



Chemical Logistics Cooperation in Central and Eastern Europe

Feasibility Study

Strengthening the Danube Waterway in Austria as Part of Corridor VII for the Chemical Industry

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Authors:

**Hofmann-Prokopczyk, Hannelore
Starkl, Friedrich
Rotter, Stefan**

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ChemLog Potential Analysis

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It has to be adverted that though elaborateness neither the authors nor the editor take responsibility for the correctness of the underlying data and statements in the study.

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1 Project ChemLog – Chemical Logistic Cooperation in Central and Eastern Europe

1.1 Preface and acknowledgments

The Chemical Industry in CEE is mostly based on Russian raw materials. The use of roads and railways together with the development of pipeline systems for the connection of raw material locations and production locations all play an important role in this context. As a result of historic decisions the important chemical locations in Poland, the Czech Republic, Slovakia, Austria, Hungary, Novara (IT) and East Germany are sites with no direct access to sea ports. Therefore, these locations have competitive disadvantages, especially in relation to the higher costs compared to chemical locations in Western Europe that have excellent access to sea ports and connected waterways. The existing cost disadvantages resulting from the traditional location and missing West-East connections are an important development barrier for the Chemical Industry in CEE. These competitive disadvantages are further enhanced by the disproportionate high usage of road transport, whereas railway and inland waterway transport still have unexhausted capacities.

In many regions, especially in Eastern Europe, road traffic has reached its capacity limits. Further deficits are a barrier to the development of the chemical clusters: Capacities and the expansion of transport infrastructure are not sufficiently oriented towards the needs.

There is a lack of harmonisation of technical, administrative and social regulations and laws in Europe. Furthermore insufficient European coordination of transport related decisions on the part of the countries concerned remains a problem. There are shortcomings in the organisation of transport, especially in the conception of intermodal terminals and the further development of technologies for the transfer of goods between different transport modes and equipment. Insufficient priority is given to freight traffic compared to passenger traffic. Finally, there is no collective approach to share and find logistic solutions in the relevant regions and countries.

The target group of the project consists of chemical enterprises, logistics service providers, national and regional politicians, national and regional ministries for transport and economic affairs, regional development agencies, chambers of commerce and research institutions. There are about 2500 chemical enterprises and 200 enterprises in the area of logistics service providers specialised in chemicals in the partner regions. Furthermore, there are about 50 chambers of commerce and 50 research institutes. The chemical enterprises and logistics service providers are interested in improving framework conditions to transport their products and feedstock in Central Europe in terms of reduced costs, increased speed, better reliability and flexibility as well as higher safety. The logistics service providers are interested in improved logistics and transport of chemical goods. The national and regional administration and chamber of commerce want to improve chemical logistics to strengthen competitiveness of the economy.

Transnational cooperation is vital for the achievement of the expected results due to the complexity and transnational dimension of chemical logistics in Central Europe. The Chemical Industry itself is one of the most globalized industrial branches in Europe, 50 to 60% of its products are exported. Moreover, the largest parts of the feedstocks are transported to the production locations, mostly from Russia. Therefore the chemical industry is responsible for a large share of transnational freight transport in Central Europe.

The project aims to work on different dimensions of logistics e.g. rail, waterway, intermodal transport, pipelines and harmonisation of regulations. The biggest barriers in these areas result from different framework conditions, policies and regulations in the partner countries. The lack of cooperation at transnational level in the area of transnational logistics is the main reason for many deficits in the area. The project specifically wants to improve this situation. Moreover the division of Europe during the Cold War has not enabled the development of functioning transport networks similar to those that have emerged in Western Europe in the past decades. Therefore the enlargement of the European Union is still a specific challenge for chemical logistics.

In order to develop solutions to the above mentioned problems it is necessary to bring together the relevant stakeholders from the partner countries in order to initiate a transnational cooperation process. This process will allow the transfer of experience and mutual learning. Furthermore feasibility studies for specific transnational logistic projects will be developed under participation from partners of different countries. Finally the development of the joint strategy and action plan is an undertaking that can only be agreed by partners from the relevant countries in order to agree on future priorities for infrastructure planning.

1.2 Project Idea

The project idea has been developed by the partners during the discussion of the High Level Group for the Competitiveness of the Chemical Industry in Europe, which united high-level representatives from the European Commission, Member States and Industry. The European Chemical Regions Network, which represents the joint interest of 19 chemical regions from 9 countries participate in the High Level Group and has proposed a more intensive cooperation in the area of logistics in CEE, which has found wide support by the High Level Group Members. In order to further develop the project idea a workshop was organised on 20.02.08 in Magdeburg with participants from Germany, Poland, the Czech Republic and the European Commission, which have agreed on the main objectives and activities of the projects and a successful project application as been developed. The project is financed by the INTERREG IVB Central Europe Programme and was approved on 25.09.2008. The project duration is 3 years from November 2008 to October 2011 with an overall budget of 2.2 Mio. Euro, whereas 1.7 Mio. Euro are financed by the European Regional Development Fund (ERDF).

1.3 Project Partners

The partnership consists of different entities, which fulfil specific functions:

- Regional and Local authorities, such as ministries for economic affairs or transport, municipalities or regional development agencies,
- Research and Cluster organisations,
- Interested Groups and Associations

This composition of partnership allows an efficient division of work and ensures a good implementation of project activities. The public regional and local authorities have the responsibility for infrastructure planning, they provide sound framework conditions and offer substantial funding resources in the area. They are especially working in view of joint strategy development and action planning.

- Lead Partner: Ministry for Economy and Labour of Saxony-Anhalt (DE)
- Ministry for Regional Development and Transport Saxony-Anhalt (DE)
- isw Institute for Structural Policy and Economic Development (DE),

- Polish Chamber of Chemical Industry (PL)
- Association of the Chemical Industry Czech Republic, (CZ)
- Association of Chemical and Pharmaceutical Industry of Slovak Republic (SK)
- Usti Region (CZ),
- Province Novara (IT),
- FH OÖ Research and Development GmbH / Logistikum Competence Centre, Steyr (AT),
- Regional Development Holding, Budapest (HU)

The research and cluster organisations fulfil a mediator function between the political and industrial environment. They are specifically focussing their efforts in the analysis and exchange of experience. The identification and transfer of best-practice will be mainly supported by these entities. Furthermore they actively contribute to the mainstreaming and evaluation of the project.

The interest organisations have the direct contact to the enterprises, one of the most important target groups of the project. They will ensure the integration of the needs and interests of the enterprises in the project activities and disseminate the results to a broad range of relevant stakeholders. Furthermore the development of the feasibility studies is an important activity for them.

Altogether the partners are committed to establishing an intensive cooperation to improve the situation for chemical logistics and provide concrete examples and recommendations for actions in the future. The combination of the specific strengths and joint interests of the partners will ensure a successful outcome of the project.

The relevant stakeholders and key actors are chemical enterprises and logistics service providers and chambers of commerce from industry side, the national and regional ministries and development agencies from political side and research institutions from academia. The industry stakeholders will be involved in the project in the framework of the regional stakeholder meetings. Furthermore project partners such as the Chemical Industry Association will ensure involvement from industry. The political level will also be actively involved in the project activities, by participation in meetings or development of the action plan. Especially the advisory group meeting will be used to involve the political level (national and EU) in the mainstreaming of results. The analysis and exchange of experience activities will be implemented under the involvement of relevant research institutions. The different types of project partners will use their existing links to the relevant stakeholders for the project.

Transnational cooperation is vital for the achievement of the expected results due to the complexity and transnational dimension of the chemical logistics in Central Europe, as the biggest barriers in these areas result from different framework conditions, policies and regulations in the partner countries.

1.4 Project Objectives

The project ChemLog has the following general objectives:

1. to strengthen territorial cohesion in Central Europe by developing a Central and Eastern European Chemical Logistics Network as a platform for the joint discussion and cooperation for chemistry related transport issues,
2. to promote the internal integration by improving chemical logistics in Central Europe and

3. to strengthen the competitiveness of the chemical cluster in better connecting raw material and production locations and better accessing the growth markets in CE Europe.

The specific objectives are:

1. Strengthening rail and waterway transport for chemical goods in comparison to road in order to improve safety and environmental protection, to reduce costs and increase speed and flexibility of chemical logistics.
2. Support the development of logistic centres for intermodal transport and their integration in infrastructure planning.
3. Facilitate the connection of pipelines for an effective Central and Eastern European Chemical Logistics Network.
4. Initiate transnational know-how and technology transfer for the development of transport and guidance systems focused in the West-East direction.
5. Supporting the realisation of Trans-European Traffic routs and harmonisation of regulations and coordinated planning of infrastructure and the use of Structural Funds.

The project will strengthen the territorial cohesion in Central Europe by developing a Central and Eastern European Chemical Logistics Network, which will improve the framework conditions for economic growth and regional development. A modern and safe infrastructure is also the precondition for new investments, creation of employment and increased productivity. Especially in regions lagging behind and in the new member states improved infrastructure will give impulses for growth and convergence and improve life quality. The project will promote the internal integration in Central Europe by improving chemical logistics. The countries of Central Europe are especially disadvantaged due to existing barriers and missing connections alongside the former border between Eastern and Western Europe. The project will especially work on the further development of the Transeuropean Transport Networks with specific focus on the transnational projects in the partner countries. The project will strengthen the competitiveness of the Chemical Industry in Central Europe, which is a major economic industry with strong impact on innovation and employment in the partner countries. Furthermore the Chemical Industry has a strong influence on many other industries alongside the value-chain. A better connection between the chemical locations is a precondition for the sustainable development of the industry in the long-run, especially taking into account the increased competition from Asia and the Far East. The know-how and technology transfer will help to increase the innovation capacity of the partner regions in the area of chemical logistics. Therefore the project will actively contribute to the Lisbon Agenda.

1.5 Project Activities

Besides Management in work package 1, Dissemination activities will be implemented in work package 2. Work package 3 will focus in the first year on the analysis of the current situation and identification of needs and best practice. Work package 4 will work on the preparation of investment, by implementing 4 feasibility studies of infrastructure project with transnational relevance. The final package will focus on the strategy development and the mainstreaming of the project result. The major activities such as the establishment of the Central and Eastern European Chemical Logistics Network and the Joint Strategy and Action Plan will be implemented in the last year of the operation.

2 ChemLog Feasibility Study

2.1 Feasibility Study within the Context of the ChemLog Project

The SWOT Analysis has been the first step of the ChemLog project to identify the internal strengths and weaknesses of chemical companies and the external opportunities and threats for chemical logistics in Central Europe. On this basis the project partners have drawn general recommendations on needs for future actions and improvements, which have been described in this chapter.

These general recommendations will be used for the further development of the project activities with the objective to achieve the mainstreaming of projects results with a high practical implementation orientation for the improvement of framework conditions and the support of infrastructure development for chemical logistics in CEE.

In the next step of the work package "Analysis and Exchange of Experience" the identified strengths and weaknesses will be used to further explore best-practice solutions in chemical logistics in the partner countries (from June to November 2009). This analysis will initiate an intensive process of exchange of experience among the partners and involved stakeholders and should allow mutual learning. With this activity the project wants to facilitate deeper cooperation in the area of chemical logistics in CEE and support the transnational know-how transfer.

The general recommendations of the SWOT Analysis will be further developed and specified in the course of the project with the objective to agree on concrete recommendations for measures and projects for chemical logistics and infrastructure. The project partners should set priorities for specific measures and projects in order to focus joint efforts on promising activities with a high impact for the chemical cluster in CEE. The tangible output of this exercise will be a short list of potential concrete measures and projects with a description of the current situation, needs for improvements and a road map for implementation. This mainstreaming process will reflect the different dimensions at policy level: European, national and regional; at stakeholder level: politics, industry, Logistics service provider and the time span: long term, mid-term and short-term. The project will establish a Policy Advisory Group to involve the relevant stakeholders from different policy levels and industry in the mainstreaming process.

In the process of further specification of potential measures and projects, the partner will implement several feasibility studies from November 2009 until October 2010. These feasibility studies will focus on transnational infrastructure projects in the area of railway transport, intermodal transport, waterway and pipeline transport. These in-depth studies should be used to assess the feasibility of selected infrastructure projects with high potential for the Chemical Industry and contain detailed conclusions for the realisation of this infrastructure in view of investment preparation.

The Logistikum.research put the focus of the feasibility study on strengthening the Danube waterway for the chemical industry. Reasons for this focusing are different. First, the SWOT Analysis conducted in the advent of ChemLog, had yielded that inland waterway is perceived to be a highly competitive transport mode. This thesis is linked to some prerequisites and future developments. As examples here, the following could be mentioned:

- The prospective internalization of external costs which rearrange the modal split within the Danube corridor in favor of inland waterway
- Elimination of bottlenecks within the system of inland waterway transport (figure 8)

- Increasing the trimodal connectivity and integration the inland waterway into transport chains

Further reasons for giving attention to the inland waterway transport will be presented in the course of the study in hand.

In the last year of the project from November 2010 to October 2011 the partners will focus their efforts on the strategy development and mainstreaming. On basis of the mainstreaming process and the results of the feasibility studies the partners will develop a joint strategy and action plan with concrete implementation steps for the improvement of chemical logistics in CEE. This strategy and action plan will contain a list of priority infrastructure projects and measures for cooperation and a description of relevant stakeholders and partnership for implementation of these plans. Furthermore the financial framework for this will be specified in view of combining public funding from different sources (EU, national and regional) and private investments. The Strategy and Action Plan will also include a time plan with concrete implementation steps and milestones in the years after the end of the ChemLog project. Finally the project will establish a European Network for Chemical Logistics Cooperation in CEE in order to create a supporting structure to implement the recommendations of the strategy and action plan and to continue cooperation in the area of chemical logistics after the project end.

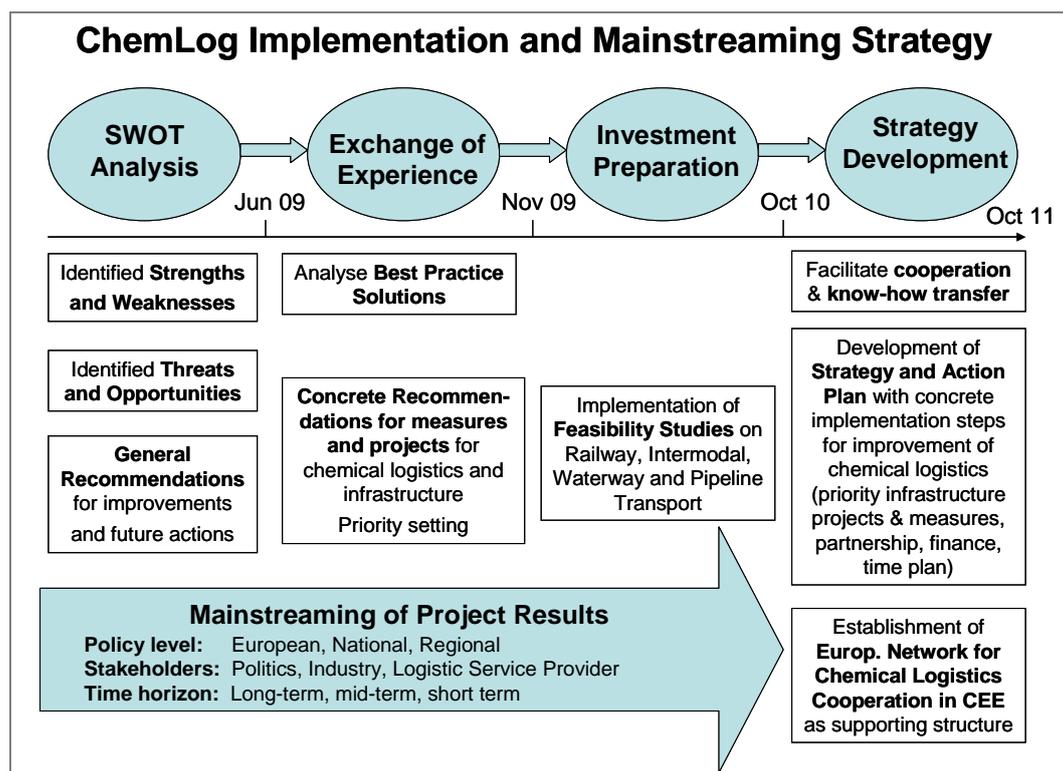


Fig. 1: Approach of SWOT Analysis¹

¹ Source: own diagram.

2.2 Structure of Feasibility Analysis

The first two chapters deal with information about the project ChemLog, the feasibility study in general as well as about the chemical industry in Austria. Further on facts on the Danube corridor VII are presented and topics about the European transport policy are analysed. The Austrian part of the Danube corridor is the main topic in the following chapter. The characteristics are analysed and traffic flows and traffic developments of the different transportation modes are investigated. Furthermore initiatives and existing projects of the Transport Policy in Austria to improve the traffic infrastructure are evaluated and especially those to force transportation by Danube waterway. The existing infrastructure and their bottlenecks alongside the Danube waterway in Austria is key element of the situation analysis. Thereby potentials to strengthen the Danube waterway Transports are evaluated. As the Chemical Industry has specific requirements regarding transportation, storage and handling of chemical goods, a criteria scheme to evaluate inland waterway ports and terminals as logistic nodes for this industry sector will be presented. The last chapter deals with measures and recommendations to make Danube waterway transport more attractive for the Chemical Industry, especially for hazardous goods transport.

2.3 Methodological Approach of the Feasibility Study

The analysis part of the study is based on a comprehensive literature research. Information about the specific requirements and capacity constraints of the Chemical Industry regarding the transport, warehousing and handling of chemical goods by inland waterway have already been gained during the former ChemLog Expert Dialogues. The feasibility study highlights the infrastructural bottlenecks of the inland waterway itself and of important Danube ports and terminals. These topics as well as possibilities to evaluate logistic nodes regarding their appropriateness for the chemical goods transport were discussed within the 3. ChemLog Expert Dialogue. The factors of the evaluation scheme to assess the logistic nodes were identified within expert workshops and interviews.

