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Final Report

Statistical coverage and economic analysis of the logistics sector in the EU (SEALS)

Prepared for the European Commission, DG Energy and Transport

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Executive Summary

This report on “Statistical coverage and economic analysis of the logistics sector in the European Union”[1] is an important part of the Commission’s “Freight transport logistics action plan”. The SEALS study was commissioned to improve knowledge of the sector and obtain a better understanding of its characteristics, its development and its needs by using available statistics and additional data sources.

Logistics, covering the planning, organization, management, control and execution of freight transport and warehousing operations in the supply chain, generated an estimated **potential market volume (total costs)** of nearly 900 billion EUR in the 27 European Union member states in 2007, of which around half was outsourced.

We were able to produce a complete set of data on employment and value added by country and sub-sector for the years 2000 and 2005. Our analysis arrives at a total of about **7 million employments** in freight logistics – the outsourced part of the market – for 2005 and at a **value added of roughly 300 billion EUR**, or approximately 3 % of GDP. These data are our best estimates because we had to fill many gaps and reorganise data. For example the present statistical system separates freight from passenger transport only in part, but this problem will be largely resolved by the new NACE Revision 2.0 classification of economic activities, effective as from 2008.

We also looked at **logistics costs** for selected branches of the economy. Here again national accounts data are not sufficiently segmented and only become available years later, whilst business-related passenger transport cannot be separated. **Service producer price indices** are now being implemented across the EU for most modes of transport; they will be produced quarterly and thus available relatively quickly.

Commercially available data give a good picture on **cost composition** and **profit margins** of logistics enterprises; they are representative at both EU and national level except for very small countries. They show a large variation between the European countries according costs per tonnage e.g. ranging from about 5 EUR in Bulgaria to nearly 19 EUR in Denmark and Sweden for road transport in 2006, mainly caused by the immense difference in labour costs. The share of labour costs in total costs varied in 2006 between 13 % (Bulgaria) and 68 % (Luxemburg) in road haulage in contrast to rail freight and also air freight transport where this share varied between 1 % (Bulgaria) and 20 % (Belgium). In this sector, the costs increased by more than 20 % from

[1] The contractors have chosen the acronym “SEALS” for the study

1999 to 2006, in low cost countries by 26 %, in high cost countries by 15 %. Results on cost structures are shown for all countries and transport modes plus warehousing in 2006 as well as the cost development from 1999 to 2006 for exemplary countries.

Stock volumes are also not part of the Eurostat data programme, whilst inventory surveys have been abandoned altogether by key member states. The **turnover of stocks** was analysed in detail in selected economic sectors; we found clear trends towards faster turnover only in some cases, not in general. Here, especially the Scandinavian countries showed an interesting development towards an optimisation of stocks with increasing stock turnover.

A further interesting trend is the degree of **outsourcing** where again we tapped data from private enterprises. Outsourcing was found to be high in all modes of transport except road freight, where the share of own-account transport is still important. In the more logistics oriented sectors, in-house activities still dominate. Only one quarter of the potential contract logistics[2] market, which is slightly over one third of the total logistics market, is so far outsourced. A similar low outsourcing degree can be identified in the warehousing market. Land transportation is outsourced by almost 60% while sea and airfreight transportation is outsourced by roughly 90%. In general, only segments with very specialized equipment or sensitive processes are kept in-house by manufacturers and retail companies.

Obviously the **profit margins** of the different sectors and how they change over time are of interest. In general, profitability improved between 2000 and 2006, quite strongly in rail, sea and air transport, but also in post and courier services. On the other hand road freight traffic, where the profit margin was already low (3 % in 2000) has seen a further reduction, and so has cargo handling & storage, albeit at a much higher level. In this chapter, the profit margins of companies differentiated by mode, service and EU member state as well as the development for some countries from 2000 to 2006 are shown in detail.

In addition, we carried out a detailed analysis of **freight terminals** for **airports, seaports, inland ports and road-rail terminals** as well as for **distribution centres**. Terminals were selected by size (throughput in tonnes and/or containers) and geographical balance across Europe. Despite extensive desk study and questionnaires general conclusions could not be drawn because of the wide differences between terminal types and non-comparable data. Stan-

[2] The definition of contract logistics requires that complex bundles of several logistical services such as transportation and warehousing, as well as a potentially wide range of value-added services, are provided within the framework of long-term contractual relationships tailored to an individual customer's requirements. The rest of the logistics market is characterized by short-term contracts, simple service offerings or small volumes.

dardising the reporting system and centralising data collection for each type of terminal could in theory provide a better picture of capacities, throughput, capacity utilisation and costs/tariffs, but it seems unlikely that the data required for such performance indicators could be collected due to business sensitivity. Terminal operators are reluctant to provide information on transfer costs and delay times. Transhipment costs per move of a loading unit range between 80 EUR and 125 EUR in seaports, between 18 EUR and 25 EUR in inland ports and between 20 EUR and 25 EUR in road-rail terminals. Waiting time at road-rail terminals averaged between 2 and 6 hours but could in individual cases extend to 30 hours. Ship waiting times at seaports averaged at 10-15 hours.

Distribution centres are constructed and operate according to individual needs and strategies. In these circumstances, it is impossible to produce a comparable set of indicators.

What are the **characteristics of container shipments** in different geographical regions in Europe? The main objective of the task “shippers’ perspective” was to answer this question by the simulation of virtual container journeys in Europe: a *standard sea container* was to be moved on **selected origin/destination relations from seaports and major agglomerations in three distance classes (short- middle-long)**. A simulation model recorded monetary cost and travel time for all available transport modes including short-sea shipping and intermodal transport. Air transport was excluded because it uses different containers and in any case airfreight within Europe is mostly trucked by road. We assessed **reliability** via desk-research and expert interviews, looking at damages, thefts, and compliance with specific time frames. All corridors analysed were generally thought to be reliable, but most experts considered “punctuality/delivery in time” to be the most critical factor for all modes and corridors in this context. According to the data published by the CER the punctuality of international combined transport trains – especially the level of compliance with timetables – is below 60 %, but is increasing slightly. In particular road transport seemed highly vulnerable for thefts and damages. Major potential bottlenecks for long-distance transports have been pointed out by the desk-research and expert interviews. Especially railway and road bottlenecks in Eastern Europe, road bottlenecks in central Europe and port bottlenecks in the North-Atlantic and Baltic ports have been pointed out here.

The simulation of **transport costs including time costs** confirmed that in general road transport was best because it did not require additional times and costs for transhipment. However, for longer transport distances the immanent advantages of rail and inland waterway transport made themselves felt. Moreover freight transport by barge and short-sea shipping in the longer distance classes could be cost competitive in specific corridors. Intermodal transport chains could be competitive over long distances in terms of costs and times provided the participating transport modes were coordinated and chosen in the most effective way, whilst additional handling and terminal waiting times were reduced to the absolute minimum; this would apply especially if the transport chain and each single transport mode used were adjusted to overcome additional obstacles and bottlenecks.

Following these analyses we retained **15 performance indicators** from the macro-economic, micro-economic and terminal analyses and proposed an **assessment scheme** whose results are shown in the following table.

Assessment of logistics performance indicators

	Indicator	Description	Data sources	Availability collection method	Availability public/ commercial	Repre-sentativity	Timeliness	Total
	Macro-economic indicators							
1	Sector employ-ments (full-time equivalents) / total employments	Share of logistics employments in total employments	Structural business statistics	3	3	3	2	11
2	Logistik turnover per GDP	Share of logistics turnover (costs) in GDP	Structural business statistics, national accounts	3	3	3	2	11
3	Logistics sector value added per GDP (in real terms)	Share of logistics value added in GDP	Structural business statistics, national accounts	3	3	3	2	11
4	Logistics value added (in real terms) per employee in total and by subsector	Ratio of value added and employees	Structural business statistics	3	3	3	2	11
5	Logistics intensity	Ratio of logistics inputs and total inputs	National accounts, Symmetric input-output tables	3	3	3	1	10
6	Services producer price indices by subsector	Evolution of servicess producer price indices	Services producer price indices	3	3	3	3	12
	Micro-economic indicators							
7	Cost composition of transport by mode	Transportation costs per tonne by cost component	Various sources incl. questionnaires, bench-marking data, studies for base year; statistics, desk research, interviews for subsequent years	1	3	1	2	7
8	Cost composition of warehousing	Warehousing costs per tonne by cost component	Various sources incl. questionnaires, bench-marking data, studies for base year; statistics, desk research, inter-views for subsequent years	1	3	1	2	7
9	Profitability margin by transport mode and warehousing	Profitability of trans-port and logistics companies	Company information	3	2	3	2	10
10	Turnover of stocks	Turnover of stocks by manufacturing sector	Company information	3	2	3	2	10
	Terminal indicators							
11	Throughput of terminals for commodity groups to be defined	Annual throughputs (tonnes, TEUs or LUs)	Company information, regular survey for seaports, inland ports and airports, commer-cially available	2	3	2	2	9
12	Terminal/berth productivity	Throughput per hectare or $1,000	Special surveys, com-mercially available	1	2	2	1	6
13	Terminal capacity utilisation	Share of throughput relative to capacity	Special surveys	1	1	1	1	4
14	Distribution centres: delivery reliability; days of inventory	% on time delivery, days of inventory	Company information	1	1	1	1	4
15	Port efficiency	Multiple data sour-ces	Scientific methodology, being developed	1	1	1	1	4

Addendum

While the analysis in this report relates to data until 2006 in a continuously growing economy, the world financial and economic crisis that is affecting all economies has changed the outlook.

The question of **how far the logistics sector could be sucked into the downturn** accompanied the SEALS study throughout**.** Whilst work progressed during the first nine months of 2008, the financial crisis had unfolded and the subsequent economic crisis menaced the transport sector. Familiarity with the drivers of the logistics market made it clear that freight transport demand would be seriously affected, in particular in foreign trade. Moreover, logistics companies need access to borrowed capital, just as do companies operating in other sectors, whilst the minimal equity holdings common to medium-sized logistics companies make it harder for them to obtain financing. This has already led to bankruptcies and reductions in capacities and may ultimately lead to further problems, though these will in turn open up individual new opportunities for larger, more stable competitors.

