freight forwarders and integrators. The aim should be to get to better integration in logistic chains and to pursue long-term contracts based on attractive services.

After the end of the fleet capacity regulation, the European Commission has ceased the market observation system for the IWT sector. In the near future this will be succeeded by a new system. It turns out that enterprise statistics from Eurostat are inadequate, since they do not focus on inland waterway transport activities and may therefore be misleading. The new market observation system – possibly in the form of a benchmarking system – should include uniform statistical information and be extended to the countries Bulgaria, Romania, as well as to Serbia-Montenegro and Croatia. This way, changes in a sector, still rather vulnerable, can effectively be made transparent and forthcoming crises can be better understood and tackled.

Strengths	Weaknesses
• High entrepreneurship and commitment within IWT enterprises	• Many 'one vessel companies' in EU-15, limited supply chain integration • Some former state-owned enterprises have limited market orientation.
Opportunities	**Threats**
• Supply-chain integration and long-term transport contracts • Technical and organisational innovations • Development of a benchmarking system for inland navigation enterprises (including uniform statistical information)	• Differences in the cost structures between western and eastern companies

Figure 24. Enterprises: strengths, weaknesses, opportunities and threats

3.1.3 Human resources

Employment

Despite the lack of uniform and comparable data on employment, it can be stated that the shortage of employees is one of the fundamental problems relating to the future potentials of IWT. The reasons why the IWT sector – most urgently in the Rhine corridor – is increasingly short of (domestic) staff can chiefly be found in economic and social factors. Compared to other sectors, a job within the IWT sector has become less attractive due to the modest wage development. As a result of liberalisation, freight rates went down, sometimes dramatically. In due course, the shipping companies laid off employees, ships were outsourced and put under cheaper flags (e.g. Luxembourg). The owner-operators of countries with higher wages (Germany, France, the Netherlands)[6] reacted by employing 'temporary' staff from Poland, the Czech Republic or Eastern Europe. Consequently, parts of the IWT-sector are characterised by a high turnover of staff. This process of labour migration and mobility puts pressure on the general salary levels and social security.

Also from a social point of view, the IWT sector has serious entry barriers for newcomers. A large part of IWT shipments is carried out on demand (i.e. irregularly). Not only are crewmembers away from home for long periods, also their leisure time cannot be planned in advance. In addition, there is no uniform legislation on manning requirements and working and rest time. The working conditions and social benefits (e.g. pension rights, social security, accident insurance) for foreign (eastern) employees often are below Western levels, especially if they have no contract. Together with the economic factors, these issues regarding ***social standards*** tend to have a significant impact on the image of the sector from a career point of view.

Up to now, the shortage of personnel has been counterbalanced by technological innovations (less personnel on board) and by staff entering from the eastern EU accession countries. Labour cost differences are the main push factor for the migration from eastern employees to the west. This can in some cases lead to language problems and subsequently misunderstandings, possibly involving accidents risks.

With the enlargement of the EU, the employment gap – currently filled by accession country personnel – could grow again because of reduced migration streams from accession countries. Because of diminishing wage differences, Eastern-European staff could decide to re-migrate. Further research will be needed to get a clear idea of the dimensions of the personnel shortage. For most countries, we do not expect the situation to change in the near future, looking at the number of trainees.

A clear strategy will be needed to open the labour market of the EU for employees from outside the Union. The aim should be long-term legal employment accompanied by clear social standards, as well as strong enforcement of these rules. This will create an attractive

[6] See Full Final Report, Part A, chapter 3.4, pp 41-49

and safe sector to work in: a prerequisite for a healthy IWT sector needed for the White Paper policies.

Education

Attracting young people is a promising approach, but a long-term process. One example of such a strategy is the German ‘Ausbildungsinitiative’ (training initiative). This is a successful programme for the recruitment and education of young people, which might serve as an example for other western countries and for some accession countries as well.

The general level of education and training can be regarded as good. In general, nautical training differs among countries within the EU-15, and in comparison with accession countries. For IWT to be competitive with other modes, training and especially life-long training is essential. However, as a contribution towards harmonisation, education should allow navigation on different EU inland waterways. By using a modular system concerning knowledge of river sections, over-qualifications can be avoided while harmonised knowledge can be guaranteed at the same time.

Strengths	Weaknesses
• Good vocational education/ training • Good general level of qualification • Lower personnel costs in East than West (at the same time partly threat for Western companies)	• Lack of national personnel • Limited harmonisation on social standards • Shortcomings concerning the knowledge of foreign languages, foreign waterways and economic aspects
Opportunities	**Threats**
• Recruitment of staff from accession (and 3rd) countries • Reduction in demand for personnel • Harmonisation of education and improvement of safety/ communication • Development of sustainable and durable incentives for the employees • Creation of reliable employment databases	• Lack of personnel • Lack of full mutual recognition of boatmasters’ licenses between CCNR and other regimes

Figure 25. Human resources: strengths, weaknesses, opportunities and threats

3.1.4 Fleet

General framework conditions and interactions

Fleets and waterways have close interactions whereby the fleet structure – considering the market requirements – is adapted to the nautical conditions of the waterways. This explains the wide variety of vessel types operated on the different European waterways. Contrary to the waterways, usually under the state responsibility, the fleet structure is mainly based on market-governed decisions. However, especially in the Rhine corridor, the fleet structure has been affected by different administrative measures, e.g.:

- wrecking schemes and old-for-new regulation;
- different national treatment of operational profits;
- different national treatment of gains on sale of vessels[7].

The competitiveness of the fleet is considerably determined by the costs. As the analysis in section 2.2.4 showed, costs are above all dependent upon the available loading draught (and/or bridge clearance for container transport) as well as the size of the operating vessel and therefore mainly on the infrastructure conditions.

Principally, additional competitive advantages can be realised with further specialised vessels (high degree of adaptation to a certain navigation area and/or commodity). Due to mostly needed expensive and long-term investments and the dedicated character, this strategy can basically only be applied in case of long-term partnerships between operator and shipper.

EU-enlargement

The fleets of the acceding countries come from former state-owned companies. As a result, in the Danube corridor, a shortage of self-propelled vessels and an overcapacity of pushed barges can be observed, especially on the middle lower Danube. Interoperability between the river basins is possible to a limited extent, e.g. between the West-East and the Rhine-corridor and between the Rhine- and the Danube-corridor. Often, this has to do with differing the fact that vessels do not comply with the technical standards between two corridors.

[7] e.g. discussion on § 6b of Income Tax Law in Germany

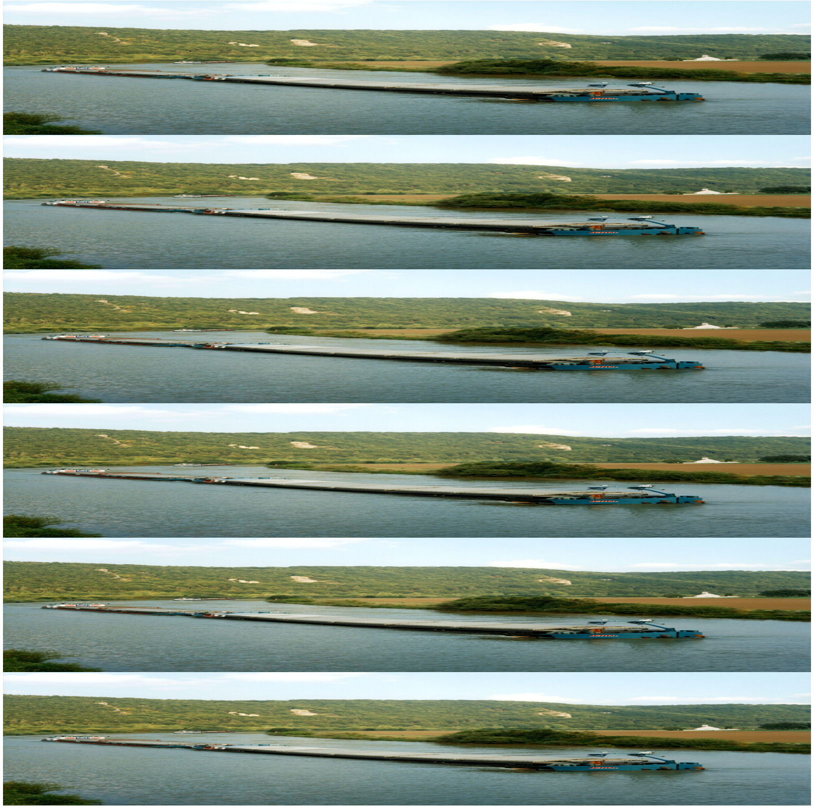


Figure 26. Pushed train
Source: via donau, Photography Rob de Koter

Modernisation and innovation

An optimal use of the existing infrastructure is of crucial importance. In this context, a targeted and further adaptation of the vessels up to the limits of the existing infrastructure conditions will strengthen the competitive position of inland navigation.

On account of the long lifetime of vessels, modernisation and innovation aspects have the highest priority. A considerable share of the present fleets has to catch up in terms of modernisation. Promising approaches to solve these problems are systematic research activities, as well as targeted financial means and incentives. Against the background of the large number of small and medium financially restricted ‘single-vessel-operators’, these aspects are of vital importance.

Strengths	Weaknesses
• Large variety of ship types • High safety level • Environment friendly	• Long lifetime of vessels hinders fast adjustments • Partly insufficient IT-equipment
Opportunities	**Threats**
• Further adapting vessels to infrastructure conditions • Modernisation and new building programmes for the fleets • Systematic research on modernisation of vessel technology • Pilot-projects for new vessel types	• International differences in legal framework for vessels • Overcapacity not completely solved • Limits in transparency and insight into the sector due to lack of data

Figure 27. Fleet: strengths, weaknesses, opportunities and threats

3.1.5 Infrastructure

Waterway infrastructure standards determine IWT competitiveness, since it lays down maximum vessel sizes and thus affects navigation costs. Harmonised standards are vital, because inland waterway shipments tend to span long distances and load capacity is determined by the worst bottleneck. Even local bottlenecks on loading depth for bulk goods or bridge clearances for container traffic clearly influence IWT competitiveness over long stretches.

The infrastructure network, which can be seen as the basic prerequisite of IWT, is characterised by a high degree of ***geographical variation***. This has several dimensions:

- ***Territorial variation:*** whilst there is a dense network in certain countries, there are also countries with no navigable inland waterways.
- ***Network density variation:*** in a limited area, the network has a much higher density and penetration than in other countries where the infrastructure is limited to one main axis or one connection to the sea (inlet).

- ***Scale/capacity variation,*** with large-scale infrastructure, offering efficient and competitive operations as well as small-scale infrastructure having fewer possibilities for efficient and competitive utilisation.
- ***Usability variation:*** high quality infrastructure conditions with reliable usability all year round, as well as different state of maintenance, (seasonal) unreliability of water level, occurrence of ice, etc.

Clearly, there are many bottlenecks on several parts of the network. Some take the form of draught and size restrictions, reducing the utilisation level and efficient navigability (e.g. Elbe, Upper Danube), other reflect missing links. In almost all cases***, these missing links and bottlenecks involve high costs.*** Reliable cost-benefit analyses for IWT projects are complicated, especially because of the extended range of benefits of the improvements. These for example include indirect impacts on other modalities, environmental effects on various scale levels, and many economic effects. On the costs side, one has to take into account that waterways have more than a mere navigation function. Especially in IWT infrastructure projects, there can be a certain dominance of environmental aspects.