3 The Austrian Chemical Industry

3.1 General Characteristics of the Chemical Industry

The Chemical Industry embraces all industrial processes, based on the theory the characteristics, transformation and appliance of substances.² This includes beside the conventional production of organic and inorganic chemicals, the further processing like the plastics and rubber industry, paints as well as the pharmaceutical industry, which are an integrated element of bigger chemical companies³. The Chemical Industry is oriented globally, mainly driven by innovations and skill-intensive. Companies of this industry sector are highly integrated within the value chains of pre- and ongoing industry sectors. Chemical process and production technologies are capital and energy intensive.

A long product development time requires stable and predictable policy framework. Due to the high degree of globalization, competition takes place at global level. Products of the chemical industry can be found nearly in every product or area of life. Upstream sectors are mainly trading companies of fuel, ore, metals and technical chemicals as well as the transport sector as a whole and especially pipelines which are essential for the service provision of the chemical industry. Furthermore the chemical industry sources company-related services like legal and tax advice, advertisement or provision of leasing staff.

Worldwide the chemical industry ranks among the most important industry sectors and especially represents a key success factor for the Austrian economy. 10.3% of the domestic working population is employed in this heterogeneous industry sector, contributing 10.6% of the domestic production value and more than 12% to the gross domestic product of the Austrian industry.

3.2 The Chemical Industry in Austria

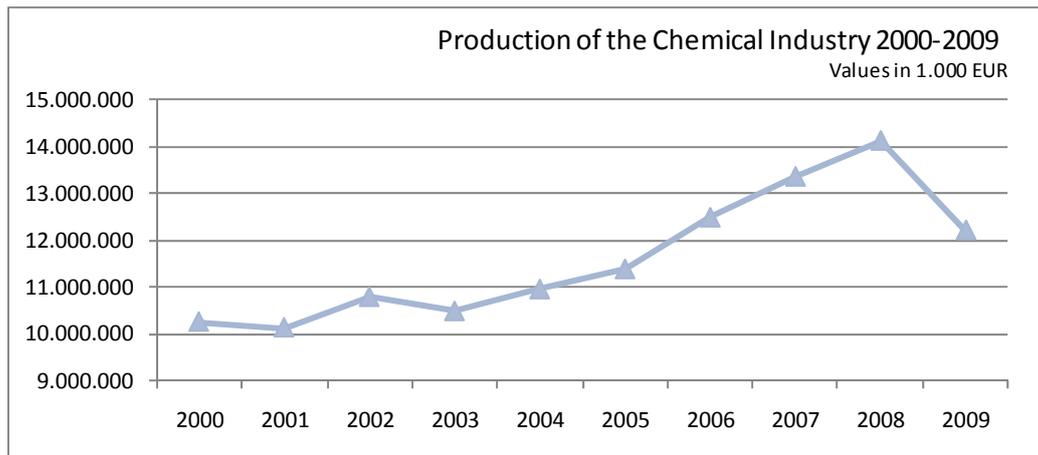
Economic Development⁴

The chemical industry contributes considerably to the production and the value creation of downstream sectors as wells for instance energy, gas and water supply, machines and metal ware industry, electric and electronic sector and paper industry.

² VCI [Umwelt & Chemie 1990], p. 31.

³ Post [Chemielogistikmanagement 2002], p. 14.

⁴ cp. FCIO [Jahresbericht 2008], Schneider Schneider/Brunner/Lengauer/Koller [Chemische Industrie 2008].



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Annual Percentage Change	10,5%	-1,2%	6,4%	-2,8%	4,5%	3,9%	9,7%	7,0%	5,7%	-13,5%

Fig. 2: Production of the Chemical Industry 2000-2009⁵

The graph shows the development of the chemicals production, representing the sharp decline from 2008 to 2009 due to the economic crises. Both capacity utilization and volume of orders showed the same development, the turnaround is expected to be managed in 2010, although the economic pick-up cannot yet follow up to former performance.

It can be mentioned that the year 2008 was the end of a long lasting economic boom which has already been noticed at mid-year within the chemical industry. As supplier for several industry sectors which were affected by the economic crises, the chemical industry was hardly hit by the global regression. In the first term of 2008 the chemical sales were higher than in the year before, so from summer on companies remarked a sharp decline in orders by 11%. Especially exports lag behind expectations as for a long time export growth was lower than the domestic sales. The domestic market has proved to be a stabilizing factor, although a high degree of satiation can be determined. Companies are afraid of further weaknesses in demand, stagnating domestic sales, declining degree of capacity utilization, reduced working hours and significant losing in sales. The employment situation reflects the state of the economy. Latest figures show that in July 2008 44.167 people still were employed in the chemical industry, whereas at the end of the year this number amounted only to 43.000.

In order to guarantee a sustainable development of the Austrian business location, massive investments for education are vital. The chemical industry demands a broader base for innovation and research as well as an intensive integration of chemical topics into educational institutions. A higher number of university graduates and researchers mean a better chance for Austria to survive as a sustainable business location in terms of innovation, specialization and qualification.

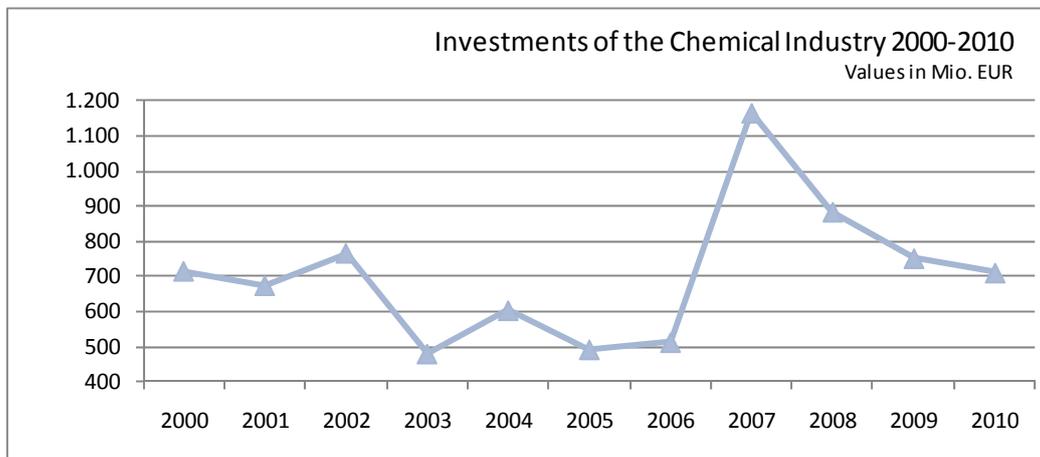
2009 was a highly difficult year for the Chemical Industry. The Chemical sector is supplier for numerous processing industries and was affected by the global economic regression. Chemical sales decline by 13.5% during 2009. Therewith the industry sector fell back into the economical situation of the year 2006. The crises of the automotive sector not even had a significant influence on the

⁵ Source: FCIO [Jahresbericht 2009, 2010].

chemical sectors but also on the plastics and paint sectors. The only sector which recorded a positive development and showed stabile business activities.

Closed relationships with foreign economies – the Chemical Industry listed an export quota of 70% – brought growth impulses. In the year 2009 exports dropped by 10%. Especially exports to Western European Countries were hit due to the crisis. Only the pharmaceutical sector as well as soap and detergents could expand the exports, the other segments of the Chemical Industry had to deal with binary losings.

The Chemical Industry quickly adjusted to the drop in demand. Improvements in productivity were set in the functional areas of companies, especially within production and administration processes, investments and savings in staff. In 2007 investments belong to 1,165 Mio. Euro, in 2008 investments reduced to 884 Mio. Euro and in 2009 they further dropped to 752 Mio. Euro. In 2010 a recovery is not expected.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Annual Percentage Change	10,5%	-1,2%	6,4%	-2,8%	4,5%	3,9%	9,7%	7,0%	5,7%	-13,5%

Fig. 3: Investments of the Chemical Industry 2000-2010⁶

Enterprises and Employees

According to the latest numbers the chemical industry is one of the biggest employing industry group in Austria as more than 10% of all industrial staff or more than 55,000 people are employed in about 1000 chemical companies as well as about 80.000 workplaces are indirect and secondary employment effects.

⁶ Source: FCIO [Jahresbericht 2009, 2010], Statistik Austria [Leistungs- und Strukturstatistik 2009].

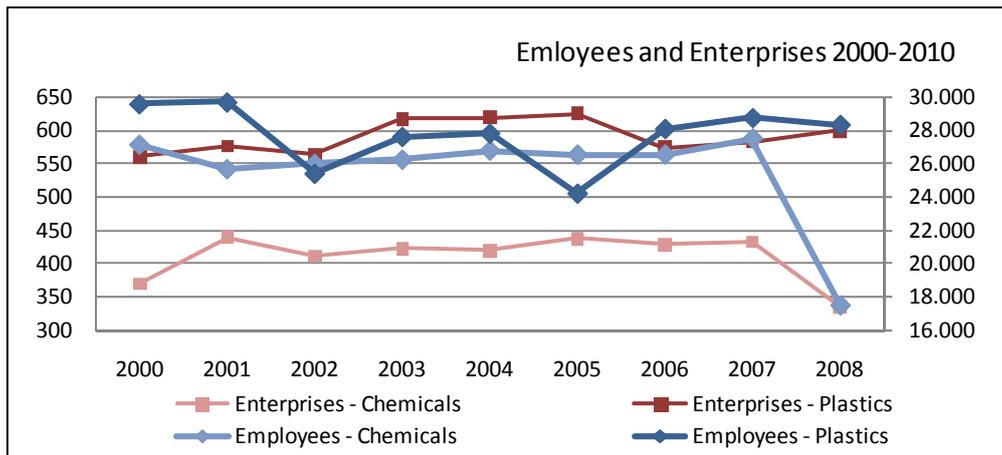


Fig. 4: Enterprises and Employees – Chemicals and Plastics⁷

Impressed by a heterogeneous structure, the chemical industry is impressed by small and medium-sized companies with about 145 employees at an average and with an SME-intensity of approximately 85%. The personnel expenses in Austria for staff within the chemical industry amount to 2.23 billion Euros in total and nearly 51,000 Euro per year per employed person.⁸

During the economic crises the plastics sector remained rather stable, whereas the Chemicals sector had to reduce staff by about 10,000 workplaces.

Sectors

The Chemical Industry consists of several sectors covering about 70,000 different products, which are produced by more than 1,000 big and medium companies as well as by numberless small companies.⁹ This traditional industry sector has gone through main restructuring efforts in the last few years, as a consequence of focusing on core competences and a number of merger and acquisition activities. Many companies were forced to develop from diversified structures to global acting specialists. The scope of chemical products is wide and versatile, ranging from petrochemicals, polymers to pharmaceutical products and food additives. The sectors of the Chemical Industry are mainly oriented according to registration rules, varying between industrial associations, economic and statistic institutions. The following table shows the common division, which is based on the orientation of the companies' portfolios.¹⁰

⁷ Source: adapted from Statistik Austria, Leistungs- und Strukturstatistik 2000-2008.

⁸ cp. FCIO [Jahresbericht 2008] and www.fcio.at, 2009-04-13.

⁹ Budde/Krämer [Chemical Industry 2001], p. 1.

¹⁰ The pharmaceutical industry is not considered within this division, as this sector has to be reviewed separately due to its importance.

Segment 1: Commodities	Segment 2: Intermediates
Basic chemicals, which are industrially produced in high quantities, used as basic materials for ongoing processes. These are composed substances for mass production, for instance plastics, fertilizer, paints, etc.	Intermediates – well known under the synonym „industry products“are differentiated products, which are manufactured in large quantities. Although these formulated products already are compositions of several substances.
Segment 3: Fine Chemicals	Segment 4: Specialities
Fine Chemicals are undifferentiated products produced in smaller quantities. Together with the segment of specialities, they represent the refining sector of the Chemical Industry.	Special chemicals are manufactured in small amounts. Like intermediates, specialities already formulations, which are mixed for specific appliances and final process steps.

Tab. 1: Sectors of the Chemical Industry¹¹

Another mode of segmentation is based on the ÖNACE-system, which enables a detailed division and allocation to sub sectors. Those sub sectors, building together the industry sector “Manufacture of Chemicals and Chemical Products”, are mentioned as follows:

- Basic Chemicals,
- pesticides and other agro-chemical products,
- paints, varnishes and similar coatings, printing ink and mastics,
- pharmaceuticals, medicinal chemicals and botanical products,
- soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations,
- other chemical products and
- man-made fibres.

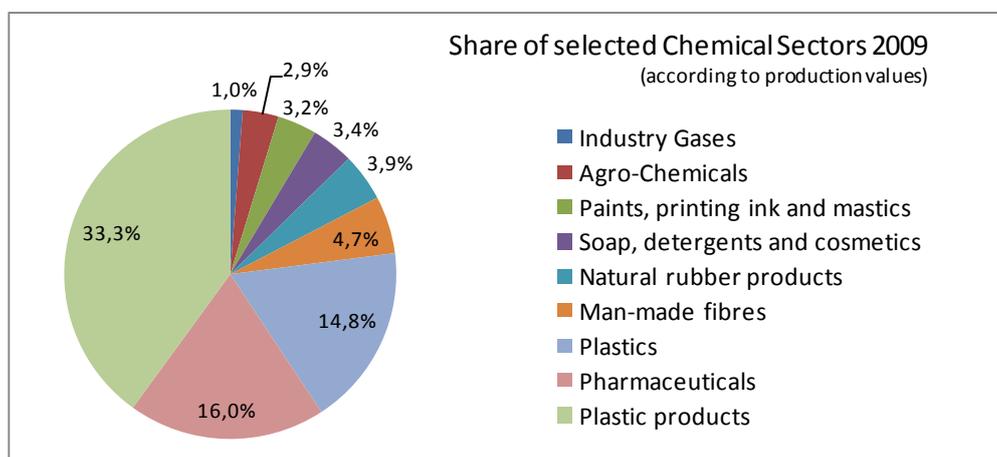


Fig. 5: Share of selected Chemical Sectors 2009¹²

The above shown graph represents the different shares of selected chemical sectors in the year 2009. The plastic products industry contributes the highest share (33.3%) to the production value, followed by the pharmaceutical sector (16.05) and plastics raw materials (14.8%).

¹¹ Source: adapted to Hübner [SCM Process Industries 2007], p. 25; Schulz [Marktgesteuerte SC 2007], p. 6, Murjahn [chemische Produktentwicklung 2005], p. 53f.

¹² Source: adapted from FCIO [Jahresbericht 2009, 2010].

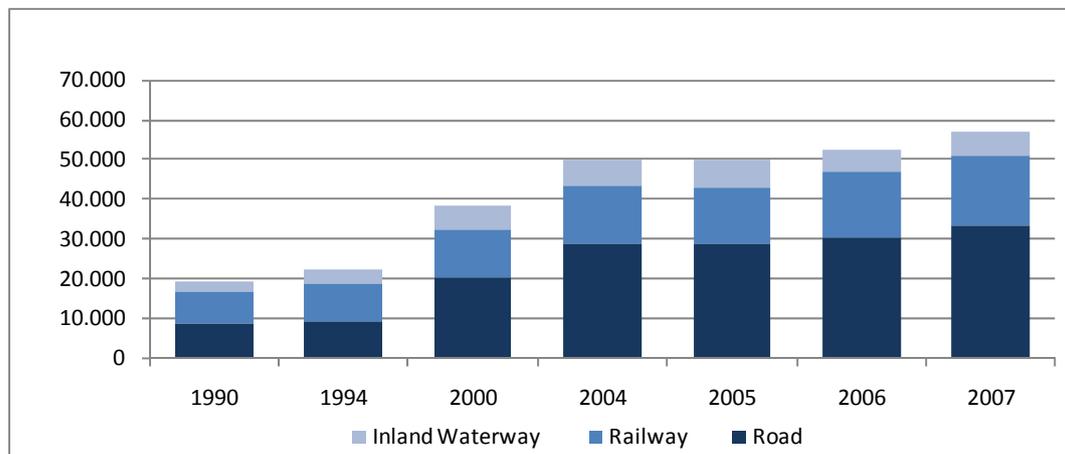
4 Corridor VII – The Danube Corridor

4.1 PAN European Networks – Corridor VII

The Danube Corridor is one on the three European-wide East-West-Connections. In Austria, Bavaria and Hungary, the three transportation modes road, railway and inland waterway provide advantageous infrastructural prerequisites. After the revision of the Paneuropean Networks, the Danube axis is regarded as Railway Corridor No. 17, leading from Paris, Strasbourg, Karlsruhe, Stuttgart, Munich, Salzburg, Linz, and Vienna to Budapest. The axis connects the existing infrastructure between four national states (France, Germany, Austria and Hungary). The magistral between Paris and Budapest covers an area of about 35 Mio. inhabitants and about 16 Mio. Employees, whereas within the direct zone of attraction of the railway terminals about 9 Mio. people are living.¹³ Regarding the traffic infrastructure, the corridor is continuous bimodal (road and railway) and in Bavaria, Austria and Hungary trimodal (road, railway and inland waterway). The East-West Danube Corridor is connected to the baltic-adriatic corridor near Vienna and Bratislava. By this connection the Danube Corridor contributes to the European integration.¹⁴

4.2 Freight Development within the Danube Corridor

Due to the topography and traffic infrastructural conditions, wide-spread transit traffic concentrates on selected axis in Austria. In total about 57 bn tons are transported via the Western border of the Danube Corridor in Austria and about 43 bn tons via the Eastern border.