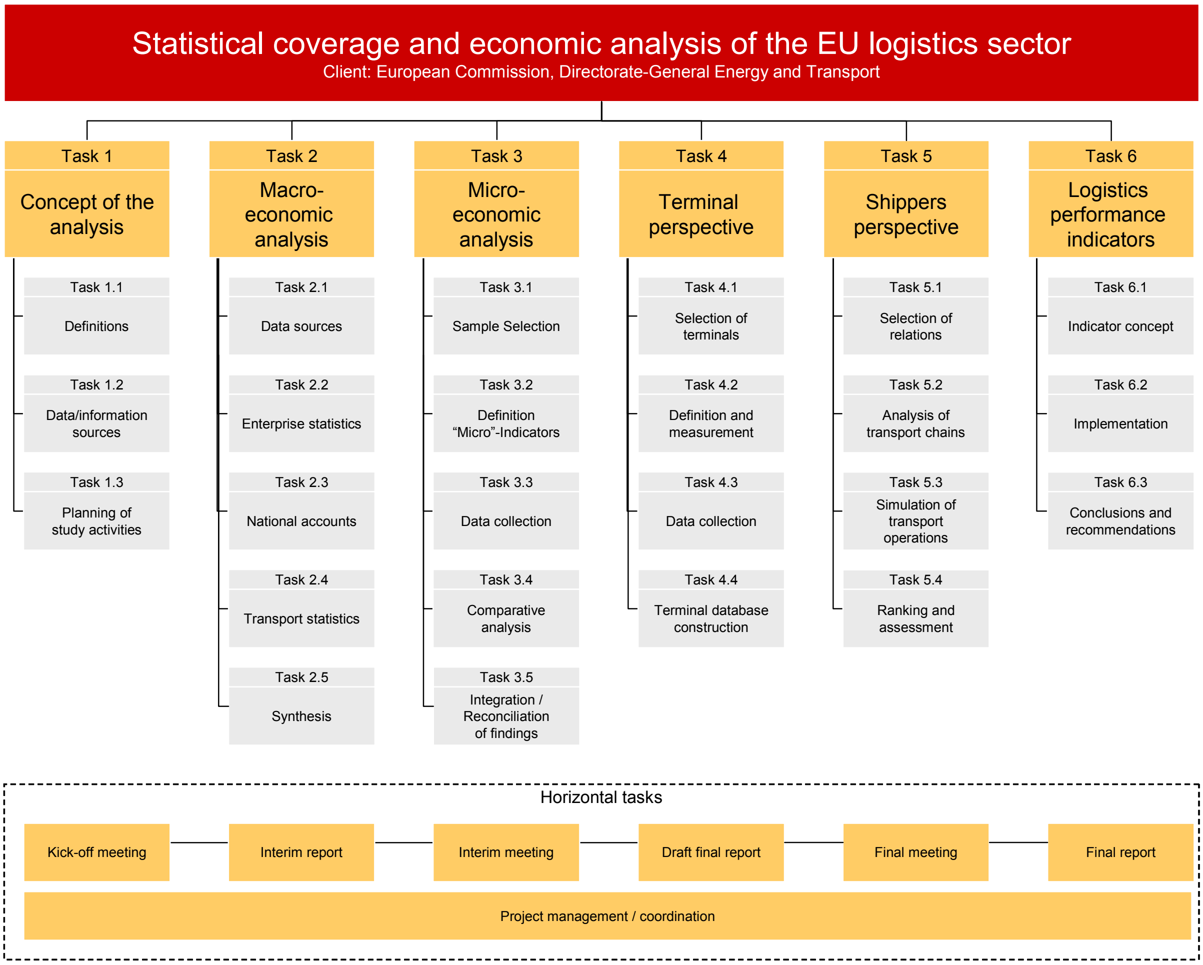
According to our **most recent estimates of October 2009**, the 2008 logistics market of the 27 EU member countries was around 930 billion EUR and the shrinkage in 2009 is likely to be 5%, with a worst case estimate of 8% (compared to our original worst case scenario of a 11% contraction). As a result, the market size in 2009 is expected to be around 880 billion EUR. The (revised) 2007 level of 900 billion EUR could be reached again in 2010 (in current prices).

1 Introduction

This report of the study "Statistical coverage and economic analysis of the logistics sector in the European Union"[3] is to be seen as part of the Commission's "Freight transport logistics action plan" (COM (2007) 607 final, dated 18.10.2007). The Action Plan (p. 7) specifies: "The Commission together with the stakeholders will review the availability of and determine the requirements for data on freight transport logistics across modes and assess improvements of the collection of statistical data."

In its invitation to tender (N° TREN/A2/138-2007, dated 17 August 2007), the Directorate General for Energy and Transport (DG TREN) of the European Commission has described in a concise way five tasks to be carried out within this study. These tasks were reflected in the SEALS consortium's technical offer (dated 4 October 2007) with a detailed work programme (Figure 1).

Figure 1: Work plan overview



[3] The contractors have chosen the acronym "SEALS" for the study

Following the Kick-off meeting, the Commission specified seven economic sectors for which logistics play an important role and which were to be given special attention in the macro-economic and micro-economic parts of the study:

- Food products and beverages
- Chemicals and chemical products
- Basic metals
- Radio, television and communication equipment apparatus
- Motor vehicles, trailers and semi-trailers
- Wholesale trade
- Retail trade

The Consortium of ProgTrans AG (Basel/Switzerland), ECORYS (Rotterdam/Netherlands), Fraunhofer ATL (Nürnberg/Germany) and TCI Röhling (Denzlingen/Germany) carried out the study between January and September 2008.

The logistics sector is by no means a clearly defined sector of the economy. It does not exist as a service sector in the national accounts system. In general it is understood that the logistics sector covers all outsourced logistics activities, while in-house logistics activities within the manufacturing and distribution sectors are not part of the logistics sector. We have judged it useful to further clarify our understanding of the logistics sector concept as described in Chapter 2. This is supplemented by a summary review of relevant EU and other studies and research undertakings.

In separate chapters, we then present the outcome of the different work packages: macro-economic analysis (Chapter 3), micro-economic analysis (Chapters 4), terminal perspective (Chapter 5) and shippers' perspective (Chapter 6). This is followed by Chapter 7 on performance indicators, with conclusions following in Chapter 8.

Statistical data and other information for this study have been collected until August 2008. Later information could not be made use of.

The SEALS partners wish to thank the many persons who gave support and guidance, responded to our questionnaires or were available for interviews and consultations.

2 Freight logistics as a sector of the economy

2.1 Definition

The freight logistics sector as defined for this study implies all processes, which are needed to supply industry, retail and wholesale and the end customer with goods. This definition concurs with the definition of the European Commission of freight transport logistics covering ”the planning, organisation, management, control and execution of freight transport operations in the supply chain”[4] and includes:

- all *freight transportation, storage, transhipment, order-picking* and other directly connected services, before, after and between production and retail activities in the economy;
- all *inventory maintenance activities* in the economic value-creation chains including sector-typical inventory write-offs for the reporting period of an imputed rate of interest;
- the *order processing activities* of the logistical transactions, and
- the related *supply chain planning, management and related administrative activities.*

The definition of logistics services applied here excludes production logistics, in order to assure the availability of quantitative data:

- **THS**[5] **logistics** – according to the initials for **Transport** operations (“moving objects in space”), **Handling**, i.e. trans-shipment, picking and packing, consolidation and deconsolidation activities (“changing the arrangement of objects) and **Storage**, i.e. storage and inventory holding activities (“moving objects in time”)[6].
- The market for THS logistics services therefore encompasses all necessary transportation, consolidation and storage activities *outside the production process* (i.e. “THS” operations connecting production lines, suppliers and sales outlets, but excluding activities within production and

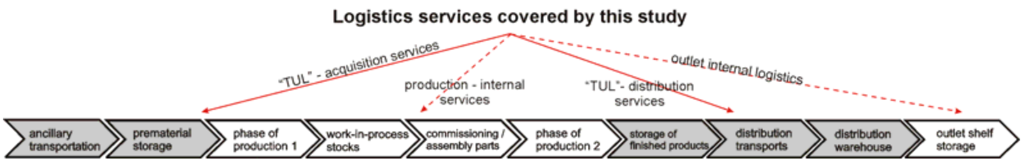
[4] European Commission “Freight Transort Logistics in Europe – the key to sustainable mobility”, COM(2006) 336 final, 28 June 2006

[5] The term “THS” has been adapted from the abbreviation “TUL“, standing for “Transport, Umschlag und Lagerung”, as used in German.

[6] In the American Literature (see: Sheffi, Yossi, Klaus, Peter: Logistics at large: Jumping the barriers of the logistics function, Council of Logistics Management Educators’ Conference, Chicago, Ocotber 1997) we also find the term PPP logistics. PPP logistics – according to the initials for “Place” operations (adding place value to items by moving them from locations of lower value for the customer to locations of higher value for the customer), “Pattern” (adding order value to items arranging them in desired quantities and patterns), i.e. trans-shipment, picking and packing, consolidation and deconsolidation activities and ”Period & Pace” (adding time value to items by storing them), i.e. storage and inventory holding activities (“moving objects in time”).

sales operations domains). Market volume includes *in-house, insourced* operations by the primary industrial and trade companies, such as private, not-for-hire carriage and warehousing, as well as *outsourced services* from third-party service providers. The most basic "THS" definition of logistics is shown in the familiar illustration of the "value chain" in Figure 2. Only pre- and post-production "THS" activities and activities that occur prior to activities at points of sale – as opposed to purely in-house logistics as part of production processes – are considered.

Figure 2: The most basic definition of logistics: transport, handling and storage outside the production process



Source: Klaus/Kille 2007[7]*, p. 33*

This most basic definition of logistics gives the possibility to quantify the market and therefore forms the basis for the following report.