In addition, the international community has not yet compiled an overall (political) vision on the European waterway network. Such a Strategic Masterplan might very well be needed to treat it as such. In parallel, to combine top-down with bottom-up, individual cost-benefit analyses will have to be carried out on individual projects. The TEN-T network with its list of priority projects, although valuable, cannot function as a framework to take such decisions at the European level.

Corridors

The Rhine and Danube clearly are the most important corridors, with advanced developments on the Rhine and clear and promising potentials on the Danube. Other waterways that penetrate Europe's mainland – e.g. Elbe, Weser, Odra and the East-West connection – have lower nautical potentials, but also offer good opportunities.

The East-West corridor connects important accession countries (Poland and Czech Rep.) to the EU core network. Upper sections of the Elbe (Labe) in the Czech Republic already have good construction standards. For the upper Odra, construction and upgrading measures are envisaged ('Program Odra 2006'). However, the nautical conditions of the middle sections of both rivers (Elbe on German territory and Odra along the German-Polish border) are determined by limited draughts and intensive water level fluctuations.

Other potentials could be envisaged in the North-South Corridor (Seine and Rhône/Saône). However, at present this corridor is insufficiently interlinked and not linked with other corridors (yet). The Seine-Scheldt upgrading will strongly improve this for the connection Île de France – Benelux countries/ARA seaports.

Smaller waterways

The potential of IWT as a mode, at European level, narrows down with the scale on which it takes place. This has to do with the basic trend of scale enlargement: a main characteristic of logistics in general. This would suggest that one should not have too many expectations of the ability of small waterways to solve the problems which larger scale waterways can excellently deal with. The scale-related advantages of higher-scale IWT can only be transferred to small waterways in a limited way. The same goes for the additional facilities needed, e.g. ports and transhipment points.

With the disadvantages of IWT, the same observation can be made. For example, the main drawback of IWT is the fact that in many cases an additional transhipment movement and/or pre- and end-haulage is needed. This weighs heavily on the costs of the overall transport chain. In the case of small waterways, the cost advantage is already of a thin nature because of the operational cost factors. In combination with a high network density as well as a high density of transhipment sites, the need for pre- and end-haulage may be reduced. The resulting cost and efficiency advantages can thereby (partly) compensate the disadvantages mentioned before.

Figure 28. Examples of small waterways (left, Sweden, right Scotland)

The reasons for the past (and, partially, ongoing) decline of small waterways are not easily outstripped, or neutralised, by recent developments boosting IWT on small waterways. Examples include locks (see Figure 28) and the role of seasonal influences. Aspects like these strongly contribute to inefficiency, making IWT less interesting as a transport mode. However, continuing congestion on the road network and an active modal shift policy could persuade industries to switch to inland waterway transport, even on smaller waterways.

Strengths	Weaknesses
• Large capacities of the major waterways • Good hinterland links	• Low density of the network in connection with missing links between major waterways • Bottlenecks limiting seamless transport and ships capacity utilisation • Water level variations having impacts on reliability and ships capacity utilisation
Opportunities	**Threats**
• Elimination of infrastructure bottlenecks • Improvement of the capacity/ quality of the infrastructure	• Limited financial means / biased prioritisation for maintenance measures • Environmental policy aims put restrictions on transport infrastructure policies • Weak co-ordination at pan-European level on the improvement of network • Continued infrastructure limits and bottlenecks reducing the potentials of inland navigation

Figure 29. Infrastructure: strengths, weaknesses, opportunities and threats

3.1.6 Interfaces: ports and transhipment sites

As explained in the previous chapter, a representative cross-section of all EU-27 inland ports was studied. This results in the following conclusions.

Disparities in port characteristics

The PINE Consortium has observed large disparities within the European inland ports in the following aspects:

1 quantity of ports/density along waterway;
2 productivity and turnover;
3 management/responsibility aspects;
4 facilities offered.

These disparities are specifically visible between the inland ports in the current member states, and those in the Accession countries. Throughout the enlarged European Union, the ***port density*** along the waterways is very uneven. Port density is by far highest in the Rhine corridor. About half as many ports can be found in the north-south and east-west corridors, and by far the lowest number in the Danube corridor.

In the ports of the Rhine corridor, ***turnover and productivity*** are most advanced. This is the result of numerous circumstances such as the level of economic development, population density, quality and density of the waterway network, potentials and qualities of fleet units and their performances, etc. Only some ports in other corridors achieve the same level of quality and efficiency as the average port in the Rhine corridor. According to the sample investigated, ports located in the eastern parts of the Danube and East-West corridors have lower productivity levels than those in the Rhine corridor.

Throughout the enlarged Europe, there are many differences in ***ownership/responsibility*** of waterways, ports and the connected 'dry' infrastructure. On the one end of the spectrum, there is full public ownership and responsibility. On the other end, private ownership and involvement can include all fixed and floating assets. Of course there are many mixed forms, all with their characteristics, (dis)advantages and cost and management structures. One of the main problems in this respect is the spread of responsibilities of (parts of) the infrastructure over different parties. The threat of conflicting interests urges for communication and co-operation. Increasingly good public private partnership is needed in which the industries shipping goods should be involved.

Figure 30. Nijmegen Container Terminal
Source: BCI

There can be many ***different facilities*** at ports, varying from basic facilities such as cranes, storage areas and 'landside' infrastructure (for other modes) to the availability of 'advanced' logistics concepts (e.g. container-related facilities or even pallet transhipment systems, in line with innovative IWT trends). Often, these facilities are the responsibility of private actors. Basically, again the same divide between West and East is visible. In the EU15, and especially in member states with a high IWT profile, ports are actively adopting new logistics concepts, including involvement in hub-and-spoke systems, adequate storage space including covered space, value added logistics, etc.

EU enlargement

As mentioned above, in some aspects there are considerable disparities between the EU-15 and the accession countries. Shortcomings relating to ports and the EU enlargement specifically include:

- limited adjustment of facilities and equipment to future development;
- weak infrastructure links to major roads/rails;
- know-how lagging behind on such items as logistics optimisation and organisation;
- (in some cases) inadequate storage capacity.

To take full benefit of the accession of the new Member States, the situation of the ports and transhipment sites in these countries should be improved, possibly through dedicated but coordinated development programmes.

Strengths	Weaknesses
• Trimodality of ports • Recent development of ports to logistic centres	• Uneven density of the ports / transhipment sites
Opportunities	**Threats**
• Concerted and co-ordinated development of ports and interfaces • Costs reduction for pre- / endhaulage and transhipment by increased efficiency and / or improved technologies • Continuation and strengthening of logistic activities and developments	• Different levels of ownership and responsibility potentially result in conflicting interests

Figure 31. Interfaces: strengths, weaknesses, opportunities and threats

3.1.7 Information systems

The development and implementation of River Information Services has made significant progress during the last decade. RIS is one of the main innovations in the IWT that will make the sector more efficient and safe. At present, the most common services include fairway information services, voyage planning tools and the gathering of inland waterway statistics. Only a limited number of applications deal with port/terminal management and water infrastructure charges.

As regards the users groups, boatmasters are the most targeted user group. Almost every RIS application involves an information exchange between some actor in the logistic chain and the boatmaster. Other user groups usually addressed are fleet managers and waterway authorities. The relative lack of applications and services aimed at shippers and logistics service providers may prove to be a limiting factor when stimulating the further growth potential of inland waterway navigation. RIS applications for these user groups need to be further developed in order to support logistics decision-makers in their modal choices in favour of inland navigation.

Figure 32. ECDIS sample chart
Source: via donau

Expert interviews and desk research revealed ***five problem themes*** as the most important barriers to the future development of RIS at the European level:

- compatibility and interoperability between RIS applications;
- realisation of technical framework conditions;
- interfaces between RIS- and external applications;
- acceptance among (potential) system operators;
- user acceptance.

First, the lack of standardisation and interoperability of applications will hamper common use of the systems and therefore runs counter to the policy of creating a Europe-wide RIS. Standardisation of RIS is needed, because of inland navigation's international character. Secondly, certain technical framework conditions have to be fulfilled (e.g. on board of vessels) in order to be able to operate the services that are available. The last years have shown that skippers are catching up in terms of implementing new technologies (e.g. internet use has grown significantly). Thirdly, interface applications have to be developed in order to make RIS fully compatible with information systems of waterway authorities, customs, ports, etc. Fourth, acceptance by (potential) system operators should be increased, for instance by developing training programmes and, if possible, by reducing the investment costs. Finally, user acceptance should be increased, mainly by drawing attention to the (potential) commercial benefits of RIS applications for end users.

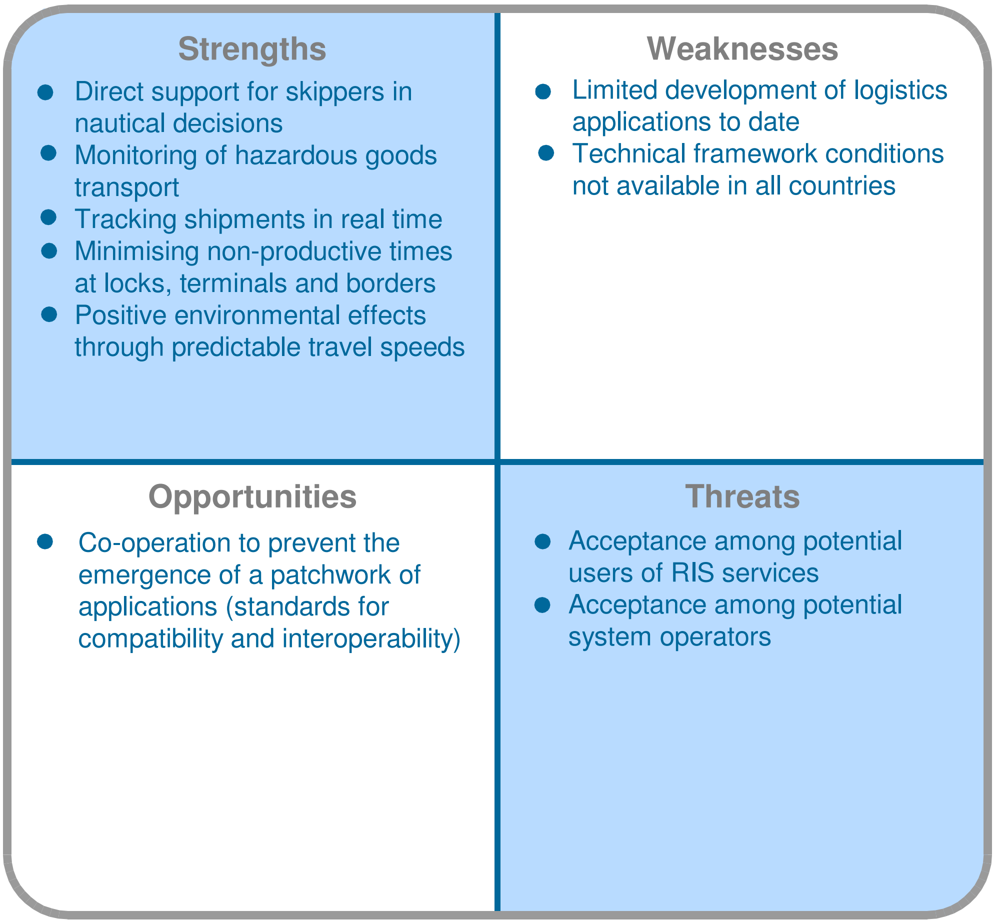


Figure 33. River Information Services: strengths, weaknesses, opportunities and threats

3.2 Conclusions on the demand side

3.2.1 Present transport volumes

Amongst the inland modes of transport – road, rail, inland waterway –, IWT plays a different role in the various countries and corridors, depending on framework conditions such as economic development, fairway conditions, network characteristics, etc. Since distances covered by IWT tend to be significantly longer than by the dominant road transport mode, the share of IWT in terms of tonnage carried is lower than in tkm. For example, the IWT volume share in the EU-15 is only 3.5%, as compared with 7% in tkm. IWT plays a significant role in international freight transport within the EU-15. Here it accounts for 26% of the tonnage, as compared with 14% for rail and 60% for road.