Western Border	1990	1994	2000	2004	2005	2006	2007
Road	8.715	9.521	20.213	28.817	28.693	30.616	33.618
Railway	8.198	9.113	12.192	14.490	14.358	16.363	17.232
Inland Waterway	2.566	3.689	5.876	6.716	7.132	5.743	6.387
Total	19.480	22.322	38.280	50.023	50.183	52.722	57.238

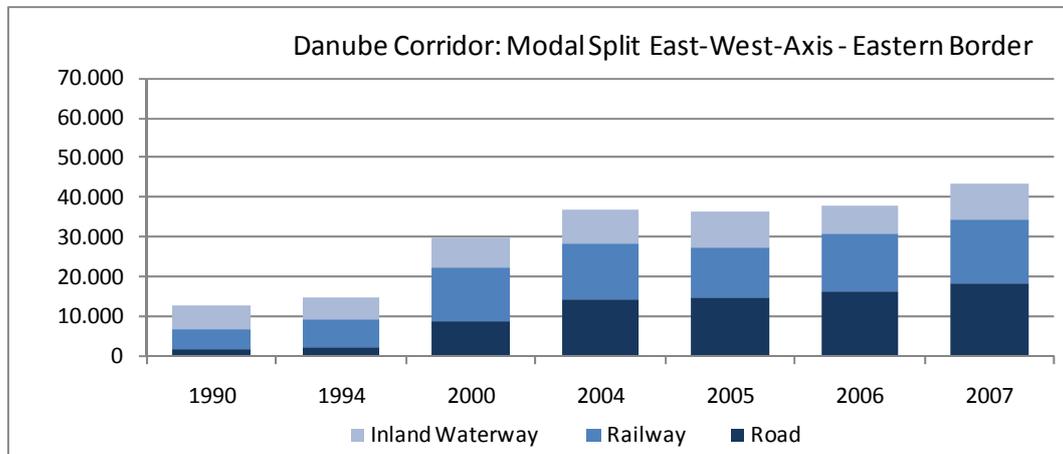
Fig. 6: Freight Development within Danube Corridor – Western Border¹⁵

¹³ Bökemann/Rothengatter/Stohler [Magistrale für Europa 2001], Karlsruhe, Zürich, Wien.

¹⁴ Adelsberger [Neue Wege zwischen Nord und Süd 2006], Entlang der Entwicklungsbanane von der Ostsee zur Adria, Sopron.

¹⁵ Source: adapted to ÖIR [Güterverkehr in Korridoren 2007], p. 18.

Since 1990, the traffic at the Western Border has augmented by nearly 200%, as road traffic has increased by 286%, railway traffic by 110% and inland waterway by 149%.



Eastern Border	1990	1994	2000	2004	2005	2006	2007
Road	1.603	2.476	8.963	14.552	14.675	16.312	18.190
Railway	4.976	6.728	13.542	14.019	12.822	14.357	15.976
Inland Waterway	6.306	5.754	7.151	8.544	8.684	7.311	9.230
Total	12.885	14.958	29.657	37.115	36.180	37.981	43.396

Fig. 7: Freight Development within Danube Corridor – Eastern Border¹⁶

At the Eastern border approximately 43 bn tons were transported in 2007, representing a nearly 300% increase between 1990 and 2007. The road traffic has augmented tenfold, whereas railway and inland waterway transports has enlarged by 220% and 46% since 1990.

4.3 Trends and Tendencies within Infrastructure and Traffic Development

Trends of Business Locations and Infrastructure

Main trends within the production sectors are increasing company interdependencies, merger and acquisitions leading to bigger production units, change of ownership structure, prioritisation of short-term profit expectations (shareholder value) and raising international division of labor. For the traffic sector these trends come along with increasing transports of high-order products, smaller units and higher integration into logistic concepts. In total goods are transported over longer distances. According to the territorial location development, production sites concentrate on central economic regions.¹⁷ Within the context of the mentioned enlarged scale, the connection to supply and selling markets is of high importance regarding competition aspects. In the course of globalization and the ongoing European integration, the scope of action is changing too. European and global benchmarks are getting more dominant for national and regional acting, leading to a reduced scope of action for national actors. The main influencing facts result from spacious flows of traffic, international infrastructure networks (Transeuropean Networks TEN) and from ongoing shifting of responsibilities to the European Union.

¹⁶ Source: adapted to ÖIR [Güterverkehr in Korridoren 2007], p. 18.

¹⁷ European Environment Agency [Transport and Environment 2007].

The position of corridors and nodes as business location factors: by now competition regarding advantageous locations nearby corridors and nodes exists between regions. The Transeuropean Networks, as high-ranking traffic connections, favor important centers and economic regions. Inevitably this preference leads to a relative devaluation of regions, situated offside from these axes. Member states and regions consider the main task of traffic policy as follows: the establishment of prerequisites to take out the growth potentials generated by the TEN-nodes, into the regions as far as possible. The development of the Transeuropean Networks is one of the main pillars of the political initiatives, next to the liberalization of the traffic networks, the implementation of an European railway networks and the traffic-oriented research and innovation politics. In the long-term run, the accessibilities will change considerably and will influence location decisions and competition between companies and regions.

Traffic Flow Development

In the course of the Europeanization, transport volume will augment over great distances over proportionally. International division of work and off-shoring of production processes cause transports of pre-products and intermediates between production sites of one company. The goods traffic within the production sector gains a European dimension increasingly. Within EU 27 countries the traffic performance increased by approximately 42% between 1995 and 2007 (1,739 bn. to 2,469 bn. ton kilometer). Until 2020 a further growth by about 30% to 3,205 bn. ton kilometer is projected. The gain in transportation performance on the road will augment by 40%, railway by 35%. By this, the share of road transport on the modal split moderately changes from 76 to 77% and the share of railway transport changes from actually 18 to 17%.

bn. tkm	1995	2000	2005	2007	2008	2010*	2015	2020
Road	1,231	1,483	1,765	1,908	1,979	2,064	2,294	2,476
Railway	389	403	413	448	463	477	515	556
Inland ww**	119	132	137	141	145	149	161	173
Total	1,739	2,018	2,314	2,496	2,587	2,690	2,970	3,205
Index	0.69	0.81	0.93	1.00	1.04	1.08	1.19	1.28

* values for 2010 are generated by interpolation of 2008 and 2015 values.

** Inland ww... Inland waterway

Tab. 2: Development of goods traffic (transport performance bn tkm) within EU 27 countries¹⁸

Within the recorded time frame (1995-2007), the share of road transport had increased from 70.8% to about 76.4%; within 2007 to 2020, a growth of transport performance by 28% is projected, though an absolute augment of railway and inland waterway, those shares within the modal split had reduced.

In the context of the economic crises in 2008/2009 the goods traffic had reduced significantly; declines in road and railway transport by up to 25% were recorded. In general it is expected, that transports volumes will increase again according to the former development after the global economy is in recovery.

¹⁸ cp. Progrtrans [European Transport Report 2007/2008].

4.4 The Danube Corridor within the Context of the European Transport Policy

Initiatives of European Transport Policy

The key aspects of the European Traffic Policy are the harmonization of the framework for road traffic (weight, dimensions, working time regulation, policy of congestion charges, etc.). Further key elements are the ongoing development of railway operators to European-wide acting providers, the implementation of competition elements by calculative and/or institutional separation of the responsibilities for networks and business operation as well as by the creation of European-wide infrastructures (Transeuropean Networks, "TEN").

The explained coherence is valid on all levels. The Transeuropean Networks (TEN) of the European Union are rooted in the congestion charges of the European economy (around 0.5% of GDP) as well as in the necessity of efficient transport networks as prerequisite for the cohesion of the European economic area. Within the Austrian Master Plan for Traffic and Transportation¹⁹ the maintenance and improvement of the quality of economic areas is an important criteria.

The further development within goods traffic is within the area of conflict between the economical needs and the acceptance of the society. Since the 1990ties the European Commission aims at shifting higher shares of spacious transports on railway. The designated strategy embraces new concepts of railway policy, the expansion of the Transeuropean Networks and a stricter regulation of road transportation regarding standardization of dimensions, weight, working time regulation and control. Thereby the conflict between the measures for road transportation and the objectives of sustainability as sound problem of the traffic policy is obvious.

Trans-European Networks

According to the articles of agreement of the European Union („Römer Contracts“ 1957), the member states are responsible for the traffic infrastructure. Within the Maastricht contracts (1992), the European Union started to determine the infrastructure networks within the whole continent, which were partly further defined in the guidance in 1996 and revised subsequently. Priority axes as basic structure of the Transeuropean traffic infrastructure were determined in the course of the revision in 2004. Within the context of the spacious development the infrastructures play an decisive role for the competitiveness of the economic regions.

Each national plan is developed against the background of these Transeuropean networks. As the closeness to a bimodal axis or to a TEN node is a main advantage within the competition of business locations, the regions are interested in the consideration of the prioritization. By the TEN corridors the quality of a business location is increased as the closeness to such a corridor is a main location factor. The Transeuropean networks within the EU 27 (existing and planned) embraces about 96,000 km road and about 106,000 km railways, 13,800 km inland waterways, 411 airports, 404 oversea ports and 300 inland waterway ports. Thereto the traffic management and navigation systems are parts of the TEN too.

In the reality the realization of TEN networks proceeds significantly slower than ambitious planned, as the initiative are still started by the member states and the main financing has to be taken by the member states.

¹⁹ cp.bmvit [Generalverkehrsplan Österreich 2002].

5 Situation Analysis of Inland Waterway Transport in Austria

One of the major parts in setting up a study focusing on strengthening the Danube waterway as part of Corridor VII in Austria for the Chemical Industry is a comprehensive analysis of the system Inland waterway. The Danube Corridor VII per se was described within the previous section. This section deals with all stakeholders that are involved in this system. In addition the focus is put on the Austrian part of the Danube. The main objective is to introduce the reader to the inland waterway transportation on the one hand and to obtain a clear picture of the current infrastructure available on the other hand.

5.1 The System of Inland Waterway Transport

Now the attention is drawn to the different key elements, which are responsible for the functioning of this transport mode. These elements are represented by facilities, stakeholder, natural factors of influence, other transport modes and, of course, by legislation and politics, information systems and logistics management. The latter ones act upon all other elements quoted in the system. A first overview of the system inland waterway is shown by the following figure.

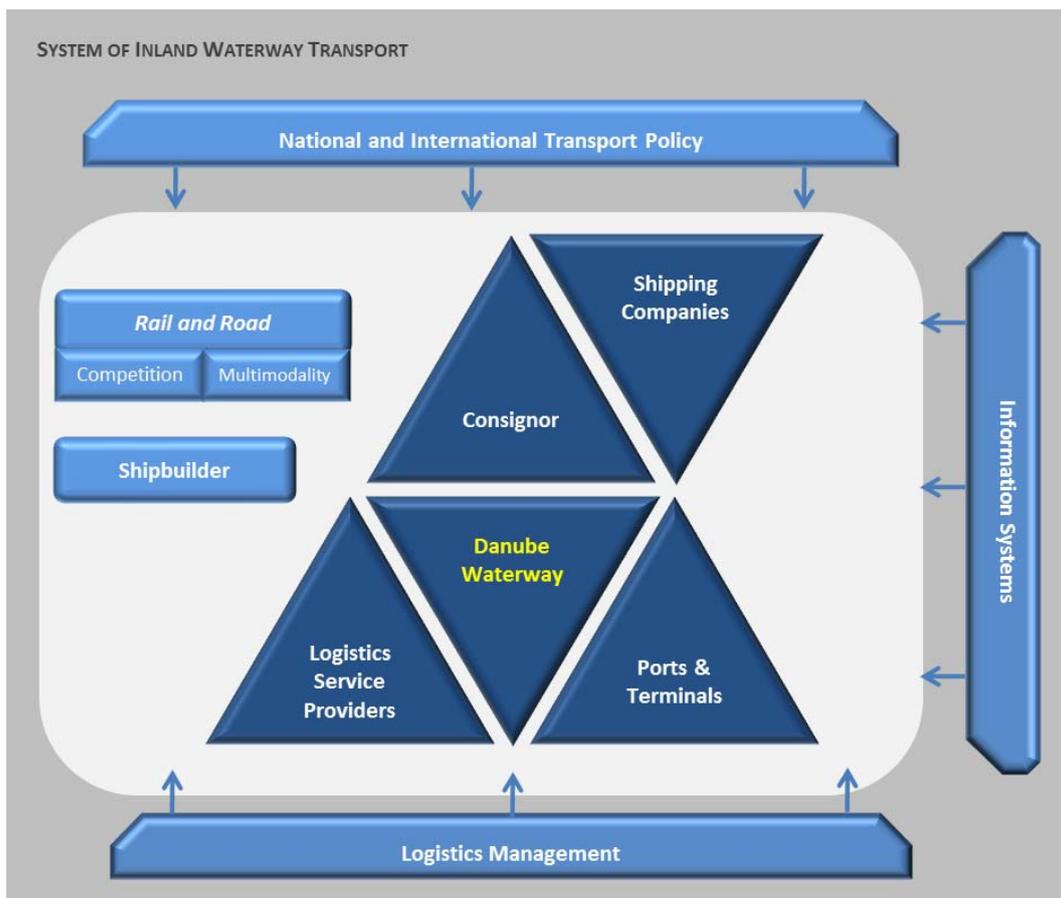


Fig. 8: System of Inland waterway Transport²⁰

²⁰ Source: modified from via donau [Handbuch der Donauschiffahrt 2005], p 14.

The main objective of section V is to give the reader a detailed description of the above mentioned key elements within the system concerned in order to understand the bottlenecks in status quo. The situation analysis is primarily based on statistical information from different and reliable sources, reports and papers. Furthermore the authors defined a specific evaluation model so as to outline the performance – in regard to the requirements of the Chemical Industry – of ports and terminals and logistics service providers respectively. This model will be presented in the next section.

5.2 Danube Waterway

The first element, which will be analyzed, is the Danube waterway itself. As mentioned before, the focus is going to be put on the Austrian part of the Danube. This element takes up a central position within the scope of the system depicted in figure 8. First of all some fundamental information about the Danube waterway will be presented. Thereupon the nautical situation is going to be portrayed and finally diverse facilities alongside the Danube waterway will be introduced.

Fundamentals

The international Danube waterway has a length of 2,415 km – measured from Kelheim (DE) until Sulina (RO) – river kilometer 0 – which represents the navigable section of the Danube. On the way from Germany to Romania, the Danube flows through 10 neighboring European states, hence it is not only the second largest river in Europe but also the most international river on earth.



Fig. 9: The Danube waterway²¹

As seen in figure 9– not only the Danube waterway – all Waterways in Europe are classified by the United Nations Economic Commission for Europe (UN/ECE) and the European Conference of Ministers of Transport (ECMT), which became valid in 1992. Essential for the classification are the basic dimensions (length, width, draft and tonnage and clearance of bridges) of the different types of

²¹ Source: modified from via donau [Donauschiffahrt 2010].

ships. Basically, there are 7 classes, but only class IV to VII are relevant for economical transportation.²²

The Danube per se is divided into three classes, which can be characterized as follows:

SECTIONS	Upper Danube	Middle Danube	Lower Danube
Start point	Kehlheim (DE)	Gönyü (HU)	Eiserne Tor (RO)
End point	Gönyü (HU)	Eiserne Tor (RO)	Sulina (RO)
Length	621 km	860 km	930 km
Altitude	~ 250 m	~ 70 m	~ 35 m

Tab. 3: Navigable Sections on the Danube²³

Since 1992, when the Rhine-Main-Danube waterway was opened through building the Rhine-Main-Danube Canal (Length: 171 km) the length of this waterway increase up to 3,504 km; connecting henceforth 14 European states. Simultaneously the Rhine-Main-Danube Canal enabled an end-to-end navigable connection from the North Sea until the Black Sea, therefore the importance of this transport route also increase in economic terms. Shipping Companies need to pay fees for passing through the Rhine-Main-Danube Canal and the Danube-Black-Sea Canal in Romania.²⁴

The Austrian part of the Danube waterway encompasses 350 km, which counts up to 50 % of the above described Upper Danube and is demarcated by an eastern (Hainburg – river kilometer 1,880,2) and western border (Passau – river kilometer 2,201.7) (figure 10). The ships passing through this section of the Danube have to hurdle an altitude of 150 meters. Referring to the above-mentioned classification by UN/ECE the Austrian part of the Danube corresponds to class VIb.



Fig. 10: The Austrian Part of the Danube²⁵

²² cp. via donau [Handbuch der Donauschifffahrt 2005], p. 29. Further information about the classification according UN/ECE can be obtained from <http://www.unece.org>.

²³ Source: via donau [Handbuch der Donauschifffahrt 2005], p. 38.

²⁴ cp. via donau [Donauschifffahrt 2010].

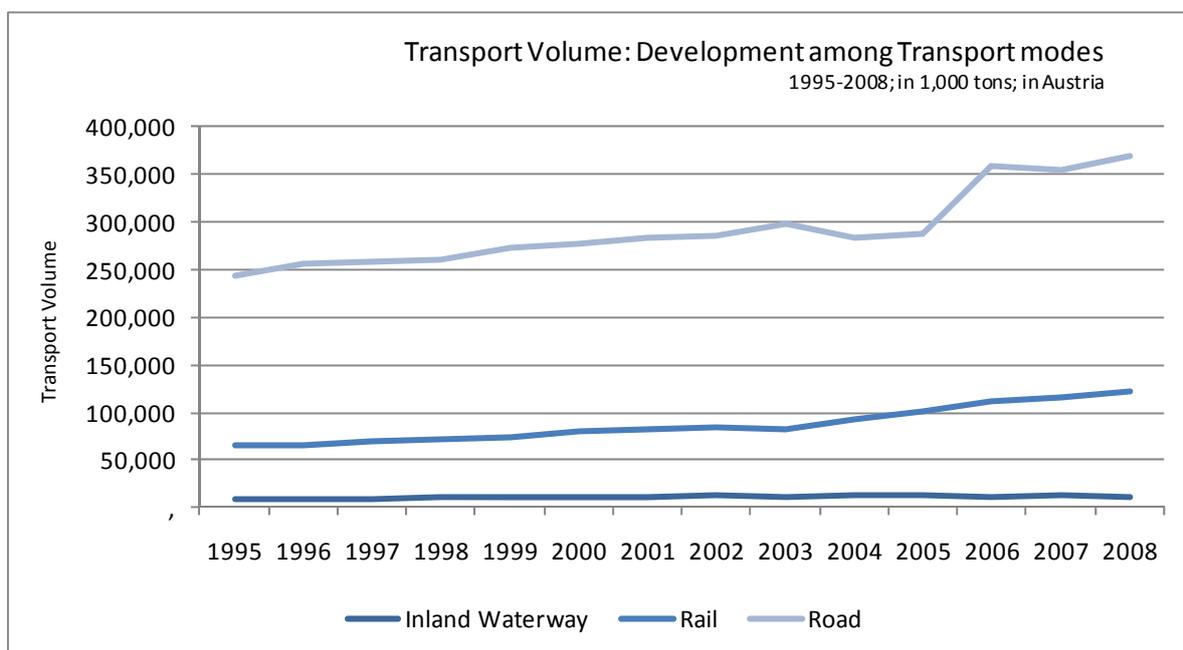
²⁵ Source: modified from via donau [Schifffahrt 2010].