For the purpose of assessing and measuring logistics cost and revenues, the following additional "overhead" activities have been included:

- Managerial and administrative activities directly related to the "THS"-activities of physically handling and dispatching of goods;
- company-wide supply-chain planning and control tasks that are required in the context of efforts among the participants in the supply chain to integrate the flows of goods, information and money;
- capital costs, inventory devaluation, write-downs and other expenses in the supply chain that incurred in direct relationship to the time (the number of days, months and years) the stock is held.

This definition of logistics cost is particularly suitable because a corresponding demarcation of logistical expenses can be found in important international surveys on the subject[8] such as the one reported by Wilson in 2007, the results of which are summarised in Table 1.

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[7] Peter Klaus, Christian Kille: Top 100 in European Transport and Logistics Services, Deutscher Verkehrs-Verlag, Hamburg, 2007

[8] see e.g. Davis, Herbert W. and Company: Aktuelle Fortschreibung der Davis Database, presentation on the Conference of the Council of Supply Chain Management Professionals (CSCMP), Oct. 2007; Bowersox, Donald J., Calantone, J.: Roger, Rodriguez, Alexandre M.: Estimation of Global Logistics Expenditures using Neural Networks. in: Journal of Business Logistics, Vol. 24, No. 2, 2003, pp. 21-36 and CSCMP: 19th Annual State of Logistics Report, CSCMP, June 2008.

Table 1: Current U.S. estimates of costs in logistics in comparison to the results of the "Europe of the 29"[9]

	2007	2006	2005	2004	2003
			in billion US$		
Carrying Costs					
Interest	103	93	58	23	17
Taxes, Obs., Depr., Insur.	273	252	247	231	209
Warehousing	111	101	90	82	78
Subtotal	**487**	**447**	**395**	**337**	**304**
Transportation Costs					
Motor Carriers:					
Truck - Intercity	455	432	394	335	315
Truck - Local	216	203	189	174	167
Subtotal	**671**	**635**	**583**	**509**	**482**
Other Carriers					
Railroads	58	54	48	42	38
Water	38	37	34	32	26
Oil Pipelines	10	10	9	9	9
Air	41	38	35	34	29
Forwarders	30	28	22	18	16
Subtotal	**177**	**166**	**148**	**135**	**118**
Shipper related costs	8	8	8	8	7
Logistics Administration	54	50	46	39	36
Total Logistics Cost	**1'397**	**1'306**	**1'180**	**1'028**	**947**
For comparison "Europe 29"	**1'234**	**1'068**	**996**	**./.**	**./.**
US-Gross Domestic Product (GDP)	13'807	13'178	12'422	11'686	10'961
Logistics Cost as % of GDP	**10.1**	**9.9**	**9.5**	**8.8**	**8.6**

Source: CSCMP 2008, Klaus/Kille 2007, Federal Reserve

For comparison, the European logistics market size accounted in 2007 for about 860 billion EUR (corresponding to 1,234 billion US$).[10]

To be more detailed, the logistics service markets can be subdivided according to various criteria, e.g.:

- Type of cargo (e.g. "food" logistics),
- Type of client or sector (e.g. "newspaper distribution" logistics),
- Service types or handling characteristics (e.g. "express" freight),
- Methods of transport (e.g. "container" or "silo" transport),
- Transport network structures (e.g. "long-haul" carrier),
- Functional context (e.g. "distribution" logistics, "spare parts" logistics).

Actual practice in the logistics industry, as reflected in industry association memberships, often combines several of these subdivision criteria. One possibility to subdivide the market is the approach of the study of Klaus/Kille 2007, which is published by the Fraunhofer ATL. It follows actual practice in subdividing the market for logistics services as a whole into nine segments corresponding in particular to the "functional context" (e.g. transport or storage) and

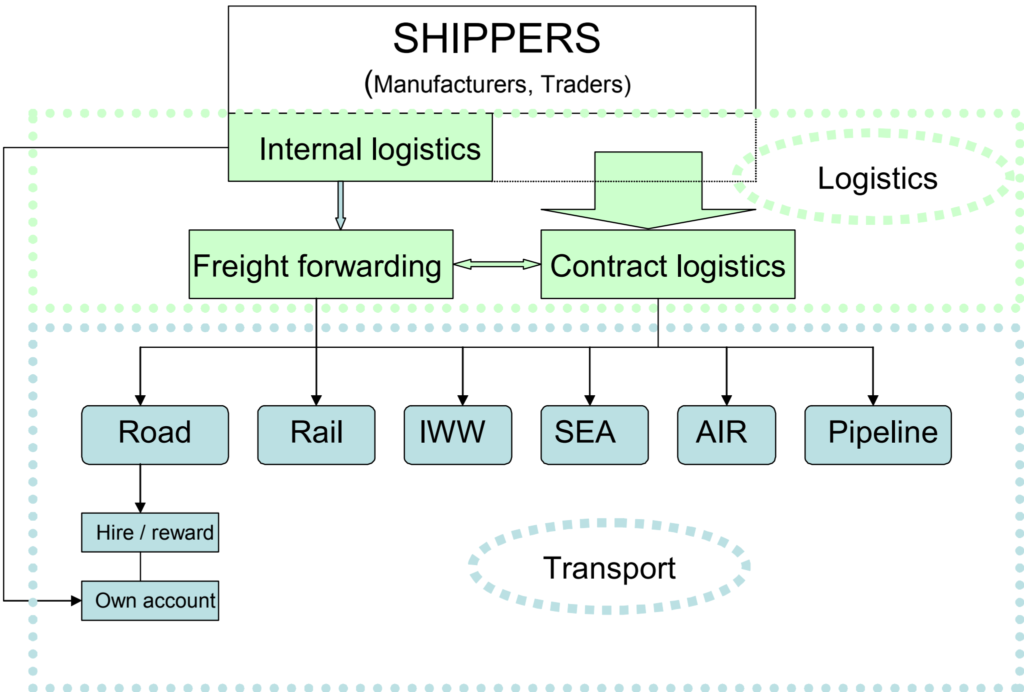
[9] EU27 plus Norway and Switzerland
[10] Cf. Klaus/Kille 2007.

"means of transport" (e.g. road, rail, water, or air) criteria. These are arranged in sequence, from largely "bulk" transport services to more logistically differentiated, smaller item, more international cargo services:[11]

1. Bulk logistics,
2. General truckload, full container load (FCL) with direct point-to-point transportation with non-specialized equipment,
3. Less than truck load (LTL),
4. Specialized transportation including car transportation, silo and tank transportation, etc.,
5. CEP – Courier, Express and Parcel Services,
6. Contract logistics including distribution of consumer goods,
7. General warehousing and terminal operations,
8. Ocean freight, forwarding and seaport operations,
9. Air freight operations.

Not only the activities of the logistics service providers and transportation companies are relevant but in addition also logistics-related activities of all primary and secondary (manufacturing) economic sectors as well as the commerce sector (wholesale and retail) as shown in Figure 3.

Figure 3: Overview of logistics and transport functions



[11] The segments 1 to 5 include all transportation modes. Here, the focus is the utilized equipment and network type.

With the continuing process of outsourcing of both transport and logistics functions, the internal logistics activities tend to lose of importance. But the remaining volume of internal logistics remains of significant importance. An estimated 50 % of all logistics costs is accounted for by “in-house” or “in-sourced”, “private carriage and warehousing” resources within industry, trade and the rest of the “shipping economy” while the other 50 % are “outsourced“ to third party service providers in the logistics sector.[12]

2.2 Drivers and trends in the freight logistics markets

2.2.1 Drivers of change in freight logistics

It is possible to pinpoint eight current global economic trends which are behind the dramatic increase in the importance of logistics and the massive changes and transformations taking place in the field (Figure 4). Together, they define both current and shape future general conditions in the logistics sector: companies will develop their strategies for the future accordingly and their actions should be interpreted in that light.[13]

2.2.2 Megatrends driving the demand for logistics

The first four megatrends are transforming the general “external” conditions for doing business in the global economy. They account for the rapid growth in the demand for professional and modern logistics services and the way they are changing. Four additional trends resulting from the “internal” dynamics of the logistics sector are influencing the range of modern logistics services, the structure of the sector and the behaviour of the decision makers.

[12] Klaus/Kille 2007
[13] The observations of this section have been taken largely from Klaus, Peter: Logistik Lotse 2005. DHL (Hg.), Verkehrs-Verlag J. Fischer, Düsseldorf, 2005, S. 1-60, p. 2 ff.

Figure 4: Global "megatrends" as general conditions, motive forces and accelerators in modern logistics developments

Four "megatrends" influencing the demand for logistics:	
1.	**Globalization of production and commerce** – Increasing transport distances, new communication and integration requirements, growing competitive pressure
2.	**The transition to a post-industrial society –** The end of growth in industrial manufacturing in the countries of Western Europe, compensated by an increasing demand for product individualization and more services
3.	**Acceleration of the clock speeds of economic activity in an "on demand" world –** Stockpile production is replaced by just-in-time responses to customer demand, the compression of technology and product cycles, time-based competition and the atomization of contract and shipment sizes
4.	**Growing external risks and environmental awareness –** Growing threats of the logistics systems by terrorism and political impact, increasing awareness on the consumption of energy and area resp. the climbing emissions by logistics, resulting in more requirements in security, prevention and sustainability. More recycling, extended logistics chains and more complex logistics chains
Four "megatrends" changing the provision of logistics services:	
5.	**The (re-)discovery of the efficacy of optimized organizational structures and processes –** Process- and value chain orientation, the emergence of integrated "pull-oriented" supply chain management
6.	**Advanced technologies opening up new opportunities for cost reduction and quality improvements –** Tighter worldwide integration by the internet, localization, controllability and automation of flows of objects and information by RFID and "smart objects"
7.	**Ongoing deregulation and privatization of former public transport and communications services and the appearance of new "hybrid" logistics service providers –** New providers, new services and new competition from former national rail and postal and telecom services, logistics service provider spin-offs and joint ventures by large industrial corporations
8.	**Shareholder value as dominant new measure for managerial success –** New financial motives driving management to focus on core competencies, complexity and asset reduction, head-counting and increased outsourcing