Four countries in the EU-15 have a significant IWT market: Belgium, France, Germany and the Netherlands. About 97% of tkm of the total EU-15 IWT takes place in, from and to these countries. Although growth rates are expected to be higher in the accession countries, it is expected that the main IWT transport market will remain in Western Europe. Reasons for this are the relatively good infrastructural conditions and the economic strength in Western Europe. It can be concluded that the impact of the accession of these countries to the EU will be limited in absolute terms.

3.2.2 Socio-economic trends and developments

It has been stated earlier that socio-economic development is a driver for freight transport growth. Therefore, ***the expectations for freight transport are relatively higher in the accession countries than in the EU-15.*** Compared to the EU-15, expectations for the development of Gross Domestic Product (GDP) are higher by a factor 2 in the accession countries.

Current forecasts until 2010 anticipate slow expansion of both exports and imports, not only during the first half, characterised by a severe slowdown of economic growth in all parts of the industrialised world. Accession Countries' growth outstrips the percentages in the west.

3.2.3 Future transport

Overall developments

Various freight transport demand forecasts have been reviewed in order to assess the growth potential for the IWT sector; see Table 21.

Prognos European Transport Report 2000-2015		TEN-STAC Consortium 2000-2020		Ecorys Consortium 2000-2010	
Total Transport Market (tonne-km)	*IWT(tonne-km)*	*Domestic IWT (tonnes)*	*International IWT (tonnes)*	*Domestic IWT (tonnes)*	*International IWT (tonnes)*
+2.4%	+2%	+2.5%	+3.4%	-1.1%	+2.6%

Table 21. Forecasts of IWT demand (annual growth in %)

The forecast of the Prognos European Transport Report (2002) is ***2.4% annual growth for the total freight transport market and 2% for the IWT sector.*** The credibility of the Prognos forecast is endorsed by a recently published forecast for Germany (PLANCO, 2003) and is considered as the reference forecast for the PINE study.

The two other forecasts (TEN-STAC 2003 and Ecorys 2002) are both in terms of transport volumes (tonnes). The TEN-STAC forecast appears to be (far) too optimistic as regards domestic transport. Also the forecast of international freight appears to be extremely high considering that intra-EU-15 international transport volume is growing by only by 1.0% p.a.

For IWT to keep its share, ***strong political measures*** (infrastructure, harmonised competitive conditions, RIS applications, stimulation of – possibilities for – modal shift) are needed and IWT enterprises have to make major efforts in order to strengthen their position.

The PINE consortium agrees with the structural results of the TEN-STAC study and the Ecorys forecast in so far as no significant shifts are expected in the composition of freight by commodity group (NST/R chapter, see TEN-STAC) but that container traffic has the highest growth potential (see Ecorys).

Developments in the accession countries

The enlargement of the EU does not change the IWT transport flows at the EU level drastically, since the current modal share of IWT in these countries is only between 1 and 2%. Based on the socio-economic developments we can draw the conclusion that the main economic strength will remain in the west and therefore the transport flows as well. However, assuming that necessary measures are taken (removal of the infrastructure bottlenecks on the Danube, increased modernisation of IWT by means of logistics applications and river information services), a study by ÖIR (2004) reveals relatively high growth rates for long-distance transport in the Danube-Rhine corridor. This could nearly lead to a threefold increase of current transport volumes by 2015. The base scenario 2015 – with no additional measures – shows an average annual growth rate of 2.37%.

3.3 Conclusions on policy and legislation

3.3.1 Economic and political framework

We consider three factors to have caused a delay in tackling some IWT problems at ***EU level:***

- the international IWT arrangements existing prior to the establishment of the EU (Rhine and Danube Conventions, UN/ECE etc);
- the need to tackle road and rail problems considered to be more urgent;
- the fact that some Member States have no or only insignificant waterway transport.

Co-operation between the EU and the other legislative actors involved is under way but should preferably be intensified.

Similar conclusions also apply to ***national policies***. Whilst strongly influenced by EU policy and legislation, the main waterway countries (B, D, F, NL, A) have developed national policies of their own, including, to a limited extent, the promotion of IWT by subsidies and regional planning (e.g. in the Netherlands). However, IWT is not always treated according to its potentials. On account of the current share in transport performance, rail sometimes seems to be favoured compared to IWT e.g. in terms of infrastructure budgets. For some countries, the impression arises that, due to the structure of the sector with a large share of small companies, IWT misses the influence of rail.

The economics of water transport are strongly tied up with the location of industry. Early siting of European industry close to waterways has favoured IWT, especially for bulk products. Current ***spatial planning*** for the newly developing service and light industries has concentrated on road access – and sometimes rail. Where appropriate, it could to some extent be redirected in view of the environmentally favourable aspects of water transport.

During the last years ***investments*** in waterways, locks and ports and even maintenance appear to have suffered from insufficient (national) government funding. Moreover, the current cost/benefit approach seems to undervalue environmental aspects and modal shift effects. A positive development is the recent increase in the percentage of potential EU funding for TEN-T projects. This is reflected, for example, by the decision to go ahead with the Seine-Scheldt project in France. However, the very long planning and construction times for such major projects remain a handicap.

The absence (so far) of an EU-harmonised policy on ***infrastructure charging*** is another handicap for IWT. Since water transport causes about five times fewer ‘external costs’ than road transport, it would benefit from a system with external costs internalised. In this technically, economically and politically very controversial subject at EU and Member State level, progress may take many years.

3.3.2 Legislative harmonisation and market access

IWT started to adopt transnational regulations in the middle of the 19th century and with the help of the River Commissions achieved a well-advanced state of liberalisation. EU legislation on IWT started in 1970 and dealt with access to the market and to the profession, state aids, competition, public service obligations and pricing. As a result, EU enterprises now have free access to the market within the Union, including cabotage rights. This liberalised regime broadly also applies, after 1 May 2004, to enterprises from the Accession Countries. IWT is therefore further ahead in respect of market liberalisation and deregulation than rail.

To deal with the tendency to structural overcapacity in IWT, scrapping and 'old for new' measures were first adopted at national level and then made into EU policy instruments. However, they and the 'tour de role' system of obtaining cargo were recently abolished. Some monitoring of market developments existed via the market observation system, but suffered from a relative lack of important data. We argue that this should be revived and improved.

To ensure a level playing field and fair competition, harmonisation measures were also adopted to ensure safety and environmental quality. This includes such matters as technical prescriptions for vessels and the qualifications of the crew, in particular boatmasters' certificates. Other aspects of fairness include human resources (especially working conditions of the crew) and economic aspects such as fiscal treatment of depreciation.

With much of the legal work done, some ***uncompleted issues of harmonisation*** remain:

- The technical requirements for vessels as laid down in Council Directive 82/714/EEC should be updated. This is at least a two-stage process starting with regulations adopted by the Rhine Commission (CCNR). An important question: should the five Rhine Convention countries be permitted to set technical requirements, applying to the whole of the EU? This is a matter of reasonable balance between safety, the environment and costs, the latter being a vital element in modal choice.
- Similar considerations apply to navigability and boatmasters' licences. In this respect, mutual recognition of other countries' licences precedes full harmonisation. 'Rhine' certificates are recognised for use on all other EU waterways, but not the reverse: two extra EU licence groups A and B were created which respectively apply to all or only some of the non-Rhine waterways. Prior to revisions to the Belgrade Convention now being negotiated, mutual recognition still applies to the Danube corridor.
- The EU also needs to complete work on the conditions for transporting dangerous goods, where the initial regulation is drafted by UN/ECE in Geneva.
- Regarding fiscal aspects, there are still differences between the (even high-profile) IWT countries, e.g. different national treatment of gains on disposal/sale of vessels or state support regarding long-term loans.

As noted in the chapter on Human Resources, manning requirements, social standards for the crew and the definition of working time all need attention, in legal drafting but especially in monitoring and enforcement, in order to eliminate unfair competition practices and overexploitation of crew members.

A point in the legislative field which needs to be settled outside the transport sector is that liability and insurance rules – which are part of civil/commercial law – differ, sometimes widely, between countries. Such differences can lead to protracted discussions and substantial legal costs.

3.3.3 Effects of charging

The EU 2001 White Paper describes measures to get to internalising or charging for external effects in transport. In this respect, first steps are currently being taken in Germany (and some Alpine countries) by introducing a trucking toll. In the end, this could lead to a system in which all modes have to account for the external and infrastructure costs (realisation and maintenance) they are responsible for. This would also apply for IWT. A review of the situation on internalising or charging for external effects in transport has provided a limited comparison of IWT and the other two modes. Whilst IWT indeed has comparatively and significantly low external costs (5€/1,000 tkm as opposed to 12,35€ and 24,12€/1,000 tkm for rail and road respectively), the discussion also shows what complex problems should be solved before a future transport pricing system can be set up.

'Scientific' agreement would have to be reached on such aspects as:

- what aspects to take into account;
- how to assess the effects that are not borne by transport users (shippers);
- how to provide monetary values for such effects;
- how to charge or, alternatively, internalise them; and finally
- how to use any revenues that might accrue from charging.

In these circumstances, especially the positive ecological aspects of IWT and the advantages to be gained from a modal shift towards inland navigation deserve emphasis. At the same time, it is unclear if we can expect significant changes in modal split from internalisation of external costs. The results of the RECORDIT project clearly show that in intermodal transport the internal costs of IWT are already very low compared to the other modes, whereas the relatively high transhipment and pre-/endhaulage costs will remain the same or may (relatively speaking) even rise.

One cannot be sure whether the charging of external costs is unlikely to change the cost relations between the modes significantly. Particularly between IWT (in an intermodal chain) and road the cost differences could turn out rather low. This may be regrettable, because high-value goods, which are mainly transported by road nowadays, could be of great interest to IWT. At the other end of the market are bulk goods. These are more sensitive to transport price changes, but since IWT has a high modal share in bulk goods, chances for further increasing seem moderate. Ongoing research will have to point out what the optimal route to the mechanisms for getting prices right would be.

Strengths	Weaknesses
• Liberalised transport operations for international traffic, practically full liberalisation by 2007 • Technical and safety requirements for vessels largely harmonised • Boatmaster's certificates on Rhine and Danube largely harmonised but not yet completed	• Restrictions on cabotage for 3rd countries. • EU-technical vessels regulations outdated. • EU rules on the size and composition of crews incomplete • Liability regimes not harmonised on an international level • Insufficient policy attention and financial means for IWT transport infrastructure.
Opportunities	**Threats**
• Clarify legal situation on the Danube in future revision of the Belgrade Convention • Update EU-Directive on technical and safety requirements for vessels • Progress by CCNR and the Danube Commission in recognising boatmaster licences	• Possible unfair competition following the liberalisation of cabotage • EU rules on size and composition of crews not fixed yet • Lack of internationally harmonised liability regimes causes unnecessary litigation and excessive insurance costs.