In the course of the next subchapters the Danube waterway will be described from different point of views. Within the upcoming chapter, the Danube waterway will be characterized by statistical information in order to describe the Danube as a transport mode.

Austrian Part of the Danube as a Transport mode

A freight transport market can be described in many different ways, e.g. transport volume, transport performance, etc. On the next level these first categories can be differentiated according to transport modes, territorial units, traffic type (import/inland/export/transit) or the concerned entity can be distinguished by types of goods or by different purposes of trips – in terms of passenger transport.²⁶

The development of the different transport modes' transport volume can be presented by the following chart:



Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Rail ²⁷	65	66	71	73	74	81	83	84	82	93	102	111	116	122
Road	243	257	258	260	274	277	283	286	297	283	288	359	354	369
Inland waterway	9	9	9	10	10	11	12	12	11	12	12	11	12	11
Total	317	333	338	343	358	369	378	382	390	388	402	480	482	502

Fig. 11: Development of transport volume²⁸

As figure 11 shows the share of Inland waterway of the total transport volume is fairly low. Within these 14 years the share accounted on average to 2.8 % of the total volume. In the year 2008 the modal split points the following picture:

²⁶ cp. bmvit [Verkehr in Zahlen 2007], p. 109.

²⁷ All values for rail, road and inland waterway transport are given in million tons.

²⁸ Source: Statistik Austria [Eckdaten Verkehr 2010].

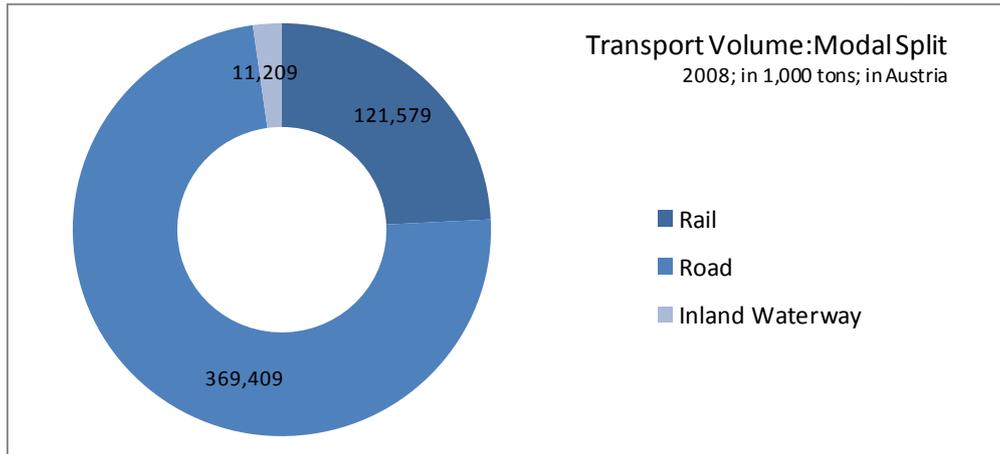
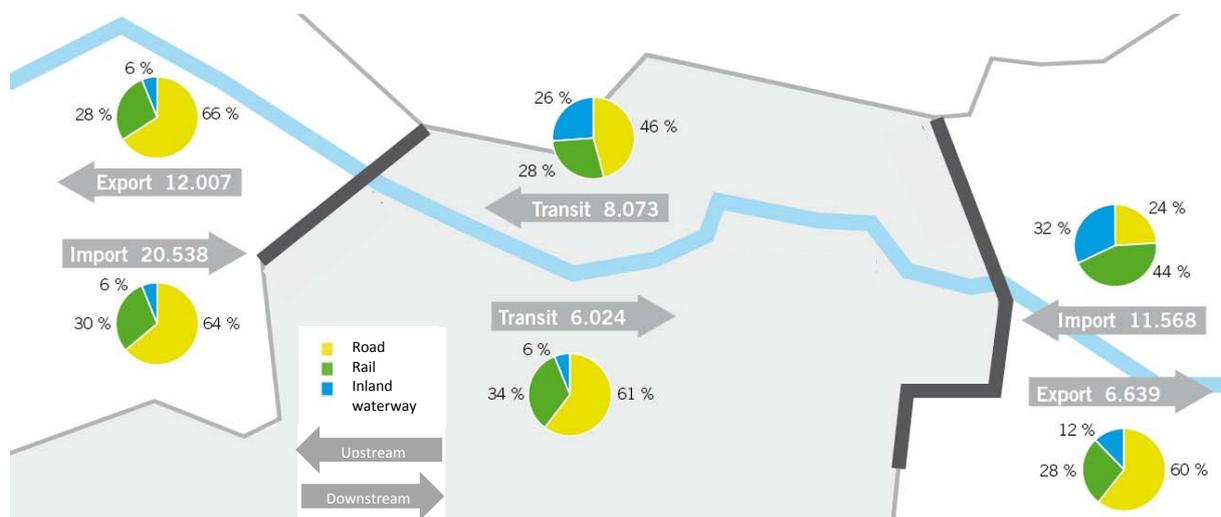


Fig. 12: Modal split of total transport volume in 2008²⁹

The biggest share remains by Road transport (73.53 %). The remaining part is allocated between Rail (24.20 %) and Inland waterway transport (2.23 %). In terms of the biggest average growth from 1995 until 2008, Rail transportation has been able to increase its shares by almost 5 %, whereas Inland waterway has raised its values by 2.22 % (Road: 3.47 %). Nevertheless, transportation on the Danube waterway needed to accept a decrease of volume by almost 17 % in 2009. The reasons for this downturn will be presented afterwards.

Another interesting chart, which was published by via donau for the purpose of the annual report 2009, presents the transport volume in terms of type of traffic for the three main transport modes: Rail, Road, Inland waterway.



	Upstream	Downstream	
Export	12,007	6,639	Total
Import	20,538	11,568	
Transit	8,073	6,024	
Total	40,618	24,231	

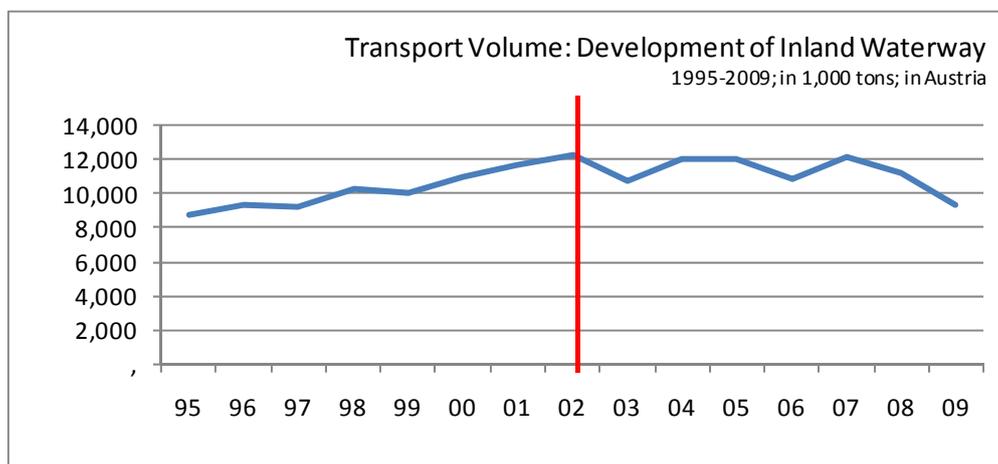
Fig. 13: Modal Split of rail, road and IWW in respect of import/export/transit (in 1,000 tons p.a.)³⁰

²⁹ Source: Statistik Austria [Eckdaten Verkehr 2010].

Figure 13 shows that the westbound traffic (50.19 %) is significantly higher in terms of transport volume than the eastbound traffic (28.08 %). Above all the transit traffic has increased notably. Today the transit traffic is 2.4 times higher than in the year 1994, in terms of road traffic even 5.3 times higher.

Furthermore figure 12 and 13 indicates the dominance of road traffic within the modal split. With a view to the businesses with Eastern Europe, the situation in 2009 is as follows: Road transportation was able to increase its share of the Export, whereas Rail transportation lost 16 %. In context to import activities from Eastern Europe, the Inland waterway was able to keep its share of 32 % constant. This circumstance points out the importance of this transport mode in this area. On the other side at the western border Road transportation dominates the goods movement.³¹

The Inland waterway Transport in Austria has had its peak with 12.3 m tons in the year 2002 (figure 14).



Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Volume	8,791	9,303	9,204	10,237	9,987	10,980	11,634	12,317	10,737	11,978	12,084	10,844	12,107	11,209	9,322

Fig. 14: Development of transport volume: Inland waterway 1995-2009³²

In 2009, world's economy was still characterized by the global economy crisis. Also the Danube waterway was affected by that economic downturn. Beyond this macro-economic influence the Austrian part of the Danube waterway was obstructed by weather-related barriers, e.g. floods or ice formation. Nevertheless the Danube waterway was navigable on 347 days in 2009 which corresponds with an availability of 95.1 %.

In 2009 the transported volume amounted to 9.3 m tons, which depicts a decline of approximately 17 % (1.9 m tons) compared with 2008. Having a more detailed look at the development of the transport volume from 2005 until 2009, the following chart can be identified.

³⁰ Source: via donau [Jahresbericht 2009, 2010], p. 22.

³¹ cp. via donau [Jahresbericht 2009, 2010], p. 23.

³² Source: Statistik Austria [Eckdaten Verkehr 2010].

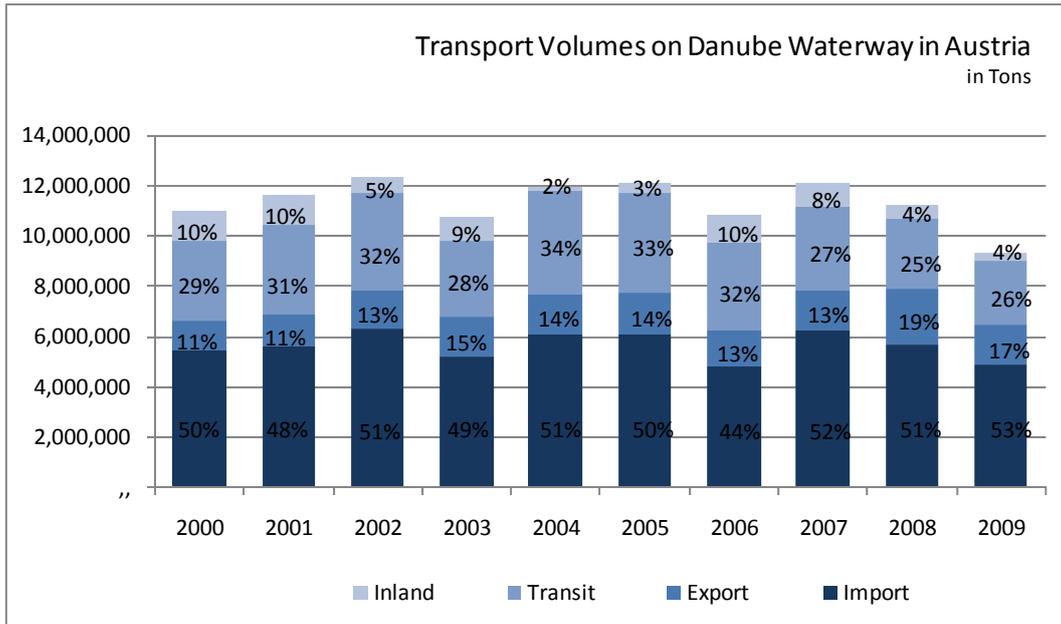


Fig. 15: Development of import/inland/transit and export transportation on the Danube³³

The inland transportation refers to trips, which starts and ends within Austria. Loading and unloading processes take place within the same country. In respect of transit traffic, trips starts and ends abroad but the route of these trips leads through Austrian territory. Therefore the goods are not handled in Austria. In terms of import/export transportation the loading and unloading process respectively takes place in Austria or abroad and vice versa.

In Austria the transport on the Danube waterway is characterized essentially by import activities. As seen in the graph the portion of the total transportation volume in 2009 amounts up to 53%, which also complies with a reduction of 13.7% (or approx. 0.8 tons) compared to 2008. In general all areas within the transportation on the Austrian part of the Danube were confronted with a decrease in relation to the previous year (Transit: -12.2%, Inland: -34%, Export: -27%.)

Regarding the transport performance of the inland waterway on the Danube in Austria, the figures for 2009 are as follows: In total the transport performance accounted about 9.6 bn tkm³⁴ whereby the average transported distance of one ton was 1,029 km in the regarding year.³⁵

Nautical Situation

The European Inland waterway system comprises 29,000 km for cargo shipping but due to the nautical influences only 14,000 km are suitable for the economical transport. The nautical conditions have a crucial impact on the navigability and therefore also on the performance and utilization of the Danube waterway as a transport route.³⁶

³³ Source: Statistik Austria [Eckdaten Verkehr 2010].

³⁴ tkm = tonne kilometer. It represents a measurement for determining the performance of transport modes. This figure is made up of the product of transport volume times the kilometers navigated.

³⁵ Cp. Statistik Austria [Güterverkehr auf der Donau im Jahr 2009], p.6.

³⁶ cp. via donau [Handbuch der Donauschifffahrt 2005], p. 28.

Nautical influences are given by floods or ice formation but also by further parameters, e.g. water depth and width of the navigable water. A detailed description of these basic parameters can be looked up from “Handbuch der Donauschifffahrt”.³⁷

The Austrian part of the Danube was navigable 347 days in 2009. That number represents an availability of 95.1 %. Considering the period from 1993 until 2009, the Danube waterway had been available on 360 days (98.5 %) for shipping (figure 16).

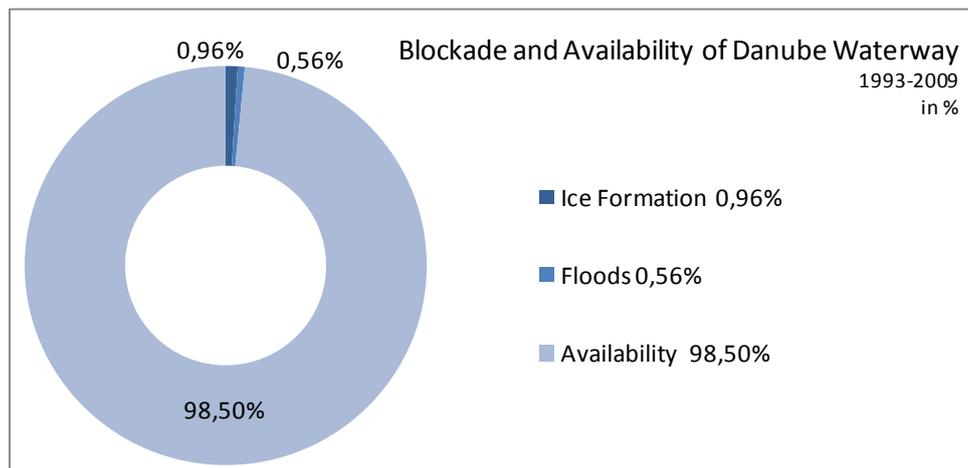


Fig. 16: Navigability of Danube waterway in Austria³⁸

In case of floods or ice formation, blockades will be installed. However, if there is low water, the shipping companies only have limited access to the Inland waterway. This circumstance reveals in the maximal loaded draft of the ships allowed, which depends on the water depth/level given. If the loaded draft is high, the utilization of ships is high, because transport volumes increases. The shipping companies are enabled to ship more goods – that means higher turnover – for the same costs. To sum up, the competitiveness of this transport mode increases, if there are no blockades due to ice formation or floods and if the loaded draft of a ship is at the maximum. In figure 17 this correlation is presented visually for the year 2009.³⁹

³⁷ This manual can be downloaded (in german language) from http://www.via-donau.org/fileadmin/group_upload/5/Wissen/Handbuecher/Handbuch_gesamt.pdf.

³⁸ Source: via donau [Jahresbericht 2009, 2010], p. 14.

³⁹ cp. via donau [Jahresbericht 2009, 2010], p. 15.