Source: Klaus/Kille 2007

Trend No.1: Globalization of production and commerce – increasing transport distances, new communication and integration requirements, growing competitive pressure

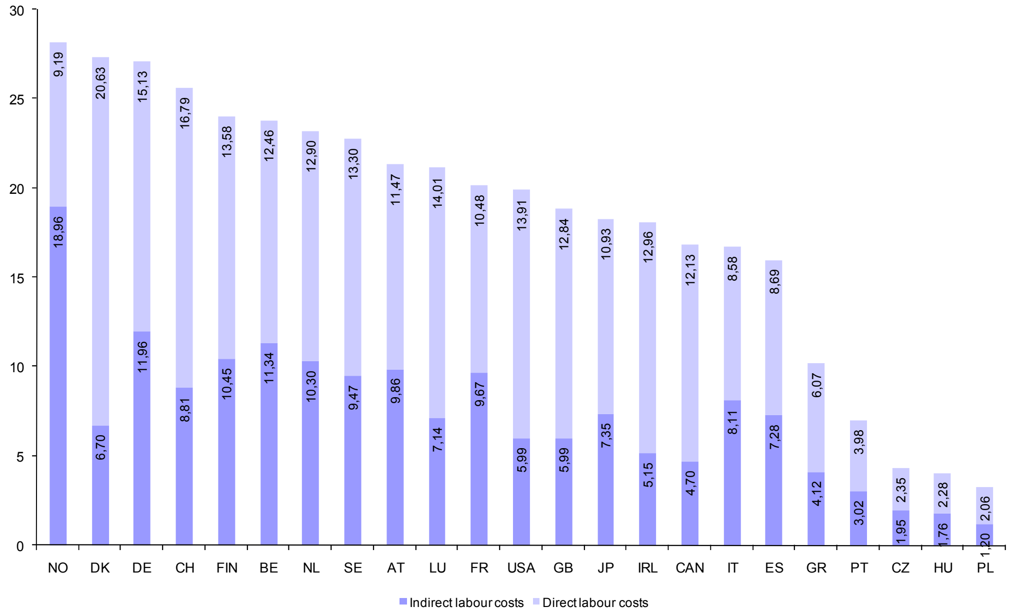
In the course of the last two decades, the opportunities for worldwide trade and commerce have expanded dramatically:

- The collapse of old-fashioned political, ideological and customs borders between countries and regions, the fall of the “Iron Curtain” and the collapse of the socialist economic systems in particular, the expansion and advancing integration of the European Community, are allowing for dramatic increases in European international trade and cooperation. Progress is accelerated by economic integration taking place in other parts of the world such as South America (MERCOSUR), North America (NAFTA) and the Pacific area (ASEAN). Also, widespread efforts to dismantle trade barriers through the global General Agreement on Tariffs and Trade (GATT) and the Organization for Economic Cooperation and Development (OECD) are moving ahead slowly but surely.

- At the same time, quantum leaps in information and communication (“I&C”) technologies since the 1990s – in particular the low cost networking of the most far-flung corners of the world through the Internet (see Scheffler/Voigt 2000), but also the development of other globally accepted virtual standards such as Windows-based PC systems, and EDIFACT and EAN coding in the communication field – have made finding business partners and carrying out everyday business transactions a much simpler proposition than it was in the 1980s. These efforts have been complemented by increasing standardisation, including of packaging and loading containers, brought about through the International Standards Organization (ISO). Last but not least, the increasing use of English as the language of global business communications has helped do away with some of the earlier obstacles to international economic cooperation. In the language of economists, these activities have led to a steady “reduction of transaction costs” within the global economy.

- As a result of all this, companies from both the industrial, trading and service sectors now find the expansion of their networks of suppliers and customers around the world more worthwhile. It enables them to find the materials, workers, know-how and general conditions for their global activities that offer the maximum cost efficiency, and because – as the comparison of effective labour costs per hour in Figure 5 shows – the differences can be enormous, companies are doing this more and more frequently. The costs of relocating value-adding activities anywhere in the world (i.e. “dislocation” in the language of the logisticians) are today much less of a barrier to international economic cooperation than in years gone by, when high customs duties, complicated documentation and expensive, slow and unreliable modes of communication and transport were the norm.

Figure 5: International comparison of labour costs as a driving force in globalization



Source: IdW 2006, S. 7

Globalisation, however, also has its downside for many of the companies involved:

- Many sectors are facing a level of intensity in global competition which is completely new to them. While they can benefit from increased access to new customers and suppliers in all parts of the world, competitors from other parts of the world also now have access to their traditional home markets: many of these often have significant cost advantages in their own home countries
- The growing international traffics result in bottlenecks of logistics hubs, especially in sea and air ports of European metropolitan areas.

These developments which can be summarised under the heading “globalisation” have led to a constant increase in the demand for long-distance transport services and the integration of warehousing, handling, communications, planning and control services within complex, multi-tiered supply chains and networks. At the same time, the pressure on companies to optimise quality and service costs is also becoming more acute.

Logistics, as a result, became a key factor in ensuring that companies both survive and thrive in global competition.

Trend No. 2: **The transition to a post-industrial society – The end of growth in industrial goods manufacturing in the countries of Western Europe and increasing demand for product individualization and more services.**

Ever since people started to consider economic problems in a systematic manner, the rational management of scarcity – in particular, the optimal use of scarce capital, labour and natural resources – has been recognised as the key to success in business.

However, since the middle of the 20th century, *the management of scarcity has ceased to be the key to success* in many markets in the global economy. Today's successful companies are those which are able to assert themselves in a world characterised by an explosion of product varieties being offered at the markets, and quantitative supply exceeding demand:

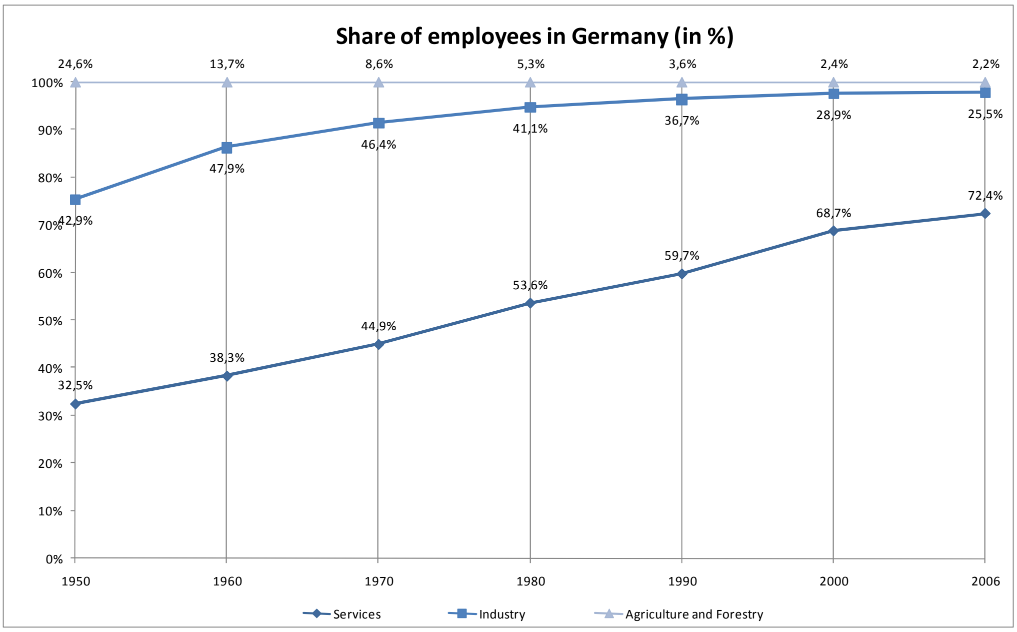
- *production capacities are far outstripping the demand* for goods in stagnating markets;
- *too many similar products* are competing for the customer's purchasing power;
- and *too much information* is competing for the customer's attention.

The reasons for this fundamental change can be found in the transition of the mature and rich countries of Western Europe from industrial to post- industrial societies and in their "new demographics:"

- *population figures and quantitative demands for material goods are stagnating. Where this is not the case, growth is based on immigration and, therefore, on*
- *the development of "multicultural" and thereby more heterogeneous societies;*
- *the average age of the population is increasing and "old" structures such as the family are losing their significance. Households are becoming smaller and more mobile;*
- *increasing amounts of money are being spent on "non-material" needs such as communication, entertainment, health care, and many other kinds of "service." The relative amount of income available to actively productive people is decreasing due to increasing transfer payments to pension and social* systems. A relatively small share of income is left to satisfy material needs such as eating and drinking, clothing, furnishing homes with "hardware" and building homes;
- as a result, *more* and more *employment is "migrating"* from the agricultural and industrial sectors of the economy into the services sector (see Figure 6).

Consequently, companies are finding it increasingly hard to meet their sales goals by producing uniform, standardised products in large batches. The demands on manufacturing industries are becoming more individualised, diverse, fluid and transient. Market niches, which for a long time could be catered for by mass production, are shrinking and more and more often call for the combination of products with services. This not only applies to consumer goods but also to the needs of the industrial sectors of the economy.

Figure 6: Continuous growth trends in the service economy – the case of Germany



Source: Destatis 2006

Examples from the automotive, computer, and fashion industries as well as from mechanical engineering and many other industries demonstrate that the businesses with the most success in the “post-industrial” economic environment are those which can offer their customers continually updated individualised and service-oriented solutions tailored to meet their particular situations or requirements without drowning in a welter of product ranges, warehouse stocks and production costs.

Trend No.3: Acceleration of the clock speeds of economic activity in an “on demand” world – Stockpile production is replaced by just-in-time responses to customer demand, the compression of technology and product cycles, time-based competition and the atomisation of contract and shipment sizes.

Twenty years ago, Boston Consulting Group’s George Stalk predicted the transition from cost- and price-based competition to “time-based” competition (see Stalk 1988). He was summing up a development that had been observed for some time: the success of a business depends more and more on its ability to react to the customers wishes. Because of the tendency towards individualisation in post-industrial society, this challenge can no longer be met by advance production and stockpiling of goods for delivery when the market wants them.