Figure 34. Policy and legislation: strengths, weaknesses, opportunities and threats

3.4 Conclusions on modes and competition

3.4.1 Modal choice and decision criteria for actors

The competitive situation of IWT compared to other modes reflects the ability of inland navigation to match shippers' requirements.

Factors in modal choice

Actors in the decision-making process are first of all shippers, freight forwarders and shipping lines. Their modal choice is determined by hard and soft factors.

Soft factors reflect individual preferences that may arise from ingrained habits, prejudice or lack of knowledge about alternatives. For many decision-makers, modal choice is limited to a decision ‘road’ or ‘rail’. This situation arises partly from a lack of market transparency and in many cases it is a matter of history or tradition. This means that the inland navigation sector must bear in mind that meeting market requirements does not necessarily mean that shippers seriously consider IWT as an alternative. The knowledge about IWT’s performance must first be brought into the shippers’ mind and consideration.

A quite similar conclusion can be drawn for the ***hard factors.*** If the IWT sector wants to be further included in logistic chains, it should more strongly present itself in the decision-maker’s circles. Hard factors are based on rational calculations like weighing-up costs and quality aspects. Reliability, frequency, lead-time and flexibility are important aspects, but all factors are strongly related to transport price.

Further aspects

Customers’ requirements generally do not differ by transport corridors, so modal choice might have some impact. Take, for example, the capacity of infrastructure of competitive modes in such corridors. As regards IWT, nautical conditions (such as draught, ice, (bridge) clearance) seriously affect performance and therefore price and quality criteria. For example, the advantage of IWT of high payloads no longer applies in case of low water. Reliability in the form of just-in-time cannot be guaranteed either. The promise of a consistent quality in this respect will be possible only by improving infrastructure.

IWT Affinity

The relative affinity of IWT to types of commodities can be summarised as follows:

- goods shipped in large quantities;
- production sites located on waterways;
- goods to be transported to and from the hinterland of sea ports;
- goods transports that are not restricted by short time frames;
- goods of low value, especially in bulk, where IWT has a cost advantage;
- goods in containers;
- dangerous goods where the safety factor is paramount
- machinery, vehicles, bulky agricultural machines, large building elements, transhipped with efficient Roll on/Roll off technology;
- goods on long distance intermodal transport where the cost advantage of long waterway transport can compensate transhipment and pre-/end haulage costs.

A ‘negative list’, on the other hand, can logically be defined as follows:

- small-sized shipments,
- shipments with short time slots, e.g. perishable goods,
- sensitive goods (paper, tropical fruits, sensitivity to water or vibrations);
- goods carried in non-stackable transport boxes (swap bodies).

Strong ***marketing efforts*** are surely required in order to overcome misconceptions of shippers and freight forwarders regarding IWT weaknesses. This goes a lot further than current (valuable) promotion activities. In this context, one of the main handicaps for IWT transport is the limited contact of ‘single-vessel-operators’ to shippers and their dependence on large IWT operators and freight forwarders, respectively.

The accession of the new member states will have little effect on the shippers’ requirements. As far as matching the cost and quality requirements is concerned, both infrastructure and enterprises of the new Member States (including fleet and crew structure) have a long to way to go to become comparable to the high-profile IWT countries.

3.4.2 Modal shift in practice

In some countries, ***stimulation programmes*** have been carried out, aimed at establishing a more sustainable modal split. There are some useful experiences. First of all, it is crucial that modal shift will not happen ‘by order’: it is the market itself that has to define its transport policy. However, stimulation can in many cases be helpful by setting an example. When it is possible to lower overall line haul costs, stimulation has the potential to generate (sustainable) modal shift. Some conclusions on modal shift stimulation can be drawn on the scale of the enlarged Europe.

Clearly, modal shift and modal shift awareness have to be taken up at the ***company level***. It will not do to optimise framework conditions only, especially at the European level. At company level, the main advantages of IWT that have been referred to earlier (reliability, safety, cost efficiency) will continue to play a central role in considering what modality suits the goods flows best. In the end, the cost advantage, which itself largely depends on the costs of transhipment and pre- and endhaulage, will determine the final trade-off.

Some conclusions, structured to subsectors:

- Modal shift to IWT using ***containers*** is in many cases perfectly viable and can be achieved in an uncomplicated way.
- For ***palletised*** goods, modal shift can only be applied by using concepts such as ‘Distrivaart’ (Figure 35) that can deal with pre- and endhaulage and transhipment problems.
- For ***bulk flows,*** a large part of the potential in the Netherlands and Belgium has already been achieved but in other countries additional yields might be attained.

During the last decade, the IWT sector has been through extensive professionalisation and modernisation. With the continuation of this trend, the sector can continue to offer even more flexible solutions to shippers. Co-operation, both within the sector and with other parties in the logistic chains, is equally important to realise mature and competitive networks and services.

Figure 35. The 'Riverhopper' vessel, decorated with brands of the co-operating companies
Source: http:// home.hetnet.nl/~hoekmanp40/SchipRiverhopper.htm

3.4.3 Intermodal and intramodal competition

The competitive situation of an individual IWT operator (micro-economic level) and the IWT sector as a whole (macro-economic level) are the result of the combination of prevailing factors at both the supply and the demand side of the respective markets. We comment first on the competitive conditions of the IWT industry vs. road and rail and subsequently on the competitive conditions 'within' the IWT mode.

Competitive conditions of IWT vs. rail and road

It has become clear that the features of the IWT infrastructure network are far from evenly spread over the European territory. Moreover, the existing network falls short of integration, sometimes because of missing links and bottlenecks lowering operation efficiency. IWT can, therefore, ***not compete everywhere*** with rail and road transport. A prominent and typical example is the missing link between the Rhine and Rhône rivers: standard vessels cannot use the existing canals and the project to build this link does, for the time being, not bear much priority. The proposals for priority projects of Trans-European inland waterways (TEN-T) suggest that budgets for investments in this sector are rather low in comparison with road and rail.

Improvement of infrastructure (waterways and ports) is often hindered by high costs of investments, although standard methods of feasibility assessment (socio-economic cost-benefit analysis) may be too narrow an approach for investments in multipurpose water management projects. Whereas building new canals or locks may indeed be of low immediate financial return on investment, there are waterway projects that remove local bottlenecks. This allows a rise in capacity of a longer stretch of a river, thus enhancing that of a total relevant corridor. Such improvements can generate ***significant potentials***. Assessment manuals should therefore be resurveyed critically, bearing in mind that a modal shift from road to IWT does have substantial impacts on the environment but also contributes to reduction of road congestion and road maintenance costs. However, in some countries, environmental policy or environmental organisations strongly oppose to infrastructure measures for IWT, as they tend to have a rather big impact on the landscape and water household.

It is widely recognised, even within the IWT sector, that the efforts made by the sector and their representations to gain new clients and acquire new business are insufficient. Marketing needs to be more convincing, presenting the alternatives to road and rail transport in a transparent and logical way for decision-makers (potential customers) to easily understand the advantages of taking freight away from congested highways and railroads.

The forthcoming EU ***enlargement*** will bring both opportunities and threats to IWT business on both sides of ‘old’ and ‘new’ member states:

- All will benefit from increased trade within the enlarged Union and with third countries.
- Acquisitions, mergers and joint ventures are likely between operators in old and new member states.
- The main fear is competition from the road sector by low-cost truck operators in accession countries, in particular on the Danube and the East-West corridors.

Apart from this, there will be a ***continuation of the strong (price) competition*** between rail and IWT as far as dry and liquid bulk goods are concerned, in both the ‘old’ and the ‘new’ EU Member States. The ‘single-vessel-operators’ have limited contacts to shippers and therefore largely depend on intermediates like large IWT-operators or freight forwarders, whereas the railway sector, has large rolling stocks and own or affiliated sales organisations. This leads to unequal competition since the big railway operator is able to drop transport prices on certain relations for strategic reasons, while the IWT ‘single-vessel-operators’ can only compete by reducing their own income.

Intra-modal competitive conditions

The high share of owner-operators in IWT (75 to 90%) in the main IWT countries of the EU ensures a high level of intramodal competition. This has to do with the fact that owner-operators are not bound to working hours, but their crew is.

The full market deregulation and harmonisation, which is part of the ‘acquis communautaire’, is a precondition for fair intramodal competition. This also refers to fiscal treatment of deprecations and gains on disposal/sale of vessels in the different countries, where presently still different standards exist. Full harmonisation of regulations throughout the Union requires efficient monitoring and strict enforcement of rules and regulations. In this context, experience gained in the road sector should be used to provide an efficient observation system on fair competition. In the road sector, for example, it has turned out that from an economic point of view the level of penalties is in some cases too low to prevent road transport operators from infringing social and technical regulations.

Further equipment of vessels (and cargo) with new communication technologies will create an additional cost advantage, thus fostering competition between IWT operators as well as between the modes.

It is often argued that low-cost operators from accession countries will appear in Western markets with prices substantially below actual market prices. The PINE study has specifically looked into this issue. Findings indicate that significant cost differences exist between the West and the East, but probably not to the extent feared by Western operators.

On the other side, private Western European IWT companies are likely to have a competitive edge due to modern equipment, market know-how and organisational efficiency. Both differences however, are expected to decline after a transition period.

Figure 36. Inland ships in the seaport of Rotterdam
Source: BCI

Strengths

Intermodal competition:

- Low average line transport costs (per tkm) for bulk shipments
- Reliable services under predictable weather conditions
- Comparatively high level of transport safety
- Comparatively low external (pollution) costs

Intramodal competition:

- Fully deregulated market
- High share of owner-operators ensures intramodal competition

Weaknesses

Intermodal competition:

- Political preference of rail transport rather than IWT in important European countries
- Limited length of total navigable inland waterways
- Low network density in many areas
- Limited scope for Europe-wide interlinked network
- Low line speed
- Dependence on intermodality for door-to-door services
- Deficits in sector organisation and marketing strategies
- Limited co-operation among operators

Intramodal competition:

- Substantial cost differentials

Opportunities

Intermodal competition:

- Removal of infrastructure bottlenecks
- Implementation of infrastructure links
- Improved transport chains Increasing on-time reliability
- Enhanced intermodality
- Organisational co-operation among chain members

Intramodal competition:

- New communication technologies
- Full harmonisation of regulations and strict enforcement
- Appearance of low-cost competitors from accession countries

Threats

Intermodal competition:

- Truck competition from accession countries
- Priority of investments in road / rail infrastructure

Intramodal competition:

- Entry of low-cost competitors from accession countries

Figure 37. Inter- and intramodal competitive conditions: strengths, weaknesses, opportunities and threats

3.5 Conclusions on potentials for IWT

3.5.1 Prospects in the present transport market

Transport forecasts show that there are small differences expected in the future IWT market segments. The traditional commodity groups using IWT do not offer growing potential for the mode, as they tend to stagnate. The TEN-STAC study, which was mentioned in the sections on the demand-side, gives a growth ranking for IWT European transport based on the NST/R chapters. Low growth (less than 1% per annum) is anticipated for solid mineral fuels, crude oil, ores, metal waste, and fertilisers.