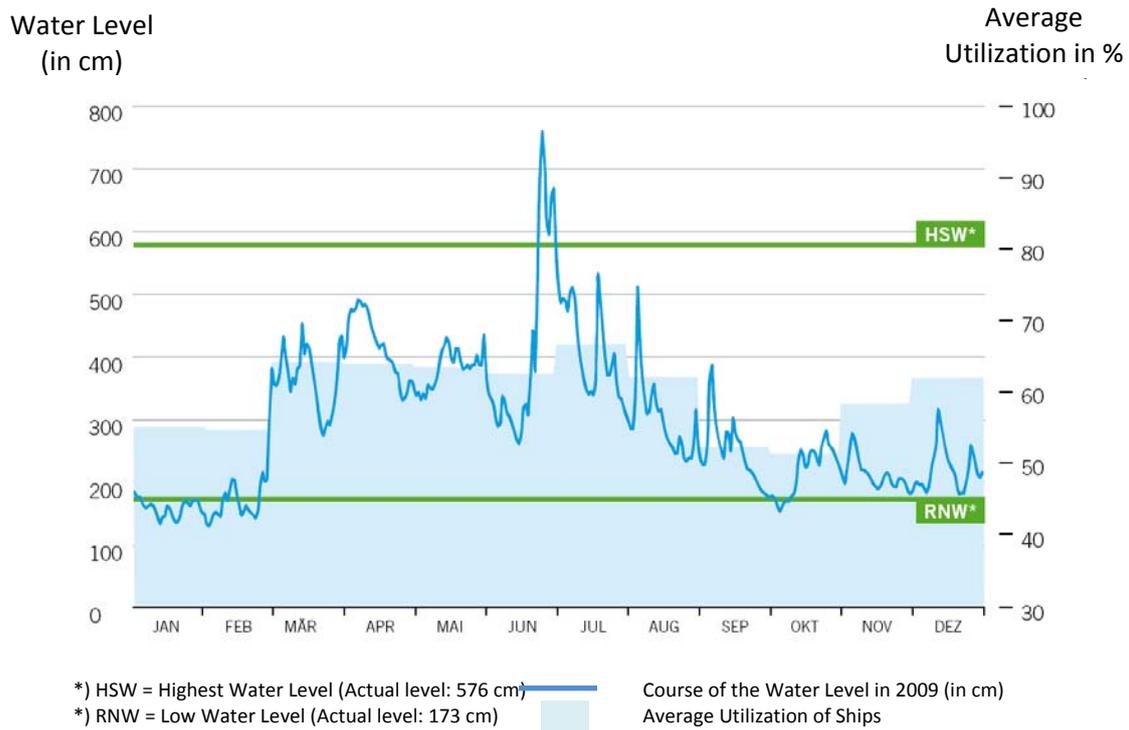


Fig. 17: Correlation between water level and utilization of ships (in 2009)⁴⁰

In 2009, the average utilization of the ships amounted to 60 %. In comparison with 2008, it represents a decline of 1.3 %.⁴¹ An enhancement of the utilization can be achieved, if the above-mentioned RNW value will be increased to 2.7 meters in order to increase simultaneously the loaded draft of the ships. Unfortunately there are some sections of the Austrian Danube, which do not fulfill the target value of 2.5 meter and represents as a consequence of the low water depth a nautical bottleneck. The most significant nautical bottleneck on the Austrian part of the Danube is the Danube section to the east of Vienna (between Vienna and the Slovakian border). Possible results of these bottlenecks are long lead times, lighterage or a demand for replacement transports. In 2002, the “Integrated River Engineering project on the Danube to the East of Vienna” was implemented in the Austrian national transport policy.⁴²

Infrastructural facilities alongside the Danube waterway

Analyzing the Danube waterway as a transport mode also claims insight into the infrastructural facilities located alongside this waterway. To start with, a first glance is put on the bridges.

Bridges

From Kelheim (DE) to Sulina (RO) there are 130 bridges installed and thereof 88 in the section Upper Danube, which encompasses the Austrian part of the Danube. The clearance of bridges is another major parameter, which has also considerable impact on the performance on the transport mode

⁴⁰ Source: via donau [Jahresbericht 2009, 2010], p. 16.

⁴¹ cp. via donau [Jahresbericht 2009, 2010], p. 17.

⁴² cp. via donau [Handbuch der Donauschifffahrt 2005], p. 46. Further information about this project can be obtained on the Internet (www.via-donau.at).

regarded – together with the above-mentioned parameters HSW and RNW. A link between HSW and RNW is given in figure 18.⁴³

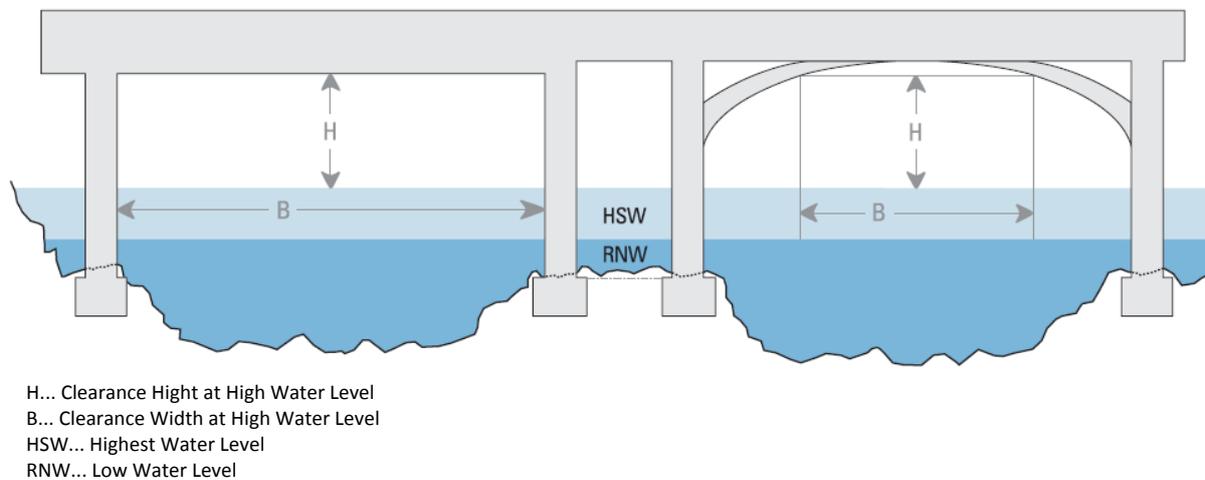


Fig. 18: Clearance at bridges⁴⁴

Locks alongside the Danube

Another category of infrastructural facilities alongside the Danube waterway represents the locks. These are buildings for hurdling a drop height by means of filling and depleting the lock chambers which enables the ships to be lifted and sunk in a controlled way.⁴⁵

From Kelheim (DE) to Sulina (RO) there are 18 hydraulic power stations, which gain electrical power due to the altitude. Simultaneously this implies for the inland waterway transport to pass through 18 locks. Nine of these gates are suited on Austrian territory (Owner: Verbund AG; Responsible for operation and maintenance: via donau)⁴⁶. All these Danube locks have two chambers which enable them to lock ships downstream and upstream at the same time.⁴⁷ In 2009, these infrastructural facilities locked approximately 96,000 ships (transportation of goods as well as passengers) in Austria.⁴⁸ An important influence on the performance of the Danube waterway has the lock management. Negative results without using a lock management system are: waiting times, higher fuel consumption, hence environmental pollution and, of course, higher transport costs due to the waiting times. Moreover, the waiting times which also includes fluctuation causes an inability of planning estimated times of arrivals (ETA).⁴⁹ These effects diminish the attractiveness of Inland waterway as a transport mode considerably.

The via donau River Information Service (RIS) Development Team launched a new electronic lock management system in 2009. By means of this new application the administrative procedures were reduced tremendously and lock personnel have been retrieved by supporting them in their daily procedures for planning, execution and documentation of the pending locking events. This system

⁴³ cp. donauschiffahrt.info [Daten & Fakten 2010].

⁴⁴ Source: via donau [Handbuch der Donauschiffahrt 2005], p. 27.

⁴⁵ cp. ELWIS [Erklärung Begriffe 2010].

⁴⁶ cp. Ploberger [Erfolgsfaktoren der Binnenschiffahrt 2009], p. 37.

⁴⁷ cp. donauschiffahrt.info [Daten & Fakten 2010].

⁴⁸ cp. via donau [Handbuch der Donauschiffahrt 2005], p. 21.

⁴⁹ cp. Cizek [Machbarkeitsstudie: Schleusenmanagement 2005], p. 26f.

enables a standardized documentation of all operational lock processes and a complete data collection. Beyond that this information system allows a compilation of statistics while reducing administrative workload and costs. Furthermore there is a close connection with the DoRIS (Danube River Information System) as well as an automatic vessel identification via voice radio.⁵⁰

According to some studies and reports the degree of utilization accounts for about 10 - 15 %.⁵¹ These numbers can be determined by having a closer look on the two major bottlenecks alongside the Danube: the capacity of locks or the volatile water depth. The first-mentioned aspect is measured in million tons per year (throughput rate) and is influenced by the following factors:

- Number of locks chambers
- Dimensions of lock chambers
- Time necessary for lock operations
- Operating times of locks
- Fleet structure (Dimensions and load capacity of ships used)

The theoretical throughput rate amounts to 168.2 m tons p.a.⁵² Practically due to nautical bottlenecks the capacity is assumed to be 70 m tons per year for the Upper and Middle Danube and 100 m tons per year for the Lower Danube section.⁵³

5.3 Ports and Terminals

The next major element within the inland waterway system is the ports and terminals respectively located alongside the Danube. In this study the focus of the situation analysis was put on five Danube ports. The outcome of the situation analysis will be introduced in the next chapter. Before this step some key figures about the Austrian Danube Ports will be presented. Basically ports are nodes that interrupt the transport streams and link the inland waterway to other transport modes simultaneously⁵⁴, hence this network node provides the possibility to use multimodal transportation. Furthermore the port per se can be subdivided into port infrastructure (e.g. basin, quay area, roads, railroad tracks, etc.) a port suprastructure (e.g. cranes, storage depots, office buildings, etc.). A more detailed view on the infra- and suprastructure will be presented in the next section.⁵⁵

In Austria, there 12 ports in total which can be primarily divided into two groups: public and non-public (private) ports. The latter one constitutes the interface between a company located alongside the Danube and the Danube itself and are owned by the companies. The most important private port belongs to the Austrian steel producing company voestalpine AG (Linz). This company handled 3.2 m tons in the year 2009, which is the most important port in terms of quantities handled.⁵⁶ An overview about total handled goods in Austrian Danube ports are given in figure 19.

⁵⁰ cp. via-donau.org [News/Danube Premiere 2009], 2009.

⁵¹ cp. Klöckl [BiSchi als innovativer Verkehrsträger für die Wirtschaft 2005], p. 52 and via donau [Handbuch der Donauschifffahrt 2005], p. 24.

⁵² Assumptions for the calculation: 2 lock chambers; 4 ships for each lock chamber; each ship of 1,800 tons and 32 lock operations per day; 365 days p.a.

⁵³ cp. Klöckl [BiSchi als innovativer Verkehrsträger für die Wirtschaft 2005], p. 53.

⁵⁴ cp. Ploberger [Erfolgsfaktoren der Binnenschifffahrt 2009], p. 27.

⁵⁵ cp. Ploberger [Erfolgsfaktoren der Binnenschifffahrt 2009], p. 27.

⁵⁶ cp. Ploberger [Erfolgsfaktoren der Binnenschifffahrt 2009], p. 28.

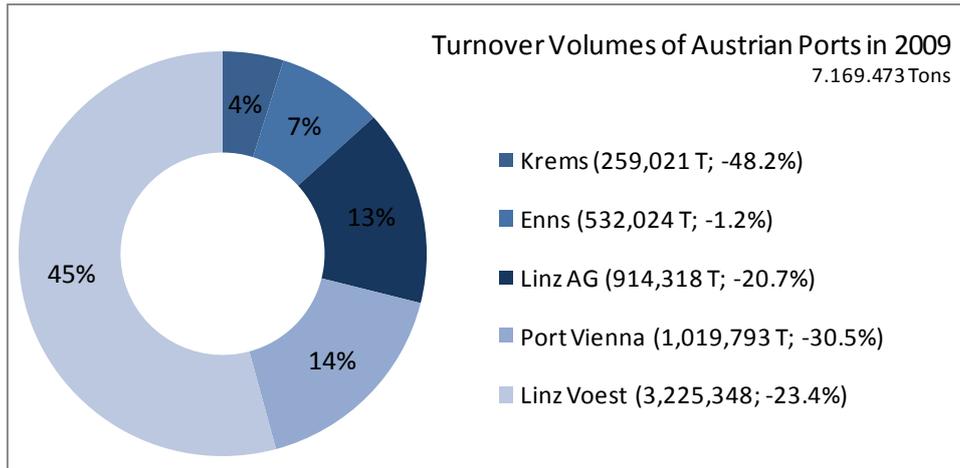


Fig. 19: Distribution of handled goods among Danube Ports⁵⁷

In total a volume of approximately 7.2 m tons were handled in the Austrian Danube ports. In contrast to the year 2008 there was a decrease of 1.7 m tons (-19.3 %). This circumstance can be traced back to the world economic crisis and to blockades dependent on weather conditions. Although the ports in Vienna (-30.5 %), Linz (-20.7 %) and Krems (-48.2 %) reported a drop in 2009, only the port in Enns was able to keep this performance indicator almost stable (-1.2 %). Beside these four public ports and the port of voestalpine AG, more and more small ports and landings⁵⁸ become increasingly important. An example is the landing in Pischelsdorf which is owned by Donau Chemie AG. In spite of the above-mentioned reasons for the general economic downturn, this landing was able to obtain a growth by 39 % in comparison to 2008. Most of the goods handles were solid mineral fuels as well as agricultural and forestry products.⁵⁹

In terms of quantity handled the port of the Austrian steel producer voestalpine is the most important one. Followed by Port Vienna, which consists of the ports Freudenuau, Albern and Lobau (oil port), handled about one third of the volume of the biggest port.

5.4 Shipping Companies

Within the shipping business there are several protagonists involved. Basically the market consists of two types: inland navigation companies and independent ship owners.⁶⁰ Beside these two main types, specialized Logistics service providers, companies that offer freighting services as well as agencies which are responsible for linking consignor's demand and shipping companies' supply plays an important role in this market.

Inland navigation companies perform the organization and execution of transports on inland waterways either with their own or with external ships. In any case this type of market player takes responsibility for scheduling multiple ships and manages and prepares the transports onshore. Whereas the independent ship owners have no organization onshore and are the ship's masters of their own ships. Most of these market players are located in Western Europe and are organized via

⁵⁷ cp via donau [Jahresbericht 2009, 2010], p. 8.

⁵⁸ A landing is a place of handling, which has no basin.

⁵⁹ cp. via donau [Jahresbericht 2009, 2010], p. 9.

⁶⁰ cp. Ploberger [Erfolgsfaktoren der Binnenschifffahrt 2009], p. 38.

consortiums.⁶¹ Recently both inland navigation companies and independent ship owners have cooperated more intensively.⁶²

An overview about the actors in this market can be obtained from the “Blue Pages”⁶³ which represents a register with all inland navigation companies, forwarding companies and agencies. Moreover the user of this website is able to define his requirements more precisely by selecting the kind of transported goods, additional services.

Selections of the shipping companies which transport either chemical goods or dangerous goods yield the following result:⁶⁴ Shipping Companies that are competent to transport chemical goods:⁶⁵

Company	Panta Rhei Befrachtungs- und Speditions GmbH
Company headquarters	Austria
Operating alongside the Danube in	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany
Company	Navromsa ag basel
Company headquarters	Austria
Operating alongside the Danube in	Romania, Serbia, Hungary, Slovakia, Austria, Germany
Company	SC Accord Ltd.
Company headquarters	Ukraine
Operating alongside the Danube in	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany
Company	Bavaria Schifffahrts- und Speditions-AG
Company headquarters	Germany
Operating alongside the Danube in	Romania, Bulgaria, Serbia, Hungary, Slovakia, Austria, Germany
Company	Gebr. Vaeth GmbH & Co. KG
Company headquarters	Germany
Operating alongside the Danube in	Ukraine, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany
Company	Transport Trade Service SA
Company headquarters	Romania
Operating alongside the Danube in	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany

⁶¹ cp. via donau [Handbuch der Donauschifffahrt 2005], p. 95.

⁶² cp. Ploberger [Erfolgsfaktoren der Binnenschifffahrt 2009], p. 39.

⁶³ cp. www.blaue-seiten.at (Status: October 29, 2010).

⁶⁴ Transportation is made with both with or without own fleet.

⁶⁵ cp. http://www.blaue-seiten.at/suche/?no_cache=1 (Status: October 29, 2010).

Company	Danu Transport GmbH
Company headquarters	Austria
Operating alongside the Danube in	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany
Company	Kühne + Nagel Euroshipping GmbH
Company headquarters	Germany
Operating alongside the Danube in	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany
Company	Hrvatsko Rijecno Brodarstvo Dunavski Lloyd Sisak d.o.o.
Company headquarters	Croatia
Operating alongside the Danube in	Ukraine, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany
Company	Reederei Jaegers GmbH
Company headquarters	Germany
Operating alongside the Danube in	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany

Tab. 4: Selection I from "Blue Pages"

Shipping Companies that are competent to transport dangerous goods:⁶⁶

Company	SC Accord Ltd.
Company headquarters	Ukraine
Operating alongside the Danube in	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany
Company	Gebr. Vaeth GmbH & Co. KG
Company headquarters	Germany
Operating alongside the Danube in	Ukraine, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany
Company	Danu Transport GmbH
Company headquarters	Austria
Operating alongside the Danube in	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany
Company	Transorient
Company headquarters	Romania
Operating alongside the Danube in	Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany

⁶⁶cp. http://www.blaue-seiten.at/suche/?no_cache=1 (Status: October 29, 2010).

Company	Kühne + Nagel Euroshipping GmbH
Company headquarters	Germany
Operating alongside the Danube in	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany
Company	Reederei Jaegers GmbH
Company headquarters	Germany
Operating alongside the Danube in	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany
Company	Jugoagent
Company headquarters	Serbia
Operating alongside the Danube in	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany
Company	Agent Plus
Company headquarters	Serbia
Operating alongside the Danube in	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany
Company	Touax Rom SA
Company headquarters	Romania
Operating alongside the Danube in	Ukraine, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria
Company	Rextrans
Company headquarters	Ukraine
Operating alongside the Danube in	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany

Tab. 5: Selection II from "Blue Pages"

Recently the characteristic of goods transported alongside the Danube has developed slightly. Not only commodities will be transported by inland waterway but also higher-value goods. This reorientation is going to be supported not least through new logistics and telematics applications. Such new solutions will be presented briefly afterwards.