The answer is “on-demand” production and distribution, i.e. production only when the customer has specified the requirements through an order.

As a result, the demand for goods and logistics services manifests itself in smaller and smaller, more individualised orders. Since consumers and industrial customers have not become more patient, this development is accompanied by increased time-pressures and high expectations that deadlines will be precisely met. The ability to manage “on-demand” supply chains and provide resources “just-in-time” (see Ohno 1988) has become the key to successful business management.

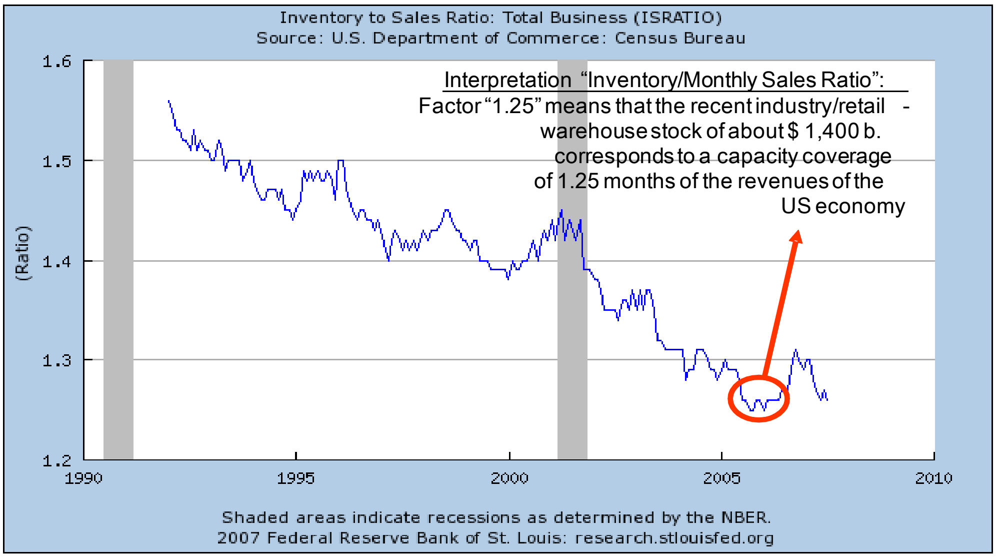
At another level, the accelerating development of new technologies in many areas means that their economic “lifetime” and the lifetime of many products – i.e. the “window” for successfully launching and selling technologies and products – are getting smaller. “Clock speeds” of the economic activities are accelerating (see Fine 1999). An often quoted and particularly dramatic example of this is “Moore’s Law,” which refers to developments in the microelectronics industry. “Moore’s Law” says the performance of microprocessors doubles every 18 months while its price halves over the same period. That means plants making a certain generation of microchips together with the PCs and countless other products based on that generation are becoming obsolete at an ever-accelerating rate.

In the PC, mobile phone and the fashion industries — and to a lesser extent in many other important sectors of the economy — this means the really successful companies are not those that sell their products most cheaply within their markets, but those which are the first to exploit new technologies and offer new products and which react most rapidly to the individual needs of their customers.

New demands on the product development, order processing and speed of reaction (often referred to as their *“agility”)* by companies are leading to an effect of “atomisation” of lots, orders, and shipments - the substitution of large, sporadic order releases with smaller, continuous and precisely-timed flows of small “granular” deliveries. The importance of bulk and full-load transport systems is declining relative to those which provide faster, minutely-synchronised “granular” services.

As *experts in the architecture of such flows – the supply and value-creation chains* of the economy – and their intelligent bundling, management and mobilisation, logisticians have taken on an important new task field. The effect of the post-industrialisation and "on-demand" trends and the success professional logisticians have had in dealing with them can be seen from inventory/sales ratios, which have been falling for years, as American statistics show (see Figure 7).[14]

Figure 7: Relation of economy-wide inventories to monthly turnover in trade and industry in the USA



Source: Federal Reserve Bank of St. Louis 2007, www.stlouisfed.org

Trend No.4: Growing external risks and environmental awareness – Growing threats of the logistics systems by terrorism and political impact, increasing awareness on the consumption of energy and area resp. the climbing emissions by logistics, resulting in more requirements in security, prevention and sustainability; more recycling, extended logistics chains and more complex logistics chains.

The growth in demand for modern logistics services is also driven by a trend, which does not primarily stem from the economy or business interests.

In particular since September 9, 2001, logistics have to cope with many security requirements, which should prevent or alleviate the effects of terrorist at-

[14] Unfortunately, no relevant data for Germany has been compiled. However, one can assume that the ratio of sales to inventory is similar here.

tacks. The sensitivity of the worldwide complex supply chains regarding external effects like political, terrorist, environmental or cultural incidents has increased ever since.

Since the beginning of the 1970s, when the global oil and energy crisis and following the upcoming political parties and NGOs like Greenpeace sparked off the debate on the "limits of growth" to modern economies[15], a new public and political awareness of the need for a "sustainable" economy that conserves the earth's natural resources has emerged. This led many companies to the conclusion that the economical use of raw materials, energy, water, air and land in many cases made not only ecological sense but was also good for business. Concepts such as material flow analysis in manufacturing, the recycling of materials and cutting down on waste by avoiding "make-to-stock" and advance production, as well the reduction of heavy inner-city traffic through the application of "city logistics", cooperative, locally-concentrated distribution operations, the bundling of goods and the employment of environmentally friendly modes of transport with the help of "freight villages" and combined transport solutions have been growing in popularity since the 1990s.

Even in the EU's new members in Eastern Europe, environmental protection has become more important than it was only a few years ago. Rail transport performance was at its lowest absolute level in 2001, recovering since to the level of 1995. At the same time the modal share of rail in inland transport has decreased from 60 % in 1995 to 45 % in 2006. The proportion of traffic carried by rail is still much higher in EU12 countries compared to the old member states (EU15) where the share is at 13 %. Efforts are made to maintain the highest possible rail share through intelligent concepts and the expansion of the infrastructure.

The integration of waste disposal and recycling processes into extended logistic chains are another new task field, calling for concepts for systems of reverse logistics, more intelligent channelling and the bundling and optimisation of goods and passenger traffic. Last but not least, the logistics industry will have to deal with the steadily growing aversion to modes of transport which are either supposedly or actually harmful to the environment. This concerns the biggest and most important freight carrier of all, the truck, most of all.

The mentioned challenges of political and society changes like terrorism and interventions increase costs and complexity of logistics activities further on:

As the US prevent terrorist assaults by stricter import rules and therefore increase the effort and duration, the tight supply chains are affected explicitly by

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[15] See D. Meadows: The Limit to Growth, New York 1972

environmental disasters, piracy, etc., but also by jumping energy costs, which can end up in production downtimes. In future, the supply chain managers and planners have to consider this and therefore in some cases have to increase stocks.

2.2.3 Megatrends changing the provision of logistics services

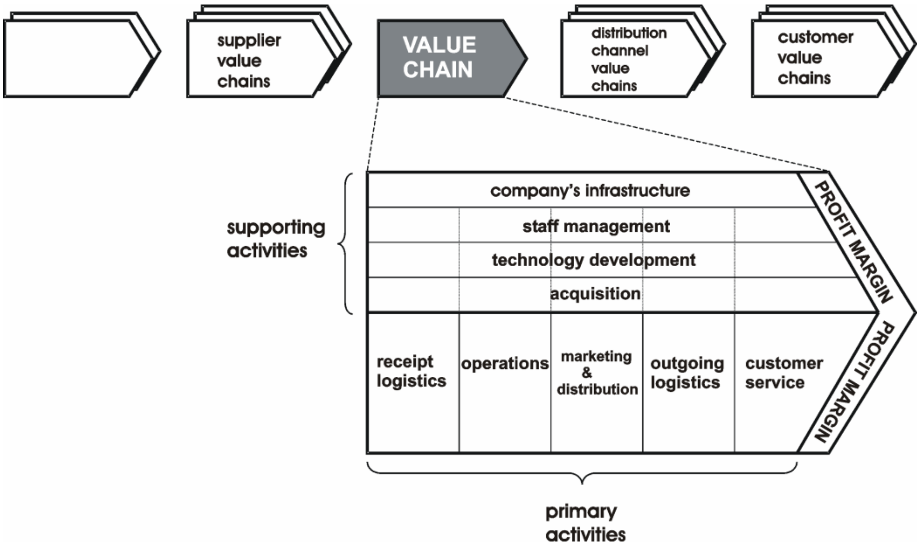
The four “megatrends” of the global economy outlined above how the changes in global economic conditions over the last two decades have increased demands for the know-how necessary to optimise the architecture of complex supply chains and to manage and mobilise operational flows of goods, information and money – demands that logistics promises to help satisfy.

Four more trends, as shown in Figure 7 above, also show how top logistics service providers are reacting to the challenges of their environment and providing additional impulses for change in the processes and practices of the global economy. These trends go some way to explain why logistics has now – and only now – become a driving force of economic innovation and how it is redefining and restructuring itself in the process.

Trend No.5: (Re-)discovery of the efficacy of optimised organisational structures and processes – Process- and value chain orientation, the emergence of integrated, “pull-oriented” supply chain management

Numerous recipes for success and “best practice” in current business management, as discussed in the concepts of the “just-in-time” economy (see Ohno 1988), “Efficient Consumer Response (ECR)” and “Continuous Replenishment (CRP)” (see Corsten/Jones 2000) for the management of consumer goods and industrial materials, are based on one recent insight: the ways in which economic activities aimed at satisfying customer requirements are interconnected are of crucial importance to total production cost and quality and the ability of companies to react to changing environments and market conditions.