Apart from the NST/R chapters, an important IWT potential is the rising ***container transport.*** Since containers can carry almost every product this means that IWT should in principle be interesting for a large range of goods (NST/R chapters) and economic sectors. This is supported by the Ecorys study (2002). Container transport will witness a substantial increase and IWT will participate in this growth. This 'sector' will be the most important one to IWT because of its high growth rate. On the other hand, if the current overall economic and legal conditions remain, future IWT volumes will not be sufficient to keep the present modal share.

The accession of 10 new members to the EU is not changing this picture significantly. The most promising goods categories are the same for the four corridors as for the EU-15, but growth expectations differ between them. This is especially the case with container transport. During the last decade, container transport has already grown fast in the West but this growth has not been visible in the accession countries yet. The expectations are that the main growth still has to come.

The overall growth in the Rhine and North-South corridor will be up to 60% of the 2000 volumes whereas this will be much higher in the Danube and East-West corridor (up to 180% of the 2000 volumes in the next 20 years).

3.5.2 Additional IWT markets: new concepts and niche penetration

From the previous section it can be concluded that the IWT volumes of some NST/R chapters are expected to grow, but that no significant changes are expected in the modal split. These forecasts are based on the current developments. However, IWT affinity might change over time.

IWT opportunities can arise ***by introducing new concepts and by entering niche markets.*** It has been explained that waste, recycled goods and car distribution are good examples of niche markets with IWT potentials.

Figure 38. Waste Transport by inland ship
Source: INE

Introduction of new concepts can create extra opportunities for IWT. The use of new logistic concepts can open up new markets and expand existing ones. An example is the concept of floating inventory, in which large batches of – unsold – goods that can be considered as inventory are shipped (via IWT) in anticipation of real demand. Among several initiatives, this is done as part of the 'Distrivaart' concept, which focuses on the bundling of flows of non-perishable palletised goods.

Another possibility for IWT to penetrate additional markets, is to promote the modal shift concept. Modal shift programmes can offer individual companies insight whether, and if so, to what extent, IWT can be used for shipping transport flows. The positive results, reached so far, indicate that the programmes should be continued in West European countries and introduced in accession countries.

Strengths

- Potentials of IWT are closely related to IWT network [Belgium, The Netherlands and parts of Germany]
- IWT scale advantages will continue
- Big flows of slow-moving goods: balanced development expected

Weaknesses

- Limited knowledge of logistics chains among IWT actors (supply side)
- Limited knowledge of IWT possibilities among shippers (demand side)

Opportunities

- Increasing level of containerisation
- Development of stackable swap bodies
- Innovative concepts such as floating inventory concept
- Modal shift approach at company level

Accession country related:

- Containerisation perspectives even higher

Threats

- Fast growing economic sectors often road-oriented: low IWT-affinity
- Bad maintenance infrastructure will continue to hamper growth
- Low cost / benefit margins prevent flexibility of sector [or some subsectors]

Accession country related:

- Development of supply in road transport

Figure 39. Goods categories and logistic chains: strengths, weaknesses, opportunities and threats

Chapter 4 **Recommendations**

4.1 Introduction to the recommendations

The ***central objectives*** of the European Commission's transport policy are the establishment of a shift of balance between modes of transport and the elimination of bottlenecks [White Paper, 2001], in order to strengthen the position of inland waterway transport within the European transport system. This way, inland waterway transport will be capable of playing a significant role, contributing to a sustainable economic development in Europe – especially in light of the enlargement of the European Union.

The conclusions of chapter 3 of this report lead to targeted recommendations on how the current situation might be improved. The aim is that IWT would stop the trend of declining market share and maintain its current share against the strong competition. Thus, it would contribute to a sustainable EU transport policy. Its advantages of basically low costs, safety and good environmental qualities would enable IWT to take some pressure of the growing congestion in road transport and play a role more in line with the planned revival of rail transport. Moreover, its natural links with sea transport would also be brought out more clearly.

In order to strengthen the position of IWT within the European transport system, several basic preconditions have to be fulfilled. First and foremost, equal and fair competition within a free and liberalised transport market has to be guaranteed by creating a level-playing field in terms of ***basic waterway- and port infrastructure*** and ***harmonised legislation***. Only seamless transport with vessels of sufficient scale (same infrastructure conditions on the entire transport route), will lead to competitiveness in terms of costs. These two issues are therefore considered to be the ***priority themes*** to be tackled as soon as possible. Within these framework conditions private companies should be able to operate efficiently and unhindered, in competition with each other as well as with other modes.

Next, even though it has already provided positive developments, the sector itself needs to become ***more effective*** in its approach to the market. It needs to ***innovate and co-operate***, both within the sector and with other modes. Greater flexibility, increases in scale and innovative logistic concepts must be taken up and implemented. Integration in logistics chains should get more attention. Transparency vis-à-vis the market needs to be improved, one important aspect of which is that IWT should be clearly presented in networks of transport actors, of the relevant authorities and of the economy in general. If these issues are realised, a genuine market will arise and the sector will be able to develop its potentials.

It is the broad aim of the PINE project to provide in this chapter a series of measures that would help to improve the position of IWT. Following the Conclusions set out previously, this chapter lists a number of recommendations.

Specifically in the area of Inland Waterway Transport, the sustainable transport policy aimed for by the EU and Member States[8] could be attained in a more effective manner if the recommendations noted and described below were followed. Before presenting them in detail, some aspects of these recommendations will be reviewed here. They concern:

- what is proposed;
- the parties addressed;
- priorities and timing.

Some conclusions simply noted the present situation without necessarily calling for further action and we shall therefore not present recommendations for each conclusion. Indeed, in some cases, the necessary action is already under way (e.g. the revision of the Belgrade Convention, updating technical prescriptions for inland waterway vessels, etc). In these cases, our 'recommendation' would be to carry on the work, finetune actions and, if possible, speed up the process.

Of the parties to whom our ideas are addressed, the following should be noted:

- ***The EU institutions**:* whilst the Commission (CEC) is usually the direct addressee, the Council and the EP are usually concerned as well. In some cases the Economic and Social Committee and the Committee of the Regions also need to be involved.
- ***The Member States***: we consider these to include the 10 candidate countries joining on 1 May 2004; in our EU-27 we also include Romania and Bulgaria which are important IWT countries.
- ***Other Authorities*** (including River Commissions): these cover a wide range, from the UN/ECE, responsible inter alia for rules on the carriage of dangerous goods, the ECMT which covers a greater number of countries than the enlarged EU, the two major (Rhine & Danube) and a number of smaller River Commissions to Regional Authorities responsible for waterway infrastructure, water household management, and possibly spatial planning of industrial locations.
- ***(Inter)national IWT promotional organisations*** in the international field, as well as more local organisations, e.g. the Flemish and Walloon bodies for promoting IWT in Belgium.
- ***Actors within, allied to or co-operating with the IWT profession***, ranging from shipping companies engaged in (freight) water transport, freight forwarders and integrators, storage companies and other logistics enterprises, the clients (shippers and receivers), and the important ports sector.

[8] As noted in the Commission's White Paper of 2001 and more recent policy declarations by the Commission, the Council and the European Parliament.

The length and diversity of this list makes it clear that our recommendations are likely to mention only the most important actors concerned and that the parties carrying them through might fall on a wider circle.

Similar considerations apply with even greater emphasis to the subject of ***cost/benefit analyses***. Suffice it here to say that it was not the purpose of this report to examine projects – and recommendations – on the basis of CBAs. We do insist, however, on such analyses being conducted for IWT projects and are recommending that their scope should be widened to include broad environmental aspects as well as effects on competing modes, e.g. relief of road congestion from modal shift to IWT.

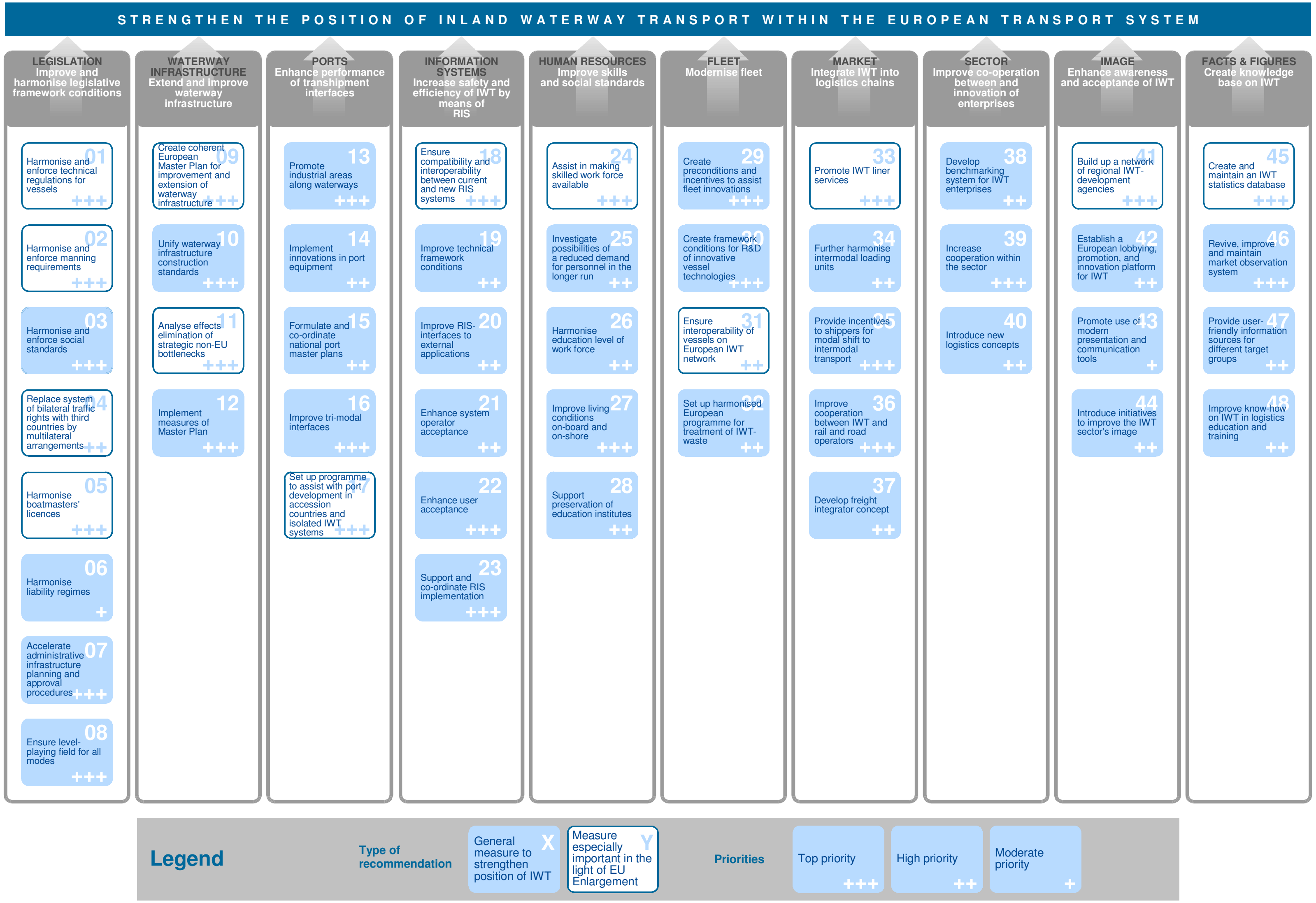
An attempt has also been made to indicate some ***ranking or prioritisation*** of these measures. As regards priorities, it is an indication. However, this proved to be difficult as for instance, a range of recommendations is proposed covering long-term investments which may not materialise for another 20 years, as well as actions which could be launched almost immediately; this does not necessarily indicate which should receive priority. Recipients of this Final Concise Report and in particular the addressees of the recommendations bear these arguments in mind when examining their role in promoting Inland Waterway Transport and thus contributing to a sustainable transport policy of the 21st century.