The market of classical transportation on the respected inland waterway is organized at the spot market or via contracts. The latter type acts as a master agreement that includes several transportations within a specific period. Whereas the spot markets have the following aspects:

- Transportation of cargos from 1,000 to 4,000 tons executed by independent ship owners
- Liberal time slots in case of arrivals or departures
- Transportation between a port of loading and a port of discharging

Due to the above-mentioned change of goods transported, the requirements for logistics systems also changed. These changed requirements reveals in smaller shipment sizes, increased number of

suppliers and purchasers and, of course, high expectation in terms of punctuality and reliability of ETD and ETA. A first solution for this new situation is intermodal line services, where ships are operation on fixed schedules. These intermodal line services represent the main carriage, the pre- and on-carriage will be executed by truck or rail (depending on the infrastructural and economical capability).⁶⁷

Beside the difficulties in establishing a line service (nonattainment of the critical transport volume and lack of appropriate types of ships) the flow of goods' disparity displays also a big challenge for this new logistical concept. Especially in terms of chemical transportation only one chemical good can be shipped in one direction, because there are strict regulations regarding shared storage space on the ship or concerning cleanliness.⁶⁸

The second category of provider that is operating on the market is the independent ship owners. Only few of them possess more than two ships and receive the shipping orders from the shipper directly. Rather they are either acting as subcontractors for bigger shipping companies in the sense of commission payments or they are cooperating with other independent ship owner within consortiums.⁶⁹ According to via donau independent ship owner as a profession does not exist in Austria.⁷⁰

5.5 Logistics Service Provider

After presenting a brief overview of the shipping companies which are carrying out the main transportation within the inland waterway, the next element of the system inland waterway transport is the logistics service providers (LSP). Some of the above-listed shipping companies are also Logistics service providers. As with the element ports and terminals, some LSPs that are located at the main Austrian Danube ports will be evaluated in detail within the next section.

Logistics service providers are companies that are specialized in organizing the whole logistical chain starting from production facilities to the warehouse of the customer. Within this chain logistical processes (transport, storage and handling) will be carried out. Moreover the LSPs offer some additional services, e.g. consulting, order management, financing, etc. Increasingly more and more Logistics service providers provide their customers (shippers) with all-in-one solutions that is the LSP gets the request to organize the handling, pre- and on-carriage or to organize the customs clearance.⁷¹

Again a selection on the "Blue Pages" by using the two criteria (1) company headquarter in Austria and (2) organizing pre- and on-carriage yields the following result:⁷²

Company	Danu Transport GmbH	Dangerous and Chemical Goods
Company headquarters	Austria	
Operating alongside the Danube	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary,	

⁶⁷ cp. via donau [Handbuch der Donauschiffahrt 2005], p. 119.

⁶⁸ cp. Ploberger [Erfolgsfaktoren der Binnenschiffahrt 2009], p. 40f.

⁶⁹ cp. via donau [Handbuch der Donauschiffahrt 2005], p. 95.

⁷⁰ cp. Ploberger [Erfolgsfaktoren der Binnenschiffahrt 2009], p. 41.

⁷¹ cp. Ploberger [Erfolgsfaktoren der Binnenschiffahrt 2009], p. 41.

⁷² cp. http://www.blaue-seiten.at/suche/?no_cache=1 (Status: November 04, 2010).

in	Slovakia, Austria, Germany	
Company	Panta Rhei Befrachtungs- und Speditions GmbH	Chemical Goods
Company headquarters	Austria	
Operating alongside the Danube in	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany	
Company	Navromsa ag basel	Chemical Goods
Company headquarters	Austria	
Operating alongside the Danube in	Romania, Serbia, Hungary, Slovakia, Austria, Germany	
Company	Multinaut Donaulogistik GmbH	
Company headquarters	Austria	
Operating alongside the Danube in	Ukraine, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany	
Company	Felbermayr Transport- und Hebetchnik GmbH & Co KG	
Company headquarters	Austria	
Operating alongside the Danube in	Romania, Bulgaria, Hungary, Slovakia, Austria, Germany	
Company	Mierka Befrachtung GmbH	
Company headquarters	Austria	
Operating alongside the Danube in	Ukraine, Moldova, Romania, Bulgaria, Serbia, Croatia, Hungary, Slovakia, Austria, Germany	

Tab. 6: Selection III from "Blue Pages"

Due to the fact that the transport of chemical and dangerous goods – within all modes of transport – requires certain equipment and adherence of strict legal requirements some Logistics service providers have expanded their business to this area. These requirements will be presented in the next section.

5.6 Consignor

This element within the system inland waterway can be compared with the trigger of the whole system. The consignor is a company that orders transport or logistics services. Moreover it can also be the consignee who orders these services. According to the types of goods shipped consignors can be divided into categories. For this classification the European Union has developed a standardized register that is called "Standard Goods Nomenclature for Transport Statistics, Revised" (NST/R)⁷³. Thereafter the 10 categories of NST/R will be presented:

⁷³ cp. http://ec.europa.eu/eurostat/ramon/reasons/index.cfm?argUrl=LST_REL&StrLanguageCode=EN&IntCurrentPage=6 (Status: November 04, 2010).

Class	Description
0	Agricultural products and live animals
1	Foodstuffs and animal fodder
2	Solid mineral fuels
3	Petroleum products
4	Ores and metal waste
5	Metal products
6	Crude and manufactured minerals, building materials
7	Fertilizers
8	Chemicals
9	Machinery, transport equipment, manufactured articles and miscellaneous articles

Tab. 7: Classification of chemical goods according NST/R

The transport volume was distributed among the above-mentioned categories in the year 2010 as follows:

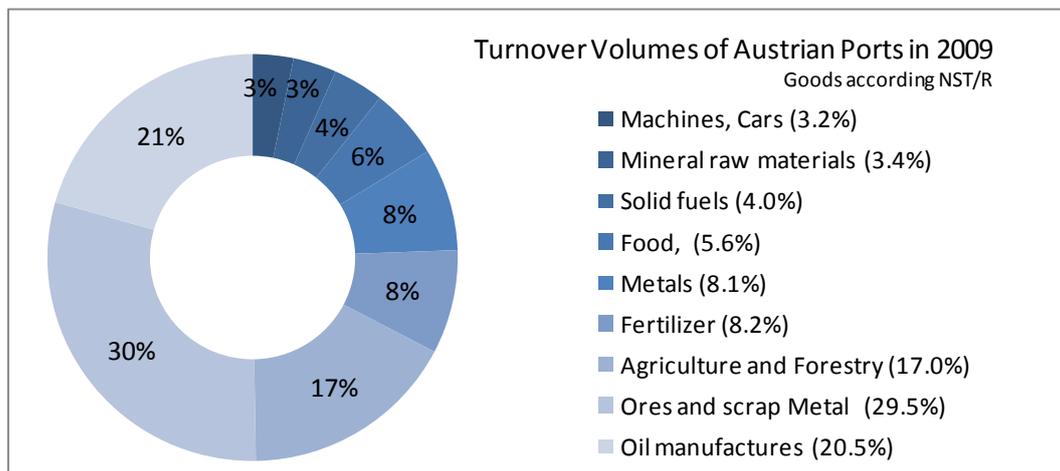


Fig. 20: Turnover Volumes of Austrian Ports in 2009⁷⁴

The share of chemical goods transported accounts for 43,589 tons (0.5 % of total transport volume 9.3 m tons). In comparison to 2008 this NST/R class made the biggest loss by a decrease of 54.4 %.⁷⁵

As this study focuses on strengthening the Danube waterway as a potential transport mode for the Chemical Industry in Austria the protagonists in the situation analysis, more precisely in terms of the consignor, are the chemical companies located in Austria.

Regarding the applicability of the Inland waterway for transporting chemical and dangerous goods, there are some specific circumstances that determine the attractiveness of this transport mode for the chemical industry. Insights to these circumstances will be summarized within the following seven points:⁷⁶

⁷⁴ cp. via donau [Jahresbericht 2009, 2010], p. 8.

⁷⁵ cp. via donau [Jahresbericht 2009, 2010, 2009], p. 6.

⁷⁶ cp. Mikusik [Rolle der Binnenschifffahrt beim Transport gefährlicher Güter, 2002], p. 129ff.

First, chemical producers do not have the storage capacity so that he is able to store the whole consignment received in his facilities or to use the whole capacity of a ship in order to ship his products.⁷⁷ Therefore some innovative logistics concepts are needed to overcome this problem, e.g. line services.

Second, generally the price for shipping chemical goods determines the choice of transport mode. Hence, only if there will be an advantage in price, the consignor is willing to change from proven road transportation to inland waterway transport. Due to the fact that in case of using inland waterway additional handling costs arises. Therefore, the costs of the total transport chain mainly rule the selection of transport modes.

Third, handling processes also represents a considerable issue. Not only for handling but also for storage of chemical and dangerous goods special equipment is needed (more details see evaluation model). Handling processes are those stages alongside the transport chain with the highest risk of accidents. Therefore the Logistics service providers endeavors to minimize the risk by minimizing the handling processes.

Fourth, the transportation of chemical and dangerous goods demands special requirements. This type of goods will be mostly shipped in containers or tanks which sometimes need to be temperature-controlled, cooled or heated. Additionally power supply is needed. In general the inland waterway is an appropriate transport mode for transporting chemical and dangerous goods. Nevertheless investments need to be made by port operators (for storage and handling processes) and by ship companies (for equipment and appropriate types of ships).

Fifth, the image of inland waterway transportation is not the best. Beside the already mentioned points, some other factors contribute to the negative image. Generally this mode of transport is considered to be slow, inflexible, unreliable, not innovative and bureaucratic. Reasons for these negative associations are set in the dependency on weather, old structures, equipment and unmotivated employees. Hence, the inland waterway needs to increase its agility and its willingness to provide innovative, reliable transport solutions.

Sixth, the organizational efforts in using the inland waterway as a transport mode are too high. Often only the main carriage will be provided by the shipping companies. Therefore the Logistics service providers are encouraged to offer integrated and comprehensive door-to-door-services.

Seventh, the environmental friendliness of the inland waterway is for the consignor not yet a reason to change the transport modes. Nevertheless by launching the performance-dependent toll this factor gains center stage. In case of further allocations of external costs to road transportation the inland waterway will increase its attractiveness.

5.7 National and International Transport Policy

The national and international transport policies have a considerable impact of the total inland waterway system. As per definition transport policy deals with the organization of processes of

⁷⁷ cp. via donau [Handbuch der Donauschifffahrt, 2005], p. 113.

mobility within passenger and goods transport on a national or international level.⁷⁸ On international level especially multilateral and bilateral treaties on inland waterway plays a decisive role. For the Danube waterway the Danube Convention is of high importance, which was signed in 1948.⁷⁹ Main objective of this convention is to guarantee frictionless inland waterway transportation on the Danube waterway, so to enable navigation free of charges, contingents and authorizations.⁸⁰ Another important aspect is the commitment of the Danube States to maintain their Danube sections in a navigable condition, to remain and improve the inland waterway transportation as well as to avoid obstacles or breakdowns on the shipping channel. The Danube Commission is responsible for monitoring the compliance with regulations.

Due to the economical and political integration of Europe, the European traffic and transportation policy gains in importance. Main objective of the European Union is to create a common market for inland waterway transportation. This shall be achieved on the one hand through harmonization of competition laws, on the other hand the traffic and transportation policy aims at strengthening the cooperate inland waterway market by expansion of the inland waterway infrastructure.⁸¹

European projects, which aspire for an improvement of the European inland navigation market, are the "European Action and Development Program for the European Inland Navigation"⁸² as well as the project about "Transeuropean Networks"⁸³. NAIADES includes recommendations for community measures, for the member states and other participants, which summarize five fields: market, fleet, workplaces and skills, image and infrastructure.⁸⁴ Among others it is recommended to advance investments by fiscal advantages and thereby to encourage entrepreneurial initiative and market development or to improve the image of inland navigation by formation and expansion of development networks.⁸⁵

TEN aims at the realization of a homogenous waterway network in Europe. In order to achieve this objective, it is essential to optimize the efficiency of the existing infrastructure, to recover missing connection between waterways and to remove constraints through extension, enlargement or deepening as well as to provide the needed lock capacity.⁸⁶ In April 2004 a new list of priorities for TEN was approved, which focuses among other measures the expansion of the Rhine/Maas-Main-Danube channel as well as the Seine/Schelde waterway.⁸⁷

Furthermore the European regulation (2005/44) about harmonized information services for inland navigation (RIS) on inland waterways came into effect on 20th October 2005. RIS means tailor-made information services for inland navigation, which provides comprehensive information to all actors and enables a continuous coordination of logistic processes with the real-time transport processes. Main objective of the regulation is the provision of harmonized river information services (RIS) within the European community, compulsory for all member states.⁸⁸

⁷⁸ cp. Ploberger [Erfolgsfaktoren der Binnenschifffahrt, 2009], p. 21.

⁷⁹ cp. Convention on Inland waterway Transportation on the Danube [Convention 1960].

⁸⁰ cp. Convention on Inland waterway Transportation on the Danube [Convention 1960], Präambel.

⁸¹ cp. Aberle [Verkehrspolitik 1997], p. 1206.

⁸² NAIADES – Europäisches Aktions- und Entwicklungsprogramm für die europäische Binnenschifffahrt.

⁸³ TEN – Transeuropäische Netze.

⁸⁴ cp. EG-Kommission [NAIADES 2006], p. 5.

⁸⁵ cp. EG-Kommission [NAIADES 2006], p. 6f.

⁸⁶ cp. Barwig [Binnenschifffahrtspolitik 1997], p. 111.

⁸⁷ cp. EG-Kommission [EG-Entscheidung 884/04 2004], p. 34ff.

⁸⁸ cp. EG-Kommission [EG-Entscheidung 2005/44].

Objective of the national traffic policy is to contribute to the realization of economic aims as well as to strengthen the competitiveness of inland navigation. The two main areas of the national traffic policy are infrastructure and traffic regulations. Main task of the traffic infrastructure policy is the creation of the general framework for the planning, the construction, the financing and the maintenance of inland waterways. Other measures concern the flood control, waterside as well as the construction and maintenance of ports. Traffic regulations of inland waterway concentrate on the regulations of inland waterway market. Objectives are the liberalization and harmonization of the traffic market.⁸⁹

In this context all inland navigation companies shall have same conditions for market access and minimum rates shall avert ruinous competition. In 2002 a comprehensive traffic master plan (GVP-Ö)⁹⁰ for Austria was prepared, which includes infrastructure packages for the transportation modes road, railway and Danube waterway. Objective of the GVP-Ö is to strengthen the Austrian business location, to expand the transport network efficiently and means-tested, to enhance the security of the traffic carriers, to secure the funding of the packages as well as to facilitate their realization. In total an investment volume of EUR 45.1 bn. was approved, although only 0.44% was granted to inland navigation. Indeed, the master plan refers to inland waterway transportation within its infrastructure program – as the expansion of the Danube and Danube Ports are considered – though a comprehensive strategy to develop the Danube waterway is missing.⁹¹

A further measure of traffic policy to enhance the Austrian inland navigation was presented in 2006: The National Activity Plan (NAP)⁹² includes the key aspects of activity for the Austrian policy of inland navigation until 2015. It is the national tool for the implementation of the integrated European action program for inland waterway transport (NAIADES). The NAP shall present a continuous basis of planning and decision-making for the national traffic policy, which forces the inland waterway transport strategically. An important objective in this context is to shift freight traffic on the Danube waterway, hence to contribute to the relief of the national road network. An essential part of the NAP represents the catalogue of measures with its 40 measure fact sheets. Thereby the initial situation, problem analysis, solution statement, status of realization, consequences, time line, priority, actors, responsibility for the implementation as well as financing sources are described for each single measure.⁹³

As described before, the EG regulation (2005/44) about a harmonized information service for inland navigation (RIS) was approved. The national implementation of RIS is the Danube River Information Service (DoRIS), which was launched in 2006 after a quadrennial testing phase. The major function of DoRIS is the listing and demonstration of ships on an electrical inland navigation map. Thereby the core nautical information about navigable water, flow regulation as well as data about the ships – like name, dimensions and position – are provided.⁹⁴

⁸⁹ cp. Kummer [Verkehrswirtschaft 2006], p. 182.

⁹⁰ GVP-Ö: Österreichische Generalverkehrsplan.

⁹¹ cp. Bmvit [Generalverkehrsplan 2002], S. VIIf.

⁹² NAP = Nationale Aktionsplan (engl.: national action plan).

⁹³ cp. Bmvit [NAP 2006], S. 2ff and 22.

⁹⁴ cp. via Donau [Jahresbericht 2005], S. C2ff.

5.8 Shipbuilder

The shipbuilding business as an element of the system inland waterway has a further important impact on the performance of the considered transport mode. From a technical point of view there are two types of ships that are operating on the Danube waterway: (1) self-propelled ships and (2) not self-propelled ships that are pushed by towboats. Moreover, these two types can be combined additionally with so-called lighters that are also not self-propelled shipping units. Due to the nautical conditions in Austria, a towboat is able to push up to four lighters which correspond to a total loading capacity of 7,000 tons. Both of the before-mentioned types are able to transport bulk goods, liquids, containers or general cargo. In more detail, the ships can be distinguished between the following types regarding the goods shipped:

- Tanker for liquids (e.g. chemical liquids, fuel oil, acids, but also nutritional oil or wine)
- Ro-Ro-Ship (charging without any handling facilities, e.g. car carrier or transport of heavy goods vehicles)
- Bulk shipping (e.g. gravel, coal, ore, etc)
- General cargo freighter⁹⁵

In 2009 there were approximately 96,000 – in comparison to 2007: about 74,000 (+27%) – shipping units locked in Austria. The average of the Austrian shipping fleet is about 30 years. Due to this continuing obsolescence of the fleet, demand for new, especially for Ro-Ro- and container ships with new drive systems arises.⁹⁶

5.9 Information Systems on Danube

A world without exchanging digital information is no longer imaginable today. Even more inexplicable would be transportation without establishing and applying appropriate information systems. The quality or function of every single process depends on its precedent, accompanying and subsequent information. However, in terms of inland waterway transportation high-performance infrastructure and development of telematics systems determine the future and success of the transport mode regarded. In order to take account of these demands information and management systems, so-called River Information Services (RIS), have been established within Europe. Main objectives of this initiative are to increase the traffic safety on the water and to increase efficiency.