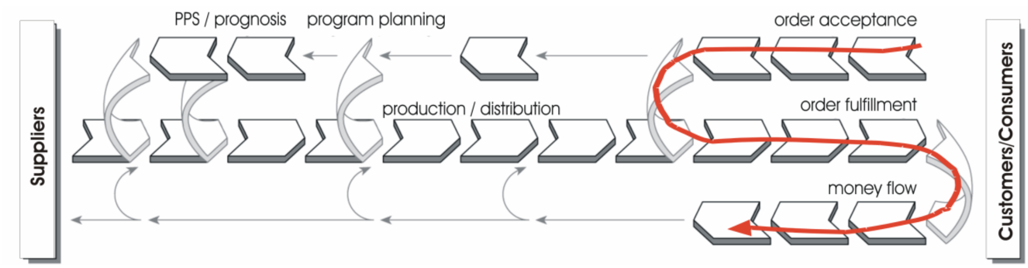
Figure 8: Illustration of a comprehensive company value chain and an internal chain of activities according to Porter 1985



This concept, which the publications of the Harvard Professor Michael Porter (Porter 1985, see Figure 8) brought to worldwide prominence, have – in the form of "value chain analysis," "process orientation", "supply chain management", and "flow systems thinking" (see e.g. Houlihan 1982, Christopher 1998, Bowersox/Calantone 1998, Klaus 2002) – had a huge influence on business vocabulary and practice.

The "order to payment" process that takes place numerous times a day in every business is central to this insight (see Figure 9).

Figure 9: Schematic illustration of an "order-to-Payment" process as a central feature of logistical activity

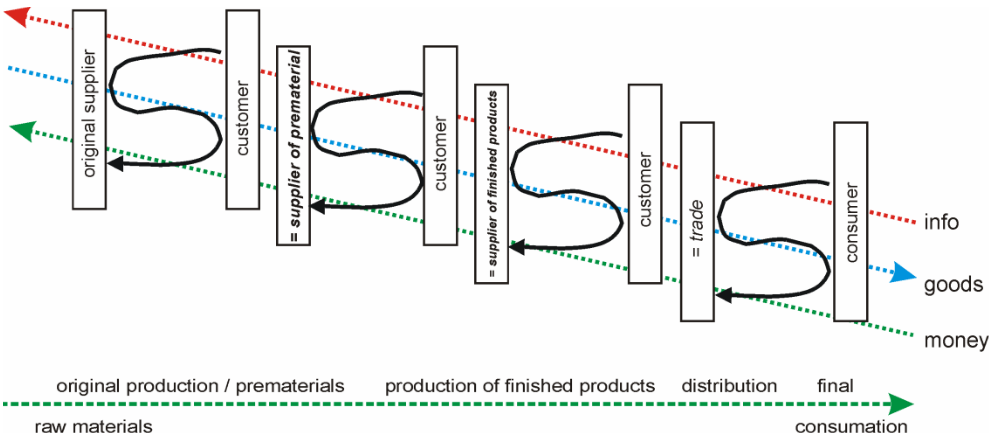


Source: Klaus/Kille 2007

The linkage of several such order-to-payment processes leads to the picture of a comprehensive company "supply chain" (see Figure 10).

These illustrations and the thinking behind them go some way to explaining logistics' current enormously increased importance as a factor for management success:

Figure 10: Schematic illustration of a supply chain as a comprehensive company-wide chain of "order-to-payment" processes



Source: Klaus/Kille 2007

Customer- and market-oriented, pull-controlled, lean, retrograde mobilised, systematic, integrated optimised processes and supply chains are seen today as the key to successful business management. Logistics is the field where know-how and optimal flow- and process-architecture and market- and customer-oriented management and mobilisation processes are applied.

Trend No.6: Advanced technologies open up new opportunities for cost reduction and quality improvements – the "Web", RFID, smart objects, etc.

Once it was recognised in the 1960s that logistics and logistical processes played a major role in the success of a company, companies not only optimised their management by restructuring and coordinating processes and interfaces[16] but also resorted to technical expedients and applications.[17] At this time – and until well into the 1980s – they focused their efforts on the automation of internal material flows rather than on the coordination and management of flows of goods between different companies. Exchanging information was too complex for what were mostly independently developed one-off interfaces. The first attempts to change this started with the introduction of EDI (Electronic Data Interchange), the electronic exchange of structural informa-

[16] See the first articles on logistics management by Magee 1960 and Drucker 1962, both of which caused a stir.
[17] Cf. Pfohl 1969.

tion and data between operating systems, a standard largely promoted by the industrial sector. The logistics sector was less affected by this, not only because it was still considered to be of secondary importance and was therefore not involved in the debate, but also because it had to deal with a wide range of companies and therefore with various standards. Investments bore no relation to the potential savings.

The breakthrough for technological applications in logistics came with the arrival of the Internet in the 1990s. This new form of communication through the "Web" meant information could be exchanged quickly with little technical effort – even if it was still unstructured and more like a substitute for faxes and telephones. The first "perceptible" applications in logistics were eCommerce solutions such as electronic freight exchange and procurement platforms, of which few survived the burst of the internet bubble at the start of the millennium (two successful exceptions are TELEROUTE and TIMOCOM). Even tracking-and-tracing systems for the monitoring of cargo movements only made a breakthrough with the advent of the Internet. Easy access to the infrastructure meant even small and medium-sized companies could operate and make use of the service. The Internet made it possible for companies to visualize complex networks, as well as their current status, and thereby organize them efficiently.

Further innovations promise a leap in the efficiency of logistical processes: the use of RFID applications for the remote identification of goods is gradually expanding. Since WAL-MART in the USA, MARKS & SPENCER in the UK and METRO in Germany started pushing their suppliers into adopting RFID, many other sectors have woken up to its potential. The efficiency of RFID has led to a paradigm shift which is being boosted further by the enhancement of the basic transponders with temperature, light and pressure sensors among others and is opening up new possibilities for the management of material flows. A combination of management optimization and technical support is paving the way for the next increases in efficiency.

Trend No.7: Deregulation and privatisation of former public transport and communications services and appearance of new "hybrid" logistics service providers – new providers, new services and new competition from former national rail, postal and telecom logistics, logistics service provider spin-offs and joint ventures by large industrial companies

The past two decades in the logistics service economy have been characterized by a worldwide trend towards the deregulation of former public service organizations, in particular in the telecommunications and public transport sectors. It had been long held that all citizens and companies should be provided with these kinds of services at the same quality and for the same price — this also applied to other public services such as water and electricity supplies, hospital services and "security," i.e. the police and armed forces. The classification of communications and transport services as functions of the public infrastructure maintained in the public interest justified the state's monopoly ownership of, for example, the postal services or railways, or at least its role in the official regulation of tariffs, access rights and conveyance obligations through the granting of concessions and licenses.

As early as 1958, when the European Community was founded by the Treaty of Rome, it was laid down that this sort of regulation should no longer be maintained in the modern market economy. Beginning in the 1980s, the American and British governments under Carter, Reagan and Thatcher were energetic in their pursuit of deregulation and privatization. After some delay many other countries, not least Germany, followed suit.

The abolition of official price regulation – as opposed to self-regulation through competitive pressures in the market economies – especially in the road and air transport and postal and telecommunication sectors, but to some extent also in the rail sector, are having a revolutionary effect on the service industries. Steep reductions in the price of parcel and other freight services have generated a lot of pressure on companies to rationalize their operations in these markets. Traditional old-line freight forwarders and carriers such as KÜHNE + NAGEL, SCHENKER, MAERSK and many others have begun to adopt new structures and to create and aggressively market new, higher-quality, and more sophisticated products. Released from the straitjacket of state regulations, especially new providers from the public sectors such as DEUTSCHE POST, the Austrian, French, German and Swiss Railroads are penetrating new markets and bringing with them innovative ideas. New business models and provider structures such as contract logistics – now fashionably referred to as "3PL/4PL" or "LLP" services – are establishing themselves and creating new opportunities for rationalization, quality enhancement and flexibility in trading and industrial companies[18].

A further, little observed development is the creation of spin-off ventures by large industrial corporations to move into the open logistics services markets, such as the German chemical industries' RAIL4CHEM, SIEMENS-SCHENKER's joint Venture SIS, Bertelsmann's ARVATO, METRO's MGL and the entry of new actors from the finance sectors into logistics, such as 3I, APOLLO, GE Financial Corporation acquiring stakes in logistics, and the rap-

[18]A comprehensive discussion of this concept can be found in the contract logistics market segment in Section IV.2.

idly evolving activities of real estate investment companies like PROLOGIS and GAZELEY in the logistics field. These companies, which may be called “hybrids” between insourced and outsourced logistics, respectively crossovers between financial, real estate und technology resource providers and genuine logistics service providers are contributing to the rapid change of European logistics.

Trend No.8: Shareholder value as dominant new measure for managerial success – new financial motives driving management to focus on core competences, complexity and asset reduction, head-counting and increased outsourcing

The eighth global economic trend providing the development of modern logistics with momentum is based on an important insight gained in the last few decades by managers and in the science of applied economics: trying to react to the challenges of the expanding, increasingly networked global economy, mass individualization, time-based competition and new ecological requirements by making planning, managerial and control systems more complex within ever larger organizational units is unlikely to be successful. Such systems generate ballooning “costs of complexity” (e.g. more expenditure on planning and management and more frequent system failures, along with their follow-up costs), which in many cases can eat up the desired benefits and even outweigh them.

As a result of this insight, a tendency to concentrate on core competences has been growing since the 1990s. Manageable, lean and, as far as possible, self-controlling organizational units focusing on one or a small number of tasks are now often preferred to large and complex multifunctional units. Activities not seen as core competences are outsourced: outsourcing and the restructuring of remaining organizational cells into flexible, standardized structures leads to the emergence of smaller, simpler and similarly structured modules, which can then be flexibly interlinked (see Warnecke 1997[19]). Such organizations can in turn function as resilient, manageable building blocks within complex value-creation chains, company structures and the economies of the future.