The recommendations for measures in this report should ultimately be translated into an ***action plan*** covering concrete actions to be taken by the actors mentioned in this overview.

In this chapter, the various recommendations are presented and explained. The recommendations are categorised along the lines of the argumentation set out above, which means:

- legislation;
- infrastructure;
- ports;
- information systems;
- human resources;
- fleet;
- market;
- sector;
- image;
- facts & figures.

Note that in the following sections, there is prioritisation in actors for each recommendation. The main actors are addressed in bold and the actors who should play a supporting role in realising the recommendation are in grey. The scheme on the next page provides an overview of all recommendations.


STRENGTHEN THE POSITION OF INLAND WATERWAY TRANSPORT WITHIN THE EUROPEAN TRANSPORT SYSTEM
LEGISLATION
Improve and harmonise legislative framework conditions
01 Harmonise and enforce technical regulations for vessels +++
02 Harmonise and enforce manning requirements +++
03 Harmonise and enforce social standards +++
04 Replace system of bilateral traffic rights with third countries by multilateral arrangements ++
05 Harmonise boatmasters' licences +++
06 Harmonise liability regimes +
07 Accelerate administrative infrastructure planning and approval procedures +++
08 Ensure level-playing field for all modes +++
WATERWAY INFRASTRUCTURE
Extend and improve waterway infrastructure
09 Create coherent European Master Plan for improvement and extension of waterway infrastructure +++
10 Unify waterway infrastructure construction standards +++
11 Analyse effects elimination of strategic non-EU bottlenecks +++
12 Implement measures of Master Plan +++
PORTS
Enhance performance of transhipment interfaces
13 Promote industrial areas along waterways +++
14 Implement innovations in port equipment ++
15 Formulate and co-ordinate national port master plans ++
16 Improve tri-modal interfaces +++
17 Set up programme to assist with port development in accession countries and isolated IWT systems +++
INFORMATION SYSTEMS
Increase safety and efficiency of IWT by means of RIS
18 Ensure compatibility and interoperability between current and new RIS systems +++
19 Improve technical framework conditions ++
20 Improve RIS-interfaces to external applications ++
21 Enhance system operator acceptance ++
22 Enhance user acceptance +++
23 Support and co-ordinate RIS implementation +++
HUMAN RESOURCES
Improve skills and social standards
24 Assist in making skilled work force available +++
25 Investigate possibilities of a reduced demand for personnel in the longer run ++
26 Harmonise education level of work force ++
27 Improve living conditions on-board and on-shore +++
28 Support preservation of education institutes ++
FLEET
Modernise fleet
29 Create preconditions and incentives to assist fleet innovations +++
30 Create framework conditions for R&D of innovative vessel technologies +++
31 Ensure interoperability of vessels on European IWT network ++
32 Set up harmonised European programme for treatment of IWT-waste ++
MARKET
Integrate IWT into logistics chains
33 Promote IWT liner services +++
34 Further harmonise intermodal loading units ++
35 Provide incentives to shippers for modal shift to intermodal transport +++
36 Improve cooperation between IWT and rail and road operators +++
37 Develop freight integrator concept ++
SECTOR
Improve co-operation between and innovation of enterprises
38 Develop benchmarking system for IWT enterprises ++
39 Increase cooperation within the sector +++
40 Introduce new logistics concepts ++
IMAGE
Enhance awareness and acceptance of IWT
41 Build up a network of regional IWT-development agencies +++
42 Establish a European lobbying, promotion, and innovation platform for IWT ++
43 Promote use of modern presentation and communication tools +
44 Introduce initiatives to improve the IWT sector's image ++
FACTS & FIGURES
Create knowledge base on IWT
45 Create and maintain an IWT statistics database +++
46 Revive, improve and maintain market observation system +++
47 Provide user-friendly information sources for different target groups ++
48 Improve know-how on IWT in logistics education and training ++
Legend
Type of recommendation
General measure to strengthen position of IWT X
Measure especially important in the light of EU Enlargement Y
Priorities
Top priority +++
High priority ++
Moderate priority +

4.2 Legislation

Within Europe, there are still different sets of regulations and technical requirements for inland navigation. This situation creates unnecessary administrative and financial burdens. The main objective would be to improve and harmonise the legislative framework conditions, in order to create an integrated waterway network with fair competitive conditions for all actors, regardless of nationality. Several recommendations can be formulated to achieve this objective of legal harmonisation.

No.	Recommendation	Main actors responsible	Priority
01	Harmonise and enforce technical regulations for vessels – accelerate current progress	**River commissions** EU National administrations	+++
02	Harmonise and enforce manning requirements – accelerate current progress	**River commissions** EU National administrations	+++
03	Harmonise and enforce social standards	**River commissions** National administrations EU	+++
04	Replace system of bilateral traffic rights with third countries by multilateral arrangements	**National governments**	++
05	Harmonise boatmasters' licences – accelerate current progress	**National administrations** River commissions EU	+++
06	Harmonise liability regimes	**UN organisations** EU Professional organisations River commissions	+
07	Accelerate administrative planning and approval procedures	**National, regional and local administrations**	+++
08	Ensure level-playing field for all modes	**EU** National administrations	+++

The harmonisation of technical regulations for vessels [01] is one of the main issues to be tackled with priority. Whilst this work is already under way, it should be completed as soon as (at all) possible.

Once implemented, these regulations should be updated and reviewed regularly to keep in line with technical developments. What may be at least as important as the legal work is to ensure that implementation is properly monitored by inspection and that infringements are penalised so as to remove incentives for breaking the rules.

In parallel with the above recommendation, we suggest that the legal basis for such regulations should be broadened beyond the currently dominant CCNR countries (B, D, F, NL and Switzerland, which is not a Member State) in view of the direct interest of – in particular – the Accession countries. Once implemented, these regulations should be updated and reviewed regularly to keep in line with technical developments. This should be accomplished by broadening the legal basis for EU-wide ship's certificates beyond the currently dominating CCNR countries.

Secondly, the harmonisation and observation of manning requirements [02] is an important issue. EU-wide regulations on size and composition of crew should be developed at a more rapid pace than hitherto and monitored effectively. To this end, co-operation between EC, river commissions and social partners is a necessity.

Certainly, social standards should be harmonised and monitored [03] more intensively. Developing collective labour agreements at least at national level would mean a major step forward in this respect. In order to settle the working time issue a dialogue between social partners should be opened, bearing in mind the SiMAP-judgment recently decided by the European Court of Justice.[9]

Given the unnecessary administrative burdens, the system of bilateral traffic rights needs to be replaced by multilateral arrangements, and if possible be abandoned [04]. Important flanking measures accompanying such a liberalisation process would need to ensure compliance with social, safety and environment standards by vessels from all countries. Furthermore, in light of bilateral traffic rights, the revision of the Belgrade Convention should be seen as an opportunity to define freedom of navigation on the Danube unambiguously.

The ongoing harmonisation of boatmasters' licences [05] requires improved co-operation between the EU and river commissions, as well as a harmonisation of the requirements included in shipping service manuals ('Schifferdienstbücher') as proof of knowledge of specific stretches. Additionally, reciprocal recognition of certificates for use of radar and radio should be achieved.

The harmonisation of liability regimes [06] is another issue that would support the establishment of a level-playing field within the transport market. Despite the emergence of international conventions, much work is still needed before a unified civil law system covering the European waterway network can be said to exist.

[9] In respect of medical staff defines working time as the time during which the employee is present and available for work.

Liability rules should basically not be mode-specific and should not distinguish between national and international transport. Reality is still far from such a situation: carrier liability systems have historically developed at a uni-modal level. Although priority should given to developing an internationally harmonised liability regime for IWT, we argue that possibilities for the creation of multimodal liability regime should be investigated.

It would be helpful to speed up administrative planning and approval procedures [07] for infrastructure planning and the granting of operating permits by local or regional authorities where IWT facilities are involved, e.g. in ports, ‘wet’ sites, etc.

Finally, the introduction of a fair and effective system of pricing infrastructure and external costs [08] for all modes would help in the creation of a level-playing field and thus contribute to fair intermodal competition. Moreover, intermodal competitive conditions in terms of infrastructure budgets, subsidies for driving materials, etc., need to be harmonised urgently. In many countries, rail transport clearly receives a preferential treatment as compared to IWT. These severe distortions of intermodal competitive need to be resolved.

4.3 Waterway infrastructure

A high-quality infrastructure provides the basis for efficient operations for any mode of transport. This goes especially for inland waterway transport, where natural rivers form the backbone of the European waterway system. The navigability – and therefore the capacity – of a waterway are largely determined by (the predictability of) its fairway depth, width, lock capacity and bridge clearances. These parameters are important indicators for the profitability and competitiveness of inland navigation. Other bottlenecks include missing links.

Our analyses have shown that sub-optimal fairway conditions on specific stretches have a significant impact on the overall cost level of inland waterway transport. The main policy objective is therefore to improve and where necessary extend the waterway infrastructure.

No.	Recommendation	Main actors responsible	Priority
09	Create a coherent European Master Plan for improvement and extension of waterway infrastructure	**EU** **National administrations**	+++
10	Unify waterway infrastructure construction standards	**EU** **National administrations** **UN/ECE**	+++

No.	Recommendation	Main actors responsible	Priority
11	Analyse effects of elimination of strategic non-EU bottlenecks	**EU** **National administrations**	+++
12	Implement measures of Master Plan	**National administrations**	+++

First, a coherent European concept for the improvement and extension of waterway infrastructure needs to be drawn up [09]. The development of Trans-European Networks in transport (TEN-T) and the establishment of pan-European corridors stretching beyond the EU have undoubtedly started this process. However, the small number of inland waterway projects in these plans compared to road and especially rail projects suggests an imbalance, which needs to be rectified. The Master Plan we recommend would start by defining an interconnected network of European inland waterways, which would bear a closer resemblance to the major rail network already planned for the EU. Such an IWT network would make a more substantial contribution to sustainable freight transport on the basis of a broadly defined cost/benefit analysis, which takes into account the beneficial effects of IWT, e.g. relieving road congestion.

The Master Plan should result in the definition of a priority list for the elimination of bottlenecks and the construction of missing links in the IWT network with special attention being paid to the improvement of waterways in the accession countries. Another aspect to take into account is formed by the smaller waterways with a strategic feeder function to the main network.

A practical way of helping to implement such a network would be to agree unified construction standards [10] for upgrading IWT infrastructure within such a European network, in order to prevent new bottlenecks. As the implementation of the Master Plan depends on sufficient public funding by Member States and European co-financing, opportunities for public-private partnerships (PPP) should be investigated. At national level, co-ordination between regional and national governments will require adjusting regional and national transport and infrastructure plans with the Master Plan.