River Information Services are information services designed and customized for inland waterway transportation. It enables the supporting of transport and traffic related issues and, of course, the coordination of logistics processes. Furthermore RIS is embedded within the European as well as the Austrian transport policy (Austria's "National Action Plan Danube Navigation"). In Austria the realization of RIS started in 2000 as the project called "Donau River Information Services" by via donau which coordinates the implementation and acts as the RIS operator since activation of this system in 2006.⁹⁷

⁹⁵ <http://www.binnenschiffahrtswelt.de/frachtarten.htm> (Status: November 06, 2010).

⁹⁶ cp. Ploberger [Erfolgsfaktoren der Binnenschiffahrt, 2009], p. 20.

⁹⁷ cp. via donau [DoRIS – Donau River Information Services, 2004], p. 2ff.

DoRis provides both shipping companies as well as external user on land information services based on Automatic Identification System (AIS) transponder technology and electronic navigation charts:⁹⁸

- Display of the actual traffic situation (position of the own vessel and of other equipped ones) by connecting the transponder to the Electronic Chart Display and Information System (ECDIS) chart.
- Free of charge exchange of safety-relevant AIS messages via the AIS transponder within equipped ships and locks in order to facilitate navigation.
- Possibility of underlaying the current radar image with the ECDIS chart image for improvement of safety.
- Access to current ship data via an Internet web portal with the possibility to automatically transfer the data to existing IT systems.

Furthermore the following services can be accessed via the DoRis website⁹⁹:

- Free of charge downloading of electronic navigational charts (ENC charts) for the entire Austrian section of the Danube.
- Notices to skippers on fairway conditions and on possible impediments to vessel traffic. These traffic notices can be accessed either conventionally or in compliance with the new “notices to skipper” standard in German, English, French and Dutch.
- Water gauge levels updated hourly measured at the main gauge locations on the Austrian Danube.
- Additionally, information on Austria’s locks as well as a tutorial for the night and day marking of vehicles used in inland waterway transport are being provided.

The benefits for each group of users are the following ones:¹⁰⁰

Groups of Users	Benefits
Vessel operators	Nautical information for decision processes; increase traffic safety
Fleet managers	Determining transport times more precise
Logistics service providers	Link freight data to traffic data; track transport cargo in real time; provide statistical information for planning processes
Port operators	Due to more precise arrival times – optimal usage of capacity for transshipment facilities, berths and cranes
Lock operators	Gives a precise overview of current traffic situation within the lock area; hence, support planning of locking
Emergency rescue teams and authorities	Facilitate the monitoring of dangerous goods transports; supporting the coordination of emergency rescue teams in the event on an accident; simplifying customs and border procedures

Tab. 8: Beneficiary groups of DoRis

⁹⁸ cp. via donau [DoRis – Donau River Information Services, 2004], p. 11.

⁹⁹ www.doris.bmvit.gv.at.

¹⁰⁰ cp. via donau [DoRis – Donau River Information Services, 2004], p. 12.

5.10 Logistics Management in Inland waterway Transport

A system is a framework consisting of different parts. The performance of a system depends most intensively on the capacity of the individual parts and, of course, the interaction of these parts. This condition gives two implications: Firstly, if all parts work properly the full potential of the system can be obtained, whereas secondly, if one part lacks, the whole system's performance will be diminished.¹⁰¹ Therefore, the integrative management of the whole system Inland waterway represents a considerable leverage for improvements of this transport mode.

From the logistical point of view, the system Inland waterway is regarded as a transport chain, which includes generally the following components:

- Transport,
- Handling,
- Storage,
- and the associated information flow

Moreover the transport chain can be divided into direct transport or combined transport. Within the first kind of transportation, the goods do not change the transport mode; hence there is no need to handle and storage the goods additionally. In terms of inland waterway, a prerequisite for transporting goods directly is an access to waterways at both consignor's and consignee's side. Due to the fact that only a few companies have a direct access to inland waterway by having a quay, direct transport is of minor importance.¹⁰² Hence, there is a necessity of pre- and on-carriage which will be organized by Logistics service providers and carried out mostly by rail or road transportation.

As per definition the combined transport is an intermodal transport, whose main carriage is predominantly carried out by rail, inland waterway or ocean shipping. Pre- and on-carriage are done by using road transportation, but only at a minimum of necessity.¹⁰³

The main objective of the combined transport is to abstract the individual advantages of each transport mode road – rail – inland waterway in order to obtain a feasible optimum. Due to the fact that more and more Logistics service providers locate their facilities near to terminals or Danube ports the importance of combined transport increases. Nevertheless the biggest share within the modal split still remains with road transportation (see figure 12).¹⁰⁴

Within the combined transport, there is a distinction between Inland waterway as main carriage and pre- and on-carriage respectively. In context to the former the pre- and on-carriage can be either executed by road, rail or also inland waterway transport, whereas within the latter the pre-or on-carriage will be realized by inland waterway. In this case, overseas transport will do the main carriage (Figure 21 and 22).

¹⁰¹ cp. via donau [Handbuch der Donauschiffahrt, 2005], p. 14.

¹⁰² cp. Ploberger [Erfolgsfaktoren der Binnenschiffahrt, 2009], p. 8.

¹⁰³ cp. Logistikum.research [Handbuch Intermodaler Verkehr, 2010], p. 21.

¹⁰⁴ cp. Ploberger [Erfolgsfaktoren der Binnenschiffahrt, 2009], p. 42.



Fig. 21: Inland waterway Transport as pre- or on-carriage transport



Fig. 22: Inland waterway Transport as main carriage transport

As mentioned at the beginning of this section, the main objective was that the reader gets the possibility to become acquainted with the system of inland waterway transportation. Needless to say the information stated in this section represents just an overview and raise no claim to completeness. Remembering figure 8 which portrays the system of inland waterway transport, this picture provides the framework and pathway for individual improvements. However, the reader is able to go one step further within the next section. There, an evaluation model regarding the performance of inland ports is going to be introduced.

5.11 Strengths, Weaknesses, Opportunities and Threats of Inland waterway Transport in Austria (SWOT-Analysis)

Location, Structure and Capacity of Danube waterway

Inland waterway Transport in Central and Eastern Europe is mainly focused on the Rhine-Main-Danube-Corridor. The decisive factor is the performance. The navigability of the waterway determines the degree of capacity utilization and finally the competitiveness of the mode of transportation compared with road and railway transport. Both carriers are on the one hand direct competitors regarding the main transport processes, but on the other hand partners in pre and on carriage. Crucial for competitiveness too is the quality of ships as well as innovation capability of ship builder. In order to remain competitive within the contest of transportation modes, inland waterway transport has to improve the cost-performance ratio. Thereby the factors transport time, reliability and ability to plan are essential. Via Donau for instance numbers an increase of inland waterway transport from actual 1% to 7% of the total transport volume as a strategic objective.¹⁰⁵ This shall be achieved by intensive trading activities with the south-east Danube region as well as with the Black Sea region (port of Constanta). Bulk cargo and liquids are traditional goods to be conveyed and therefore highly interesting for the transportation of chemical commodities. Inland waterway Transport causes marginal negative external effects compared to other transportation modes. A

¹⁰⁵ cp. via donau [Jahresbericht 2005], section A und B.

strengthened transport by inland waterway is supposed to lead to improved environmental conditions. The main advantages facing road and railway transports are:

- lower costs of transport per tkm
- lower external effects (costs due to congestion, traffic accidents and emissions)
- sufficient reserve capacities

The external costs of inland waterway transport amount to € 10/1000 tkm, those of railway transport add up to € 15 /1000 tkm and transport by road causes € 35/1000 tkm.¹⁰⁶ Although it has to be mentioned that in connection with external costs, the environmental pollution of inland waterway transport net per ton is twice as high as road transportation, due to the used fuels and the underdeveloped motor technique.¹⁰⁷

By order of via donau the COLD¹⁰⁸ (Container Liniendienst Donau) study was analysis the potential of a container traffic on the Danube waterway. For the European economy an efficient supply an on-carriage of container volumes to the hinterland of the oversea ports is of high importance. Within the context of the container inland navigation the Danube waterway offers high potentials especially towards the Black Sea (Constanza). The current volume of overseas container of Austria, Hungary and Slovakia amounts to 700.000 TEU per year.¹⁰⁹ According to a forecast of the Austrian Institute for Land-use Planning (Österreichisches Institut für Raumplanung – ÖIR,) the potential of container traffic on the Danube waterway amounts to 1.3 to 2.4 bn TEU until 2020. Target group of container traffic is shipping companies. They should be adverted to the marginal disadvantages in delivery time and cost advantages compared to railway..¹¹⁰ The real dimension of the potential will be realized in the next few years.

Infrastructural bottlenecks have considerable consequences on the competitiveness and efficiency of the inland navigation. Objective of the political decision-makers should be the improvement of the infrastructure of the waterway by properly maintenance, removal of constraints and efficient lock management. Thereby an international coordinated proceeding with each member states has to be considered.¹¹¹

An efficient utilization of the inland waterway in CEE countries is depending on ice, flood and low flow problems as well as on the number of locks. As forces of nature and geographical circumstances cannot be excluded completely, a flexible adjustment of the logistics processes in the case of capacity constraints is essential. The expansion of the inland waterway is rarely awakened by the public in a positive sense, as this comes along with the regulation of natural regions.

Capacity, Efficiency and Location of Inland waterway Ports and Terminals

In the context of multimodal logistic nodes, ports and handling hythes take over integral functions between the carriers inland waterway, railway and road. In view of partly double-digit increase rates of transported volumes, an internationally coordinated development and investment strategy to

¹⁰⁶ cp. bmvit (2006a), p. 98.

¹⁰⁷ cp. bmvit (2006b), p. 11.

¹⁰⁸ cp. via donau (2006), p. 6f.

¹⁰⁹ TEU = Twenty Feet Equivalent Unit.

¹¹⁰ cp. via donau (2006), p. 32ff.

¹¹¹ cp. bmvit (2006a), S. 4.

implement innovations in ports and terminals as well as to support the enhancements of south/east European Danube ports is missing.

Furthermore the connection of inland navigation terminals to the railway and road network as well as the integration into multimodal logistic nodes needs to be improved. The entrance requirements are problematic, on the one hand due to the capacity, on the other hand due to the opening hours. Chances to increase the efficiency of transports are alternative motorization of ships as well as Public-Private Partnership (PPP) financing models for the adjustment of inland navigation terminals, especially regarding handling technologies and warehousing facilities. Further investments are proposed to improve the flood prevention within the ports in order to guarantee a year-round navigation.

Availability, Quality and Capacity of Ships and Equipment

The demands of the Chemical Industry go to a modernization of the existing fleet. The privatization process within the inland navigation is nearly carried out in most of the CEE countries and the outcomes of this are numerous new companies. In order to improve the competitiveness of the inland navigation, a modernization and adjustment to the requirements of the forwarding industry is necessary. Thereby priority is given to factors like environmental friendliness, security, development of new markets and competitive cost structures. Further problems are remarked regarding the availability of ships for the transport of chemical goods, the cleaning of means of transportation as well as in the missing possibility to fully load the ships, in order to provide a competitive alternative to road transport.

5.12 Strengths, Weaknesses, Opportunities and Threats of Inland waterway Transport in Austria within the Connection with Chemical Logistics

When trying to collect data to identify the volume of forwarded hazardous goods problems arise. For inland waterway and the comparison between traffic carriers, the NST/R classes are available as well as the classification of chemical goods, fertilizer and petroleum products. For railway and road transportation the volumes are divided into hazardous goods classes. Comparing the figures of Statistik Austria with those of the Ministry for Traffic, Innovation and Technology it is noticeable that there are differences up to 25%. Furthermore, after the liberalization of the market and the entry to the European Union data is only available for Austrian transportation companies. From the year 1994 until now, data from Euro Stat has to be used. The collection and therefore the quality of the data depend on different methods which are applied by the member states. For this reason, the volume of transported hazardous goods can only be indicated approximately. According to Statistik Austria the share of dangerous goods in the total traffic volume amounts to about 15-20%.¹¹² Experts estimate a higher ratio and refer to several studies from Germany, where the share of hazardous goods transported by road amount to nearly 50%. Only 4% of total dangerous goods volume is transported by inland waterway.¹¹³ These figures show the insignificant role of inland navigation in connection with the transport of dangerous goods and the missing integration of the carrier into the logistics chain. Properly the situation in Austria can be compared to Germany, although the ratio of hazardous goods transported by inland waterway on the Danube is expected to be even lower. This is due to the fact that the Rhine connects a higher number of industrial cities than the Danube.

¹¹² cp. Mikusik [Binnenschiffahrt Gefahrgut], p. 14ff.

¹¹³ cp. Recknagel/Zindel [Anforderungen Gefahrgut 1995], p. 73.

The number of handling activities within the transport process of dangerous goods shall be minimized as far as possible, as people are involved during transloading. Therefore more people are affected by negative consequences in the case of accidents as during the direct transportation from A to B. Furthermore vibrations of the transport route pose a lower risk than transloading chemical goods.

Basic chemicals are rarely time-critical products, but intermediates, fine chemicals or specialties are supposed to be delivered in time or even just-in-time. In order to keep the stock levels low, in-time deliveries gain in importance within the Chemical Industry. In these cases the inland waterway transportation does not pose a competitive alternative to road or railway transport due to the bad image of missing reliability and ability to plan. Flood and low flow periods contribute to the undependable delivery times.

Consequently rather bulk chemicals are transported via inland waterway, which in fact can be assigned to hazardous goods (for instance: fertilizer) but do not make special logistical demands to the carrier. When forwarding hazardous goods in container or tanks, inland waterway transportation is rather seen as risky as the logistic processes contain transloading activities.

6 Model for Evaluating Inland Ports and Terminals as Logistics Nodes for the Chemical Industry

The evaluation model represents a central part within the potential study. In conjunction with the situation analysis introduced in section V, the model provides a more detailed insight into how to assess the performance of an inland waterway port. Especially the chemical industry demands special requirements in terms of transporting, handling and stocking, documentation and the accompanying information flow. Moreover, the compliance of several regulations represents a necessary but also a challenging assignment at the same time. Due to the considerable impacts of accidents with chemical goods on both humans and environment it is inevitable to establish and control these regulations. Deduced from these legal requirements the port as well as ship operators are encouraged to install special infrastructural equipment, e.g. oil separator, retention ponds, etc. However, the respected model should give the reader an idea, which key information is essential in order to assess inland ports and terminals as logistical nodes. To some extent this model can also be used as a guideline to assess other logistical facilities.

The generation of this model required on the one side a profound analysis of port infrastructure and on the other side the support by individual experts. These experts are: Christian Steindl (Ennshafen), Gerhard Niederleitner (Billitz), Gottfried Buchinger (Donaulager), Thomas Putschögl (Quehenberger). Within the remaining part of this chapter the model per se is going to be presented. First, the reader gets to know to the overall structure and finally a closer look at the different components of the model will be taken.

Basically the model generated by the authors pursues the shape of a matrix. The information on the ordinate indicates the individual components to be evaluated. As can be seen from Figure XX these components are subdivided into 3 levels. In order to support the recipients of this model, information regarding the indication is given on the right hand side of each component in the respected line. The abscissa of the matrix offers the opportunity to get information from several companies located in the regarding inland port. Mainly these companies are port operators / Logistics Service Providers with competence in transport, transloading and storage operations for chemical and dangerous goods. In general the model complies with the following structure:

<i>Evaluation Model</i> <i>Inland Ports</i>			Port Operators / Logistics Service Provider with competence in transport, transloading and storage operations for chemical and dangerous goods			<i>Information as to indication</i>
			Port Operator	Logistics Service Provider 1	Logistics Service Provider 2	
Level 1	Level 2	Level 3				

Fig. 23: Basic Structure of the Evaluation Model

In general from a content-related point of view, the whole model is composed of six sections, which are stated in the following:

1. Basic information
2. Infrastructure and Suprastructure

3. Chemical and dangerous goods
4. Certification
5. Information and Communication Technology
6. Strategic activities

Hereinafter the six sections will be introduced in detail. Associated with this the underlying components (level 2 and 3) will be presented.

First, the section *basic information* should give an overview of the port operator/logistics service provider located in the concerned port. Here, basic information is asked, e.g. annual turnover or handled transport volume, ownership, etc. Furthermore, some special information only regarding the port operator will be asked. The structural connectivity represents the last component of the first section. Here the degree of integration port as well as the ports the respected port (Top 15) is dealing with will be analyzed. The overall first section can be seen in figure 24.

Evaluation Model <i>Inland Port</i>		Logistics Service Providers with competence in transport, transloading and storage operations for chemical and hazardous goods					
Port:		Port Operator	Logistics Service Provider 1	Logistics Service Provider 2	Logistics Service Provider 3	Indication	
BASIC- INFORMATION	Corporate Name						
	Address						
	Ownership						
	Location alongside the Danube					River's kilometer, left-/right-bank	
	Annual turnover						
	Transloading volume					Tons	
	Number of employees						
	Customs office						
	Business hours						
	Contact details					CEO, contact person, telephone, e-mail, homepage	
	Costms office						
	Area	Total area					Square-meter
		Office area					Square-meter
		Water area					Square-meter
Free office area for new companies						Square-meter	
Free building area for new companies						Square-meter	
Integration with other Ports	See Below.						

Fig. 24: Section I of the Evaluation Model

Integration with other ports alongside the Danube (Top 15)		
IMPORT		
Port of Loading	Port of Destination	Tons
	respected port	
EXPORT		
Port of Destination	Port of Loading	Tons
respected port		

Fig. 25: Attachment of Section I

Second, one of the biggest sections within the model constitutes *infrastructure and suprastructure*. Most important, this section influences the applicability as well as the attractiveness of the port as a logistical node for the chemical industry considerably. However, the section consists mainly of the following components (at level 2): (1) storage capacity, (2) equipment, (3) fire protection, (4) rail, (5) road and (6) inland waterway. The latter three components determine the performance as a trimodal logistics node essentially. Again, the overall section is displayed in figure 26.