This tendency is also reflected in the world of stock exchanges and financial activities, where “shareholder-value orientation” means that any managerial activity, investment or business unit is judged in terms of its contribution to the value of products and other outputs for which a company’s customers are willing to pay. This is the reason why stock exchanges and shareholders oriented towards shareholder-value thinking prefer simple and focused business struc-

[19] H.J. Warneke: Die fraktale Fabrik. Revolution der Unternehmenskultur. Hamburg, 1997

tures entailing the smallest possible capital investment, which allow a simple and clear overview of expenses and profits. The outsourcing of non-essential business activities to suppliers and other service providers is seen as the key to creating such structures. According to current accepted wisdom, the use of outsourcing to push up returns on invested capital (ROI) or "economic value added" increases the value of the company as a whole.

However, the return to modular organizational structures which concentrate on core competences while maintaining myriad relationships with suppliers and service providers (what organizational theory calls "loosely coupled systems") also leads to an increase in the number of interfaces and a growth in the importance of the effective *co-ordination* of modules within value-creation chains – hence the significance of logistics.

The logistics industry has to a great extent taken over the provision of "outsourcable" services, but, as we have seen, logistics service providers have discovered "outsourcing" for themselves.

An impressive example of this is the portfolio rationalization carried out in the last two years by the Dutch company TNT. The company has changed from a highly diversified logistics services provider with a wide product range to one focusing on just two core areas, CEP and mail. This underlines the fact that the trend towards concentration on core competencies in the transport sector has also taken root in logistics.

Furthermore, because logistics contract cycles are becoming shorter and shorter, even in contract logistics, many companies see themselves forced to adopt different financial strategies to manage their assets, and there is a clear trend towards leasing or renting property, vehicles and even staff.

Shareholder-value thinking has also been reinforced by the entry of financial investors into the logistics market. Although these shareholders have been active in the sector for several years, they only had small companies or small holdings in their portfolios. A sea change occurred when APOLLO MANAGEMENT took over TNT's contract logistics. The company, which now operates under the name CEVA, took over EGL in the summer of 2007.

Parallel to this, a trend towards increasingly close horizontal collaboration and even symbioses between logistics and service providers can be observed in value creation chains. A tendency towards integrated logistics systems predicated on a "win-win" basis has grown out of a gradually emerging consensus among businesses that long-term learning processes and a move away from mutual exploitation by supply-chain partners can yield better overall results than the permanent threat of replacing the partner with a rival, which leads to high search, start-up, quality control and other transaction costs. As a result of this trend, there has been a rapid growth in the importance of contract logistics or “3PL” and “solutions” providers of individually tailored logistics products integrated in the processes of companies in trade and industry.

At the same time, new multi-tier vertical collaborative structures are developing between logistics service companies. Those at the top of the structures view themselves as “supply-chain architects” or “navigators,” also known as “4PLs” or “Lead Logistics Service Providers (LLP)”. They place no value on having their own extensive resources for operational tasks such as transportation and warehousing. Instead, they prefer to use a “substructure” of logistics providers and their sub-sub-contractors to carry out the work.

Another development among large logistics service providers that is driven by shareholder value concerns is the expansion and “industrialization” of European and worldwide horizontal networks in the logistics sector — especially in parcel, general cargo, ocean container and distribution services. Key considerations are the realization of economies of scale, standardization, and brand building. The pioneers with this strategy are the American based UPS and FEDEX. Large European companies such as DHL, DACHSER, SCHENKER, GEFCO are following.

The structures of the logistics industry are undergoing great changes. Which of these new structures will last and which specific structures will bring long-term benefits to which market segments or process contexts only the developments of the coming years will show.

2.2.4 Implications of the megatrends on the tasks of the SEALS study

The described eight megatrends show the drivers of logistics and the implications on the performances of the study. As a conclusion, some implications on the different perspectives of the study are compiled in the table below.

Table 2: The megatrends and some implications on the tasks of the study

	Macro-economics	Micro-economics	Terminals	Shippers
1.Globalization	Rising distances, increasing tonnages in air and sea freight	Changing profit margins in international transportation	Larger volumes in the terminals, new distribution centres especially in the area of ports	New relations e.g. from sea and air ports
2.Post-industrialization	Lower tonnage increases in wealthy economies	Increase in turnover of stocks as volumes are more predictable		
3.Acceleration	Still increasing volumes in air and road freight		Increasing throughput rates	Increasing demand in reliability
4.External risks and environmental awareness	Switch of volumes from road to rail/inland waterway	Increasing fuel costs		
5.Optimizing processes		Increasing profit margins, increasing turnover of stocks, increasing revenue per employment	Increasing throughput rates	Increasing reliability, decreasing costs
6.Advanced Technologies		Increasing turnover of stocks		Increasing reliability
7.Deregulation and privatization		Change in profit margins, increasing revenue per employment		
8. Shareholder value	Increasing share of outsourced employment in comparison to whole employment	Increasing pressure on profit margins and turnover of stocks		

2.2.5 Related European Research

A number of research reports and other publications are of importance for the SEALS study. These are listed in Table 3 with the relevance for the tasks of the SEALS study clearly indicated. Highlights of the content of the most important documentation are given here:

- PAN-EUROSTAR: Information on characteristics of different transport corridors.
- REALISE: Information on transport cost structures
- REORIENT: Information on characteristics of different corridors and transport performance.
- RETRACK: Information on characteristics of different corridors and transport performance.
- SUMMA: Input for gathering overall performance indicators.
- TEN-STAC: Information on characteristics of different corridors and transport performance and bottlenecks. Input for gathering overall performance indicators
- TRANS-TOOLS: EU-wide transport network model for performance simulation and forecasting
- Containerisation International Yearbook 2008: Statistical yearbook which contains information for seaports and major inland shipping ports. Used as a source for container throughput and port information (capacity, storage facilities, etc)
- European & Mediterranean container port markets: Study by Ocean shipping consultants on future developments of the container market in Europe. Used as a source for forecasts on capacity of seaports for 2015.
- Ports of the world 2008: Lloyds database containing general information (facilities, quay length, etc) for seaports and major inland shipping terminals. Also contains contact information of port authorities and major terminal operators.
- Shipping statistics yearbook 2007: Source containing relevant statistics on seaport traffic data, such as number of calls, throughput in tonne and TEU, and share of throughput in type of good and loading and unloading region.
- Strategie 2030 – Maritime Wirtschaft und Transportlogistik: Study containing forecasts of maritime throughput for European seaports.
- The power of inland navigation: Publication of the Dutch Inland Shipping Information Agency containing statistics for inland waterway transport.
- The REDEFINE study supplies background information about key drivers of growth in the transport sector. Other useful aspects are the shares of

total transport in different economic branches. The results of SULOGTRA helped us to identify trends in the logistics sector. Also the study gave information about the lack of statistical data for the logistics sector and the need to define the logistics sector.

- “Top 100” in European Transport and Logistics Services: Study containing statistics of national logistic markets of European countries as well as major logistics companies. The source was used for selection of distribution centres.

Table 3: List of relevant European and worldwide studies and sources

Name	Publisher	Acronym	Date	Relevance: General	Macro-economic	Micro-economic	Terminal perspective	Shippers perspective	Logistics performance indicators
Communication on Freight Transport Logistics Action Plan (COM(2007)607)	European Commission		2007	✓					
Integrated Service in the Intermodal Chain, 2005	European Commission	ISIC	2005	✓					
Study on Freight Integrators, 2003	European Commission		2003	✓					✓
Promoting Innovative Intermodal Freight Transport	European Commission	PROMIT	ongoing					✓	
Regional Action for Logistical Integration of Shipping across Europe, Final Report on Statistics	European Commission	REALISE	2005					✓	
Logistics Best Practice	European Commission	bestLog	ongoing (end: 2010)	✓					✓
Relationship between Demand for Freight-transport and Industrial Effects	European Commission	REDEFINE	1999		✓	✓			✓
Effects on Transport of Trends in Logistics and Supply Chain Management	European Commission	SULOGTRA	2001		✓	✓			
Thematic Network on Freight Transfer Points and Terminals	European Commission	EUTP II	2004				✓		
Implementing change in the European railway system	European Commission	REORIENT	2007					✓	✓
Pan-European Transport Corridors and area status report	European Commission	PAN EUROSTAR	2005					✓	✓
Scenarios, Traffic Forecasts and analysis of corridors in the Trans-European Network	European Commission	TENSTAC	2004	✓					✓
Sustainable Mobility, policy Measures and Assessment	European Commission	SUMMA	2004	✓					✓
Reorganisation of transport networks by advanced rail freight concepts.	European Commission	RETRACK	Ongoing					✓	✓
Tools for transport forecasting and scenario testing	European Commission	TRANS-TOOLS	2006						✓
Benchmarking Logistics for Co-modality	European Commission	BeLogic	ongoing (end: 2011)			✓	✓	✓	
Benchmarking Intermodal Freight Transport, Paris	OECD		2002	✓					
Transport Logistics: Shared Solutions to Common Challenges, Paris	OECD	TRILOG	2002	✓					
Intermodal Freight Transport. Institutional Aspects, Paris	OECD		2001	✓					

3 Macro-economic analysis

3.1 Objectives and concept

The objective of the macro-economic analysis was to produce an overview of existing relevant data on the economic importance of the logistics sector in the EU as a whole and each of its member states and to give a picture of the importance of the sector in the economy and of its relevance for important production sectors. In addition, the evolution of the inventory component of GDP and its share in GDP was to be analysed.

The EU statistical system does not use the term "logistics" nor does it so far allow deriving composite data of logistics activities from the present classifications. Commercial logistics activities are part of the European economic activities classification NACE[20] (Revision 1.1) Section I as shown in Table 4. This section combines activities of passenger and goods transport with other supporting and auxiliary transport activities as well as with communications activities (postal and courier services and telecommunications). Activities of NACE Section I are further detailed in three additional levels (see Table 5 for a detailed description of the content of each class see Annex 3), a second level consisting of headings identified by a two-digit numerical code (divisions), a third level consisting of headings identified by a three-digit numerical code (groups), a fourth level consisting of headings identified by a four-digit numerical code (classes). Data at the lowest levels allows eliminating such activities that are clearly unrelated to freight logistics (e.g. telecommunications (group 64.2) or activities of travel agencies and tour operators and tourist assistance activities (group 63.3)). The main problem is that all transport activity divisions and groups (excl. pipelines, group 60.3) comprise passenger and goods transport which cannot be separated except in group 60.2 (other land transport) where freight transport by road (class 60.24) is separately reported.