Looking forward, we believe that future programmes should also analyse the effects of eliminating strategic bottlenecks, located outside the EU, but which have a major influence on the functioning of the major European waterway network [11][10]. Such a network perspective should prevent sub-optimisation of investments at the EU level.

Finally, the waterway network should be improved and extended while at the same time recognising environmental requirements in infrastructure planning procedures [12]. This is to be achieved by making integral trade-offs of environmental costs and benefits of IWT and

[10] e.g. Serbian and Croatian sections of the Danube.

by the drafting of balanced environmental legislation, which takes into account the positive environmental impacts of IWT.

4.4 Ports

Generally speaking, the quality and density of the ports infrastructure in Western Europe has developed satisfactorily, and has kept pace with economic developments and requirements. This is not the case for part of the ports infrastructure in Eastern Europe. Ports and transhipment sites are often decisive for the competitiveness of entire intermodal chains. The costs for transhipment and pre- and end-haulage often make up 50% and more of the total transport costs. Therefore, sufficient attention has to be paid to measures improving the interface function of ports.

No.	Recommendation	Main actors responsible	Priority
13	Promote industrial areas along waterways	**National and regional administrations** Local administrations	+++
14	Implement innovations in port equipment	**Port authorities** National administrations EU	++
15	Formulate and co-ordinate national port master plans	**National administrations** Port authorities	++
16	Improve tri-modal interfaces	**Port authorities**	+++
17	Set up programme to assist with port development in accession countries and isolated IWT systems	**EU**	+++

First, industrial areas along waterways should generally be made more attractive [13] by adopting a co-ordinated spatial planning policy in favour of IWT. It should aim at reserving sufficient expansion space for ports, and improving hinterland connections of ports by rail and road. Furthermore, providing funds to revitalise company-specific waterway connections in order to get new services going, could prove to be an effective instrument to maintain industrial activities nearby the waterway network.

The implementation of innovations in port equipment [14] has to be boosted. Until now, many research and development efforts have not resulted in actual innovations. The reasons for this relative lack of innovation need to be investigated. Important preconditions for such a programme would be to set up market-oriented port management organisations, to investigate special needs and training programmes for port development in accession countries, and to support joint ventures between ports from Western and Eastern Europe.

Furthermore, national port master plans need to be co-ordinated [15] and followed up by a European master plan for main European ports. The opportunities and niche markets for the secondary network of ports need to be investigated.

The required improvement of tri-modal interfaces [16] can be achieved by initiating and maintaining a port-benchmark system. This should serve to identify opportunities for efficiency gains within ports and terminals. As a special aspect, security requirements for ports should get sufficient attention.

Given the existing backlog as regards port development in most accession states, a programme should be set up to assist with port development in accession countries and isolated IWT systems [17]. Especially the infrastructure for intermodal transport (container terminals) has to be created and modernised, possibly with the help of the western-based private sector.

4.5 Information systems

Five themes were identified as the most important factors to the further implementation of River Information Services (RIS) in Europe:

- compatibility and interoperability among RIS applications;
- realisation of technical framework conditions;
- interfaces between RIS- and external applications;
- acceptance among (potential) system operators;
- user acceptance.

Each of these factors and possible actions will be discussed in the following.

No.	Recommendation	Main actors responsible	Priority
18	Ensure compatibility and interoperability between current and new RIS services	**EU** **European RIS Platform** **River commissions** **Systems and service providers** **RIS operators**	+++
19	Improve technical framework conditions	**National administrations** **RIS operators**	++

20	Improve RIS-interfaces to external applications	**Professional organisations** **IWT enterprises**	++
21	Enhance system operator acceptance	**National administrations**	++
22	Enhance user acceptance	**Professional organisations** **National administrations**	+++
23	Support and co-ordinate RIS implementation	**EU** **European RIS Platform** **River commissions**	+++

First compatibility and interoperability between current and new RIS systems have to be ensured [18]. Therefore, standards need to be developed and maintained for:

- notices to skippers
- European Inland ECDIS standard
- Electronic Ship Reporting
- the availability of GPRS
- Radio-Telephone Service, and
- Tracking and Tracing by means of identification systems

The creation of a supra-national agency for RIS standards could help to co-ordinate the involvement of international organisations (ISO, UN/ECE, EC, CCNR, DC). This agency should also determine a certain minimum required level of RIS application throughout Europe.

Technical framework conditions need to be improved [19], in order not to let lacking equipment block the development of RIS. The rapid dissemination of internet communication is a step in the right direction and enervates the common perception of a traditional and conservative sector.

RIS applications cannot be developed as stand-alone applications, but have to be linked to 'the outside world'.

Therefore, interfaces should easily be achievable to following external applications [20]:

- waterway authorities;
- maritime information systems;
- seaport and inland port information systems;
- intermodal information systems;
- cross-border systems;
- supply chain management software.

The advantages of RIS are clear to all competent waterway authorities. Nevertheless, acceptance among potential system operators needs to be enhanced [21]. First, the know-how and experiences among these actors could be increased by means of dedicated training programmes and the nomination of a specialised responsible RIS authority per country. Secondly, the investment costs of RIS should be reduced. This can also be reached through harmonisation of technical standards and the development of common accepted guidelines for the planning, introduction and operation of RIS.

Also, user acceptance has to be enhanced [22]. This can first be achieved by improving the knowledge on the user requirements. Secondly, opportunities of RIS are to be communicated to the potential users in good quality. Thirdly, confidentiality and integrity of data exchange needs to be ensured.

Finally, the implementation of RIS needs to be supported and co-ordinated [23]. Such an initiative should involve setting up a co-ordination and financing platform and the integration of strategic non-EU States. Special areas, which deserve focused attention, deal with the further development of RIS towards logistics and security services and the preparation of technology transition in view of Galileo.

4.6 Human resources

Despite the productivity gains achieved in the last decades, several Western-European countries are faced (or will be faced) with a shortage of skilled employees. Some of the basic causes of this development are the negative image of the IWT sector, involving long periods away from home, differences in salaries, and the general (perception of the) working conditions and profession profile. Consequences of these developments can be expected in terms of reduced safety, social problems of foreign personnel (e.g. insufficient social security, social isolation) and the limitation of future growth figures of IWT. Several recommendations have been made in order to tackle these serious issues.

No.	Recommendation	Main actors responsible	Priority
24	Assist in making skilled work force available	**IWT enterprises** **Professional organisations** National administrations	+++
25	Investigate possibilities for a reduced demand for personnel in the longer run	**IWT enterprises** Professional organisations	++
26	Harmonise education level of work force	**National administrations** EU Professional organisations River commissions	++

No.	Recommendation	Main actors responsible	Priority
27	Improve living conditions on-board and on-shore	**IWT enterprises** Professional organisations National administrations	+++
28	Support preservation of education institutes	**National administrations** Professional organisations EU	++

Various measures can help to make a skilled work force available [24]. First of all, investing in education and training programmes would be necessary for maintaining the necessary education levels. The main responsibility for this would lie with the IWT sector itself. This action could be supported by national governments by providing fiscal incentives to employers for additional education and training of their staff. Designing special campaigns could prove to be an additional way of attracting personnel from other business sectors.

In addition to the increase of supply, there is also the possibility of reducing the demand for personnel [25] in the longer run. This could happen through productivity gains, e.g. by the employment of larger and more efficient ships where possible, by automating certain tasks and better use of RIS. These strategies would not exclude each other.

Harmonisation of education levels [26] would significantly contribute to higher transparency of the labour market. As a result, employers could rely on the qualifications of applicants, opening up a reserve of available workforce. Such a harmonisation could be achieved by a harmonisation of education curricula, by the development of international education exchange programmes, and by defining special education programmes for applicants from accession and third countries.

A different aim is to make the profession more attractive for those who enter and those who stay. To a large extent, this involves improvement of living conditions, both on-board and on-shore [27]. This measure deals with the establishment of social security, with stable and long-lasting employment contracts, as well as the provision of facilities supporting family life. This means taking care of schools for children of IWT families, social events, meeting places, easy access to communication tools, etc.

Finally, the education of newcomers on the labour market can only be guaranteed by securing the existence of functioning education institutes [28]. The last decades have shown a steady decline in such educational institutions. The know-how of these schools needs to be preserved urgently.

4.7 Fleet

The European IWT fleet has many faces. There are many vessel types that have been adjusted to the requirements of specific river regimes or customer requirements. Moreover, specialised ships have been developed for specific market segments. One fundamental difference between a vessel and other transport vehicles is the relatively long lifetime. This has advantages (long economic write-off time) as well as disadvantages (relatively slow take-up of innovations as well as adaptation to (changing) market requirements).

No.	Recommendation	Main actors responsible	Priority
29	Create preconditions and incentives to assist fleet innovations	**EU** **National administrations**	+++
30	Create framework conditions for R&D of innovative vessel technologies	**EU** **National administrations**	+++
31	Ensure interoperability of vessels on European IWT network	**EU** **National administrations**	++
32	Set up harmonised European programme for treatment of IWT-waste on-board	**National administrations** **River commissions** **Port authorities**	++

First of all, prerequisites (e.g. knowledge) and incentives should be created to assist in fleet innovations [29]. This can for instance be realised by granting loans over longer periods for the purchase of ships (comparable with loans for real estate), by working out models to raise the financial potential of IWT enterprises and building up long-lasting supply chain partnerships to allow further specialisation (e.g. vertical integration, creating a pool of IWT operators, in order to generate economies of scale).

Secondly, sufficient framework conditions for R&D of innovative vessel technologies and modernisation measures should be guaranteed in order to ensure the competitiveness of IWT in the long run [30]. Subjects to be investigated further within the EU Framework Programme include:

- engine and propulsion technology;
- safety effects of given trend towards scale increase;
- double hull technology;
- interaction between vessel-waterway and vessel-vessel in the context of better infrastructure and vessel utilisation;
- environmentally friendlier vessels;
- fast and cost-efficient vessels for dedicated market segments;
- vessels for seamless river-sea transport;
- opportunities for further automation on-board;

- possibilities of improving navigational supports;
- improvement of human-machine interfaces.

Thirdly, the interoperability of vessels on the European IWT network has to be ensured [31]. The main basis for this should be the further harmonisation and observation of technical regulations for vessels (discussed under the legislation section 4.2).

Besides, further aspects of relative importance can be mentioned. A specific issue at the fleet level regarding environmental aspects is the treatment of waste from operational processes on board (e.g. bilge water, household waste). A programme for waste treatment on-board is to be elaborated and later implemented [32]. Non-EU countries should be explicitly integrated into this programme.

4.8 Market

In traditional supply chains, the inland navigation system was in practice de-coupled from the overall chain by large time and stock buffers on the various interfaces. The success of the inland navigation system in new and more demanding markets, however, fully depends on its integration into and adaptation to the requirements of the entire door-to-door logistic chain. If the entire supply chain is to function as a synchronised clockwork, inland navigation will have to adjust to the logistics requirements of preceding and subsequent links of the supply chain. Several examples have shown that this has occasionally been achieved, but there is obviously much room for improvement if the role of inland navigation in intermodal door-to-door supply chains is to be extended. For such an extension (mainly concerning general cargo), the use of Intermodal Loading Units (ILUs) should be regarded as a valid option.