INFRASTRUCTURE AND SUPRASTRUCTURE							
Storage capacity	Total storage capacity (protected)					Square-meter; euro-pallets	
	Total storage capacity (unprotected)					Square-meter; euro-pallets	
	Space for swap bodies					Number of swap bodies	
	Space for cooling swap bodies					Number of swap bodies	
	Bonded warehouse					Square-meter; euro-pallets	
	Container warehouse					TEU	
	Tank depot					Cubic meter	
	Silo depot					Cubic meter	
	Other types of warehouses					Description; capacity in tons, square meter	
	Equipment	Gantry crane					Number; payload in tons; transloading performance in container / time unit (flow rate)
		Luffing crane					Number; payload in tons; transloading performance in container / time unit (flow rate)
		Mobile crane					Number; payload in tons; transloading performance in container / time unit (flow rate)
		Reach Stacker					Number; payload in tons; transloading performance in container / time unit (flow rate)
		Other types of cranes					Description; number; payload in tons; transloading performance in liter, container / time unit (flow rate)
Decanting / pumping assets						Description; number; payload in tons; transloading performance in liter / time unit (flow rate)	
Tank cleaning station						Number	
Retention pond						Cubic meter	
Oil separator						Yes/No	
Weighbridge						Number	
Other assets						Description; specification	

Fire prevention	Fire brigade (company-owned)					Yes/No
	Fire detector					Yes/No
	Sprinkler system					Yes/No
	Smoke and heat funnel					Yes/No
Rail	Loading track					Number
	Railway siding (connecting line)					Meter
	Storage track					Meter
	Possibility of switching					Yes/No
	Frequency					Trains/day
	Capacity					Trains/day
Road	Loading road					Number
	Frequency					Trucks/day
	Capacity					Trucks/day
	Parking place for trucks					Number
	Connection to motorway					Description of motorway; distance in kilometer
Inland waterway	Basin					Number
	Water depth					Meter
	Loaded draft					Meter
	Length of quay wall					Meter
	Winter port					Yes/No
	Mooring					Number

Fig. 26: Section II of the Evaluation Model

Third, the protagonist of the model is highlighted: *chemical and dangerous goods*. As mentioned in the introduction of this chapter, the compliance of regulations represents one of the most important issues in chemical logistics. Therefore, the most common legal requirements in terms of transporting, transloading and storing chemical goods are indicated. An other major factor influencing the logistical attractiveness are the value-added-services that are also quoted within the third section. Figure 27 shows this section.

CHEMICAL AND DANGEROUS GOODS						
Transloading volume	Chemical goods					Tons p.a.
	Dangerous goods					Tons p.a.
Transloading between transport modes						
Transloading between transport modes	Inland waterway - Rail					Tons p.a.
	Inland waterway - Road					Tons p.a.
	Rail - Road					Tons p.a.
Transloading of product types						
Transloading of product types	Unit load					Tons p.a.
	Bulk cargo					Tons p.a.
	Liquids					Cubic meter, liter p.a.
Transport						
Transport	Unit load					Tons p.a.
	Bulk cargo					Tons p.a.
	Liquids					Cubic meter, liter p.a.
	Temperature-controlled transport with permanent recording					Tons p.a.
Storage						
Storage	Chemical goods					Square-meter, euro-pallets
	Dangerous goods					Square-meter, euro-pallets
	Cold storage					Square-meter, euro-pallets
	Temperature-controlled storage					Square-meter, euro-pallets
	Heatable storage					Square-meter, euro-pallets
	Bulk cargo storage					Square-meter
	Storage for liquids					Cubic meter
Value-Added Services						
Value-Added Services	Customs clearance					Yes/No
	Incoming goods inspection					Yes/No
	Order picking					Yes/No
	Assorting					Yes/No
	Repacking					Yes/No
	Assembling					Yes/No
	Other logistics services					Yes/No; description
	Container repair					Yes/No
	Inspection of dangerous goods					Yes/No
	Safety adviser for dangerous goods					Number employees
Compliance with legal requirements						
Compliance with legal requirements	Transport of Hazardous Goods Act					Yes/No/Partly
	European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)					Yes/No/Partly
	Regulations concerning the International Transport of Dangerous Goods by Rail (RID)					Yes/No/Partly
	European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways					
	Regulation according VbF (Verordnung brennbarer Flüssigkeiten)					Yes/No/Partly
	Regulation 1.10 ADR/RID/ADN (Safety and Security)					Yes/No/Partly
	Security management according SEVESO II					
	ADR checks with documentation					
	Operating licence for Dangerous Goods					Yes/No; if yes: which classes of dangerous goods

Fig. 27: Section III of the Evaluation Model

Fourth, the section certification indicates some common standards within both general industry and chemical industry. For example plays the certification Safety and Quality Assessment System (SQAS) an important role within chemical logistics. Here, logistics service providers are audited according a standardized questionnaire by independent third-party assessors and the results will be published by the representation of European chemical industry (Cefic) so that every chemical company has access to the auditing results. Figure 28 shows the total content of section four.

CERTIFICATION						
Certification with ISO						Yes/No/in process
International Food Standard (IFS)						Yes/No/in process
Environmental management						Yes/No/in process
Safety and Quality Assessment System (SQAS)						Yes/No/in process

Fig. 28: Section IV of the Evaluation Model

Fifth, the focus will be put on information and communication technology. Integrated information systems in transporting benefits every stakeholder within the whole system (see previous chapter). Especially for the consignor (shipper) and consignee (customer) more service and higher service levels can be achieved through exchanging real-time information. A special type of information system used within inland waterway transport represents the River information systems (RIS). In respect of transportation on the Danube, it is called DoRis. More information about this special information system can be obtained from the situation analysis. However, Figure 29 gives insight into section five of the evaluation model.

INFORMATION- AND COMMUNICATION- TECHNOLOGY						
Enterprise Ressource Planning						Description
Warehouse Management System						Description
River Information System (DoRis)						Yes/No
Other information- and communication technology						Description

Fig. 29: Section V of the Evaluation Model

Sixth and finally, section six titled strategic activities should give an overview about actual and future cooperation, especially with Eastern European ports. Further strategic activities encompasses specialization in terms of geographic and commodities or industries and dis- and investment purposes. Here, the respected port operator or logistics service provider should give a brief descriptive overview about his strategies. Figure 30 shows finally the corresponding part of the evaluation model of section six.

STRATEGIC ACTIVITIES						
Cooperation with central and eastern european Ports (actual and planned)						
	Strategies					Description, project partner, objectives, result(s), periode, investment
	Cooperation					
	Projects					
Specialization (actual and planned)						
	Geographical (import- & export-oriented)					Description, objectives, periode investment
	Commodity / Industry					
[Dis-]Investment						
	Expansion					Description, objectives, periode investment
	Depletion					

Fig. 30: Section VI of the Evaluation Model

Summing up the above-given information, the reader has been introduced to a model that lays claim to evaluate the performance of an inland port or terminal as a logistics node for the chemical industry. More specifically, the model should create a clear picture of the attractiveness of the inland port to the chemical industry and determine the gap between the expectation and requirements of chemical industry and the actual performance of the ports and terminals. Ultimately, this discrepancy generates the framework and incentive to initiate future projects. The main objective is to minimize those gaps.

7 Recommendations for strengthening the Danube waterway for the Chemical Industry in Austria

From the strategic point of view, inland navigation seems to be highly attractive for the Chemical Industry under the condition that the capacity and efficiency is guaranteed. A further condition is the improved integration of the carrier into the supply chain and the connection to previous or ongoing deliveries by road or railway in the context of multimodality. From the logistical point of view, the inland waterway gains importance especially regarding the supply of Eastern Europe, Middle and Far East markets.

7.1 Requirements of the Chemical Industry within the Context of Inland Navigation

In general the requirements of the Chemical Industry within the context of inland navigation can be divided as follows:

Demands of the Chemical Industry	Initial Situation
<ul style="list-style-type: none"> ○ Demands specific to the security of the system ○ Product-specific demands ○ Demands to logistics and transport performance 	<ul style="list-style-type: none"> ○ Lack of holistic multimodal concepts ○ Organization of market: different levels of liberalization standard ○ Quality of transport performance (time, safety, reliability) not competitive compared to road and railway transport ○ Capacity constraints



Fig. 31: Demands of Chemical Industry versus Initial Situation

Demands specific to the security of the system:

- Security of inland navigation due to wide-spread and well expanded waterways. Ships can move without congestion or other obstacles as well as with a sufficient safe distance to the public.
- Security due to low speed and density of traffic compared to road transportation
- Strict safety regulations for equipment and construction of the ships are prerequisites and have to be checked regularly.

Product-specific demands:

- Products and packages require special warehousing facilities with increased safety precautions as well as facilities with power supply for containers with heating and cooling systems, etc.
- Chemicals and especially hazardous goods are often transported in containers which requires transloading facilities and stowage possibilities
- Increases accident risk at combined shipments demands a reduction of handlings procedures

Demands to logistics and transport performance:

- Supply chains with the inclusion of inland waterway will be realizable if cost advantages can be achieved
- Integration of inland waterway needs additional handling and transloading processes, which raise the total logistic costs compared to other supply chains
- Flexibility of logistic processes: inland navigation is considered as weather-dependent with obsolete structures and equipment as well as unmotivated staff
- Dependence on the weather avoids accurate time-tracking and arrival forecast, although especially regarding the transport of hazardous goods adherence to deadlines, reliability and exactness is important
- Logistics service provider shall provide integrated logistics solutions, like terminal handling and pre- and on-carriage processes, additionally to the pure transport. An improved trimodal organization is required.
- Only selected inland waterway ports are able to handle and transload hazardous goods, which further limits the scope of inland waterway transport for the Chemical Industry

7.2 Recommendations and Measures to strengthen the Danube waterway for Hazardous Goods Transport

- Europe-wide and international coordinated education and training concept for logistic staff
- Improvement of the logistic infrastructure (suprastructure) and efficiency in and around ports and terminals
- Implementation of infrastructure project has to be realized parallel not step by step
- Chemical goods, especially liquids require transloading and cleaning facilities
- Terminals have to be run by neutral operator
- Investments shall be forced by co-operations between politics and economy, this requires long-term contracts and agreements
- Barges have to fulfill stringent quality standards regarding cleanliness
- Provision of an intermodal information system which enables area-wide and cross-border tracking and tracing of door-to-doors deliveries of hazardous goods
- The standardized intermodal information system enables high ability to plan and control due to real-time duration of handling processes, locks, stationary times, on-carriage processes, etc.
- Intermodal organization of logistic processes: integrated door-to-door supply chains with on responsible partner, which can offer short-term alternative solutions
- Organization of inland navigation has to be adjusted to modern supply chain management, companies have to change logistic mentality and decide which products are appropriate to be transported by inland navigation

Europe-wide and international coordinated education and training concept for logistic staff

In order to strengthen the inland waterway transport, a shaping of opinions in divers institutions has to be forced. This starts with an international harmonized concept for education and training which is integrated through all level of education to secondary and tertiary school. International standards and certificates are to guarantee an institution- and border-crossing, clear and holistic information and training guideline for skilled logistic staff and other demand carriers. Although staff is highly qualified on national level and there are numerous initiatives, there is a lack of skills on international level and a harmonized strategy in this context is missing. The NELI EU-project tries to establish a

cooperation-network for logistics and nautical education focusing on inland waterway transport in the Danube corridor supported by innovative solutions.¹¹⁴ The main objectives are to

- Establish a cooperation network among the different organizations activating in the inland waterway navigation sector with a view to facilitating the exchange and future cooperation regarding educational and training matters,
- Design and implement eLearning services for the inland navigation aimed at reducing digital divide among the regions in the South East Europe,
- Conceive and implement Information and Training Centres (at Galati in Romania and at Ennschafen in Austria),
- Increase public awareness on the role and importance of new innovative teaching methods in the field of inland navigation in order to promote the specific activities among youngsters.

Improvement of the logistic infrastructure (suprastructure) and efficiency in and around ports and terminals

In order to enhance the transport of hazardous goods by inland navigation, it is essential to expand and improve the infrastructure within the ports. Dedicated warehousing and specific transloading facilities are needed, but not provided by each Danube port. Furthermore in this context flexible working methods and schedules of logistic staff within the ports as well as transparent port charges can be mentioned. Experts remark that transloading procedures are often too time-consuming and expensive. Although experts recommend carrying out a comprehensive market analysis in order to identify the real demand of the Chemical Industry, before investments are realized. For this reason it is highly difficult at the moment to receive fixed commitments from the Chemical Industry to use the infrastructure invested. However it is important to increase the handling volume in order to reduce fixed costs and to implement new trimodal traffic routes. Long-term contracts and investments are missing.

Further on experts propose that area not built-up is dedicated to industrial purposes, otherwise port infrastructure cannot be used appropriately.

A continuous unloading depth of minimum .2.5 m and a year-round navigability effects reduction in the number of pre- and on-carriage processes.

Missing cleaning facilities lead to an increase in unloaded drives and the transport and handling of containers shall be better integrated into the inland navigation.

All these measures to improve the infrastructure of ports and terminals have to be realized parallel not step by step. Combined transportation for hazardous goods has to guarantee within the terminals for container, liquids and bulk chemicals and additional services have to connect directly at the ports.

Neutral Terminal Operator

Actions against monopolistic infrastructure operators have to be taken on the part of political decision-makers. Monopolistic situations in ports and terminals can be avoided by neutral operators.

Intermodal Information System

Currently and in the future, logistics composes of digital information and interconnection is indispensable. The provision of an intermodal information system enables area-wide and cross-

¹¹⁴ Project NELI, part of the South East Europe Transnational Cooperation Program, funded by the European Union.

border tracking and tracing of door-to-doors deliveries of hazardous goods. A standardized intermodal information system enables high ability to plan and control due to real-time duration of handling processes, locks, stationary times, on-carriage processes, etc. Logistic processes have to be organized intermodal, meaning to improve the integration of door-to-door supply chains with one responsible partner, which can offer short-term alternative solutions. The River Information System (RIS) shall be seen as risk prevention for hazardous goods transport and installed cross-nationally and standardized along the Danube waterway. Furthermore the loading industry does not have any access to this system. Actually information systems provide only visual function; in the near future data shall be available extrapolated. This requires analyzing the initial situation in order to identify future needs of information transparency. Missing interconnectedness means missing ability to plan and control.

Integrated Supply Chain Processes

Internal process organizations of companies have to be adapted to modern supply chain management. This means that companies are able to built up flexible logistic systems, which enable the forwarding of cargo in case of weather-depending hold-ups. According to experts' opinions it is essential to integrate ports and terminals in intermodal distribution networks and that customers have freedom of choice regarding the means of transportation.

Experts recommend that Chemical companies analyze their flow of goods in detail, identify deficits in certain regions and determine future-oriented location concepts and infrastructure needs. Flow of goods shall be analyzed regarding origin and destination as well as regarding the relations of pre- and on-carriage additionally to the main run.

Due to partly missing reliability of inland navigation, Chemical companies need carrier overlapping failing out scenarios. Thereby the Chemical Industry has to involve other industrial sectors in order to utilize the capacities. To strengthen inland navigation, the logistic planning within the companies has to be changed; not time-critical products have to be identified and analyzed regarding their ability to be transported by inland waterway. Preliminary lead times and lay-days have to be buffered through warehousing facilities.

Regional Economic Policy

Before measures and actions can be taken, a comprehensive analysis of the industrial sector regarding existing and future markets, flow of goods and competitive strategy, is essential to provide an information or decision base for settlement of companies and location decisions. Therefore the experts demand to orientate the Regional Economic Policy and the dissemination of subsidies according to a profound market analysis. A transparent policy of companies' settlement enables the concentration on core competences. It has to be guaranteed that site selections consider the availability of neutral providers, in the sense of infrastructure and logistics. The settlement of companies has to consider trimodal, global, competitive and sustainable aspects, in coordination with traffic policy. The policy of subsidies has to be in accord with the Regional Economic Policy, especially when identifying strategic industrial sites and locations. Thereby inland waterway has to be taken into consideration, already in the early planning phase.

Increased advertising activities are not sufficient to improve the commercialization of inland navigation. First of all, the frequency of transports within the ports, the reliability through co-operations and transparent tariffs has to be established.

Fair Competition between the Carriers

The request on behalf of the European Union to internalize external costs in traffic - thereby to guarantee cost transparency within the traffic system – come in useful to inland. By establishment of performance-related congestion charges for road traffic, inland navigation will be able to extract advantages from a positive environmental balance compared to other modes of transport. The consideration of accident risks in the case of hazardous goods transportation through surcharges or reductions of the toll or of the transport assurance will improve the competitiveness of inland navigation and achieve shifting effects. The demand for cost transparency especially for hazardous goods transport shall be added to each mode of transportation through risk surcharges or risk deductions.

Concepts of combined transport between inland navigation and railway transport shall be forced and a close cooperation between these two carriers is all the more important, the more investments are placed by political decision makers. The strongly competing transportation modes shall be replaced by useful co-operations, joint supply chains and mutual acting within the combined transport.

Innovative Technologies

Innovative technologies concern especially the types of barges and the motorization. For the transportation of hazardous goods, inland navigation provides high security standards. Decisive factors for possible accidents with barges are optical range and the curve radius of the waterway. New technologies can improve recognizing barges in the case of bad visibility conditions and to prevent the risk of a possible collision. Innovative technologies, which increase the safety, efficiency and cost-structure of handling processes of hazardous goods, shall be implemented.

Summing up, inland navigation already meets numerous demands of transporting hazardous goods. The interoperability with other carriers is given by the possibility of forwarding goods in container. Further demands, especially after a significant simplification of the organization procedures, are met by the implementation of a new AND regulation. Nevertheless the carrier still has to struggle with the dependability of external factors like water level and weather conditions. This results in an increased coordination and cooperation effort with other transportation mode.

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