No.	Recommendation	Main actors responsible	Priority
33	Promote IWT liner services	**IWT enterprises** National administrations	+++
34	Further harmonise intermodal loading units (ILUs)	**EU** IWT enterprises	++
35	Provide incentives to shippers for modal shift to intermodal transport	**National administrations** EU	+++
36	Improve co-operation between IWT and rail and road operators	**IWT enterprises** National administrations Railway and road operators	+++
37	Develop freight integrator concept	**Logistics service providers** IWT enterprises	++

The emergence of IWT liner services should be further encouraged [33]. This can be achieved by providing aids to cover start-up losses in newly developed services. Moreover, co-operation initiatives between IWT companies are to be supported. As an important pre-condition, international IWT liner services require stable and uniform fairway conditions (see section 4.3). Only under such circumstances, IWT will be capable of being a reliable supply chain partner.

A series of flanking measures are connected to the required further harmonisation of intermodal loading units (ILUs) [34]:

- acceleration of load unit standardisation by means of EU co-financing;
- co-finance necessary adaptations in port equipment;
- optimisation of stowing plans (and software) to cope with a mixture of loading units;
- EU funding for learning actions to demonstrate use of intermodal loading units.

Additionally, shippers should be encouraged to consider a modal shift to IWT [35], for instance by supporting feasibility studies aimed at such a modal shift. As bottlenecks often are encountered on the interfaces and not on the IWT stretch itself, sufficient attention should be paid to developing pre- and end-haulage concepts.

In order to integrate IWT better into existing logistic chains, the co-operation between IWT and other modes should be improved [36]. Important elements of such a measure are the creation of a 'one-stop-shop' and common booking programmes for shippers. Additionally, we support current ideas for establishing the profession of freight integrators [37] on a European scale, with harmonised qualifications.

Important supporting measures to better integrate IWT in logistic chains include the establishment of an intermodal liability regime (see 4.2), the availability of port infrastructure for intermodal transport (see 4.4), and the integration of IWT into intermodal information systems (see 4.5).

4.9 Sector

The clear tasks for administrations at different levels is to strengthen the position of IWT within the European transport system (e.g. providing waterway infrastructure, harmonised legislation). Besides that, IWT enterprises do have an own responsibility to tackle the main challenges at hand. The major tasks to be taken up by the sector itself – professional organisations and IWT enterprises – are concentrated around co-operation and innovation.

No.	Recommendation	Main actors responsible	Priority
38	Develop benchmarking system for IWT enterprises	**Professional organisations** **IWT enterprises**	++
39	Increase co-operation within the sector	**IWT enterprises**	+++
40	Introduce new logistics concepts	**IWT enterprises**	++

A measure to improve the operational performance of IWT enterprises or to trigger the awareness of improvement opportunities would to be initiate a benchmarking system for IWT enterprises [38]. This measure would involve collection and maintenance of performance data by a neutral party. The availability of such data would enhance the professionalisation of the sector as a whole.

Another very important recommendation is aimed at co-operation within the sector [39]. While shippers and competing modes are going through a phase of increase of scale and internationalisation, the IWT sector is still very scattered and enterprises are often small one-vessel companies. It therefore becomes more and more difficult to cope with the logistic patterns and demands of shippers and to compete with e.g. road-oriented logistic services providers. Increase in scale in IWT can be reached in two different ways: the creation of new companies, formed by mergers of existing ones or the establishment of co-operations of small enterprises in order to reach a certain scale.

In order to be able to meet shipper's demands in a more pragmatic way, it would be wishful to develop and implement new logistic concepts [40]. As shippers nowadays are looking for tailor-made solutions for the shipping and storage of their goods, IWT should collaborate on this with the shippers themselves and come-up with new logistic concepts. Existing initiatives as Distrivaart, bundling of transport flows in networks and waste transport should be continued and expanded. New studies and projects should be supported by (inter)national authorities and IWT organisations.

4.10 Image

Strong – and unfortunately rather negative – perceptions exist in the minds of logistics decision makers of the logistics performance levels and competitive strength of the inland waterway system. Decision makers may not always be aware of the full capabilities of the IWT system and the sector may not be aware of new technology opportunities. Altogether, people do not always act on facts, but on the basis of their perception of the real world. As a result, improving the information provided to these parties beyond current promotion activities, would contribute to a better competitive position of inland navigation.

No.	Recommendation	Main actors responsible	Priority
41	Build up a network of regional IWT-development agencies	**National authorities**	+++
42	Establish a European lobbying, promotion, and innovation platform for IWT	**Professional and promotion agencies** **IWT enterprises** **EU**	++
43	Promote use of modern presentation and communication tools	**Professional and promotion agencies** **IWT enterprises** **Education institutes**	+
44	Introduce initiatives to improve the IWT sector's image	**Professional and promotion agencies** **IWT enterprises**	++

The position of IWT can be given support by setting up a network of regional IWT-development agencies [41]. These agencies, which already exist in some Member States, would be responsible for identifying local and regional shortcomings in waterway or port infrastructure, operational performance, etc. and propose targeted actions to combat these shortcomings. These additional regional agencies should support national IWT policy making and its implementation.

At the European level, an IWT lobbying-, promotion and innovation platform should be created [42]. This platform should set up joint sales and promotion programme aimed at shippers, create goodwill as regards IWT among general public, and raise the awareness among national and European policy makers. Likewise, a dedicated European IWT innovation platform should support the dissemination of innovations by communicating know-how based on R&D, identify opportunities for joint innovation projects between companies, shift the focus to applied and market-driven research and provide subsidies or publish multimedia tools for presenting research results and innovations.

In order to support the above measures, promotion of the use of modern presentation and communication tools is to be promoted [43]. This would mainly be concentrated on implementing information portals and modern communication tools.

Finally, specific initiatives should be introduced to improve the sector's image [44]. Possible measures in this direction would be to investigate possibilities for a 'European day of inland navigation', setting up a certification system for environmentally friendly IWT companies, or introducing an award for the 'most innovative skipper of the year'.

4.11 Knowledge

Facts and figures provide vitally important information for all decision-makers, whether they are skippers, shippers or policy makers. What we experienced in various parts of this project was ***a lack of up-to-date, compatible and reliable data***. This was bad enough at regional, country and EU level, but particularly serious in looking at the four corridors. Our recommendations therefore seek to remedy this lack and inconsistency, whilst remaining aware that obtaining statistics, collecting, publishing and using them involves costs for the profession as well as the authorities concerned.

No.	Recommendation	Main actors responsible	Priority
45	Create and maintain an IWT statistics database	**National administrations** EU River commissions	+++
46	Revive, improve and maintain market observation system	**EU** National administrations River commissions	+++
47	Provide user-friendly information sources for different target groups	**Professional and promotion agencies** National administrations River commissions	++
48	Improve know-how on IWT in logistics education and training	**Professional and promotion agencies** National administrations River commissions Education institutes	++

IWT databases should be created or updated and properly maintained [45]. Inter alia, databases are needed on waterway infrastructure, the fleets, cargo developments, origin-destination relations and available vessel space. Sufficient funding for these data gathering and processing activities should be made available. This implies establishing EU-wide harmonised definitions and data collection procedures in the Member States and, if possible, applying these in non-EU European countries as well. National administrations should be encouraged to provide additional data, which may be of more local interest.

A most important application of such databases, which would vitally support policy making in a sector that has in some areas been burdened by structural overcapacity, is a market1 observation system [46]. Such a system, which was operative at EU level until recently, should be capable of monitoring market prices and developments in the IWT sector, investigating impacts of policy initiatives and identifying bottlenecks in the labour and capital markets.

Raw statistical data should be converted into user-friendly information sources for different target groups [47]. This can be achieved by developing electronic and interactive info-services connected with databases. The most important target groups for which such information sources should be made available are (potential) IWT users and policy makers.

Finally, the logistics know-how on IWT should be improved [48]. Important actions in this field would be to develop dedicated IWT e-learning tools and to define a strategy for dissemination of know-how into the IWT education and training system.

List of Abbreviations

▪ ADNR, ADND	(Accord relatif au transport de matières dangereuses sur le Rhin/Danube) Regulation on the carriage of dangerous substances on the Rhine/Danube
▪ ARA seaports	Antwerpen – Rotterdam – Amsterdam
▪ CBA	Costs/benefit Analysis
▪ CCNR	Central Commission for Navigation on the Rhine
▪ CEC	European Commission
▪ CEEC	Central and Eastern European Countries
▪ CEMT	(Conférence Europeenne des Ministres des Transport) European conference of Ministers of Transport (ECMT)
▪ CLNI	Strasbourg convention on limitation of liability for inland navigation vessels
▪ CMNI	Budapest convention on the contract for the carriage of goods by inland waterways
▪ DC	Danube commission
▪ DG-TREN	Directorate-General Transport and Energy of the EU
▪ EBU	European Barge Union
▪ EC	European Commission
▪ ECDIS	Electronic Chart Display and Information System
▪ ECMT	See CEMT
▪ EDP	Electronic Data Processing
▪ EFIP	European Federation of Inland Ports
▪ EP	European Parliament
▪ ESC	Economic and Social Committee
▪ ESO	European Shippers Organisation
▪ ETF	European Transport Workers' Federation
▪ EU	European Union
▪ GNSS	Global Navigation Satellite System
▪ ILU	Intermodal Loading Unit
▪ IMMUNITY	Impacts of Increased and Multiple Use of Inland Navigation and Identification of Tools to Reduce Impacts (EU project)
▪ INE	Inland Navigation Europe
▪ ISO	Common short name for the International Organisation for Standardisation
▪ IWT	Inland Waterway Transport

- IWW Inland Waterway
- LNRL Low Navigation and Regulation Level
- NACE (Nomenclature générale des activités économiques dans les Communautés Européennes) General Industrial Classification of Economic Activities within the European Communities
- NST/R Nomenclature uniforme des marchandises pour les statistiques de transport, révisée (Standard Goods Nomenclature for Transport Statistics, revised)
- PRIMES Computable Price-driven equilibrium Model of the Energy System and markets for Europe (EU project)
- RECORDIT REal COst Reduction of Door-to-door Intermodal Transport
- RVBR (Reglement de visite des bateaux du Rhin) Regulations on Inspection of Rhine Vessels
- SME Small and medium-sized Companies
- SWOT Strengths, Weaknesses, Opportunities and Threats
- SWP Sub Work Package
- TEN-STAC Scenarios, Traffic Forecasts, and Analyses of Corridors on the Trans-European Transport Network
- TEN-T Trans-European Networks for Transport
- TEU Twenty-feet Equivalent Unit (unit of measurement for containers)
- Tkm tonne-kilometres
- Tdw tonnes-deadweight
- UN/ECE Union of Industrial and Employers' Confederations of Europe
- UN/ECE United Nations Economic Commission of Europe
- VNF Voies Navigables de France

Countries

- A Austria
- B Belgium
- BG Bulgaria
- CH Switzerland
- CZ Czech Republic
- D Germany
- DK Denmark
- E Spain
- EE Estonia
- EL Greece
- F France
- FIN Finland
- HU Hungary
- I Italy
- IRL Ireland

- L Luxembourg
- LT Lithuania
- LV Latvia
- NL The Netherlands
- P Portugal
- PL Poland
- RO Romania
- S Sweden
- SI Slovenia
- SK Slovak Republic
- UK United Kingdom

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02-227

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