One of the main tasks in this part of the study was therefore, besides filling many gaps where data were not reported by member states, to filter out passenger transport related activities.

[20] NACE is the abbreviation of the Classification of Economic Activities in the European Community, based on the International Standard Industrial Classification of all Economic Activities (ISIC)

Table 4: NACE revision 1.1 – All sections and subsections

NACE Sub-/section	Description
A	Agriculture, hunting and forestry
B	Fishing
C	Mining and quarrying
CA	Mining and quarrying of energy producing materials
CB	Mining and quarrying, except of energy producing materials
D	Manufacturing
DA	Manufacture of food products, beverages and tobacco
DB	Manufacture of textiles and textile products
DC	Manufacture of leather and leather products
DD	Manufacture of wood and wood products
DE	Manufacture of pulp, paper and paper products; publishing and printing
DF	Manufacture of coke, refined petroleum products and nuclear fuel
DG	Manufacture of chemicals, chemical products and man-made fibres
DH	Manufacture of rubber and plastic products
DI	Manufacture of other non-metallic mineral products
DJ	Manufacture of basic metals and fabricated metal products
DK	Manufacture of machinery and equipment n.e.c.
DL	Manufacture of electrical and optical equipment
DM	Manufacture of transport equipment
DN	Manufacturing n.e.c.
E	Electricity, gas and water supply
F	Construction
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
H	Hotels and restaurants
I	**Transport, storage and communication**
J	Financial intermediation
K	Real estate, renting and business activities
L	Public administration and defence; compulsory social security
M	Education
N	Health and social work
O	Other community, social and personal service activities
P	Activities of households
Q	Extra-territorial organizations and bodies

Source: Eurostat

Table 5: NACE revision 1.1. – Section “I”: Transportation, storage and communication

NACE	Description
60	Land transport; transport via pipelines
60.1	Transport via railways
60.2	Other land transport
60.21	Other scheduled passenger land transport
60.22	Taxi operation
60.23	Other land passenger transport
60.24	Freight transport by road
60.3	Transport via pipelines
61	Water transport
61.1	Sea and coastal water transport
61.2	Inland water transport
62	Air transport
62.1	Scheduled air transport
62.2	Non-scheduled air transport
62.3	Space transport
63	Supporting and auxiliary transport activities; activities of travel agencies
63.1	Cargo handling and storage
63.11	Cargo handling
63.12	Storage and warehousing
63.2	Other supporting transport activities
63.21	Other supporting land transport actvities
63.22	Other supporting water transport activities
63.23	Other supporting air transport activities
63.3	Activities of travel agencies and tour operators; tourist assistance activities
63.4	Activities of other transport agencies
64	Post and telecommunications
64.1	Post and courier activities
64.11	National post activities
64.12	Courier activities other than national post activities
64.2	Telecommunications

Source: Eurostat

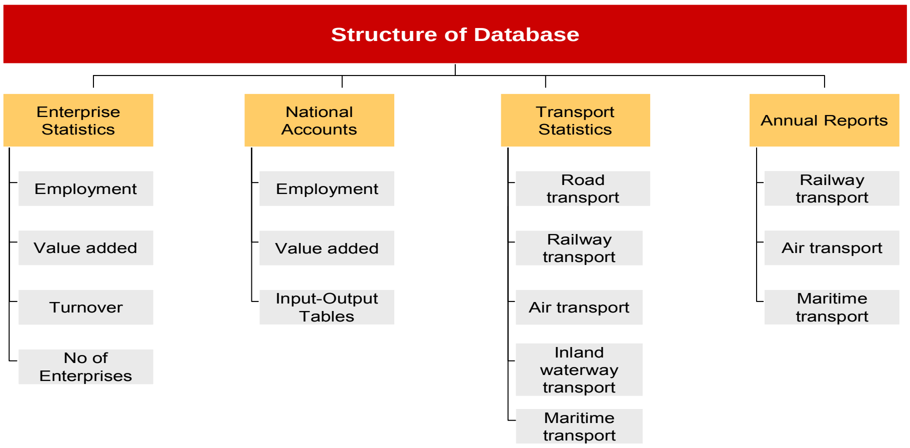
3.2 Data sources

For the purpose of this study and in particular for the macro-economic analysis, a comprehensive database was established covering the years between 1995 and 2006 where possible. This database is composed of statistical data of:

- Structural business (enterprise) statistics
- National accounts statistics and
- Transport statistics
- Complementary data from company reports

The structure of the data base is shown in Figure 11 below.

Figure 11: Structure of the SEALS macro-economic database



The main sources of macro-economic indicators are **structural business (enterprise) statistics** and **national accounts statistics**. Transport statistics were added as a basis to estimate and fill gaps in the enterprise data and so was company information from annual reports. The data base corresponds to the data that was available at the end of May 2008.

In the macro-economic analysis, only commercial (outsourced) logistics and freight transport activities are considered. Enterprises with transport and/or logistics services as main activities are included in NACE (rev. 1.1) divisions 60, 61, 62, 63, and 64. Cargo handling, storage and warehousing is one group (63.1), a pure logistics sub sector. In the different transport sectors, freight transport is separately classified only in the road sector (60.24). For all other modes of transport, in particular rail and air transport, passenger and freight transport activities are combined. The current NACE classification system is not focused on freight logistics (see section 3.7.1 on NACE Revision 2.0).

3.2.1 Data from enterprise statistics

The following economic indicators are reported in structural business (enterprise) statistics:

- Number of enterprises
- Number of persons employed
- Turnover
- Value added at factor costs

Given the numerous gaps in Eurostat statistics where data is not reported by member states, the macro-economic analysis was focused on two of these four indicators, i.e. number of persons employed and value added (at factor costs).

All available statistical sources were consulted, with the Eurostat data base (New Cronos) as the starting point, supplemented by selected national sources.

We note that national statistical publications provide to some extent more details than available Eurostat data. The degree of detail to be reported by national authorities to Eurostat is regulated by the EU[21]. To demonstrate the issue, the published data for Germany of the year 2005 from the German Federal Statistics Office ("Destatis") and from Eurostat is compiled by NACE Rev. 1.1 class, indicating the relevance of each class for the measuring of logistics activities as well as the economic importance in terms of turnover and value added. At first glance, the differences seem to be rather marginal. But in fact, the disaggregation of cargo handling activities on the one side and storage and warehousing on the other side is crucial for an analysis of the logistics sector. National statistical offices are not required to transfer this data to Eurostat but it can be assumed that they have this data available even if it is not published.

21 Council Regulation (EC, Euroatom) No 58/97 of 20 September 1996 concerning Structural Business Statistics (Annex1, Section 4)

Table 6: NACE revision. 1.1 – Data for Germany reported by Eurostat and Destatis, year 2005

NACE	Description	Relevance for the study	Availability of enterprise data	
			Eurostat	Destatis
I	Transport, storage and communication		✓	✓
60	Land transport; transport via pipelines		✓	✓
60.1	Transport via railways	partly	✓	✓
60.2	Other land transport		✓	✓
60.21	Other scheduled passenger land transport	no	✓	✓
60.22	Taxi operation	no	✓	✓
60.23	Other land passenger transport	no	✓	✓
60.24	Freight transport by road	yes	✓	✓
60.3	Transport via pipelines	yes	✓	✓
61	Water transport		✓	✓
61.1	Sea and coastal water transport	partly	✓	✓
61.2	Inland water transport	partly	✓	✓
62	Air transport		✓	✓
62.1	Scheduled air transport	partly		✓
62.2	Non-scheduled air transport	partly		✓
62.3	Space transport	no		
63	Supporting and auxiliary transport activities; activities of travel agencies		✓	✓
63.1	Cargo handling and storage		✓	✓
63.11	Cargo handling	yes		✓
63.12	Storage and warehousing	yes		✓
63.2	Other supporting transport activities		✓	✓
63.21	Other supporting land transport actvities	partly		✓
63.22	Other supporting water transport activities	partly		✓
63.23	Other supporting air transport activities	partly		✓
63.3	Activities of travel agencies and tour operators; tourist assistance activities	no	✓	✓
63.4	Activities of other transport agencies	yes	✓	✓
64	Post and telecommunications		✓	✓
64.1	Post and courier activities		✓	✓
64.11	National post activities	yes		
64.12	Courier activities other than national post activities	yes	✓	✓
64.2	Telecommunications	no	✓	✓

Sources: Eurostat, Destatis

3.2.2 Data from national accounts statistics

The national accounts statistics cover information on employment, the gross domestic product, output and value added at factor costs. We have noted that national accounts statistics often show significantly different results from those of enterprise statistics. National accounts try to provide a consistent picture of economic values and monetary flows. One key difference is caused by different depreciation methods. Another one is that globalised businesses like air transport register a major part of costs in the home country whilst revenues are registered where the tickets are sold.

Furthermore, national accounts statistics focus particularly on monetary flows which are recorded and published in the form of input-output tables. This data provides the following information in detail:

- Structure of the costs of production and value added in the production process
- Interdependencies of industries
- Flows of goods and services produced within the national economy (values)
- Flows of goods and services with the rest of the world (values)

Input-output tables are matrices describing the interdependencies between economic sectors in great detail. The use of input-output tables (IOT) is useful for describing the supply relationship between industries and between industry and end-users, wholesale and retail services. Furthermore, an IOT provides information about the quantity of production for export and the quantity of imported products from other countries for national production. Based on this information and with additional consideration of other data sources (e.g., transport statistics of foreign trade, surveys and expert interviews), transport patterns and logistics requirements can be derived.

Although data from national accounts are generally more elaborate and consistent and hence more reliable than data from enterprise statistics, there are some shortcomings:

- The data are less detailed with regard to breakdown by economic activity. Four transport and logistics related sectors are covered; passenger and freight transport are combined:
  - Land transport by rail and road as well as transport via pipelines services
  - Water transport services
  - Air transport services
  - Supporting and auxiliary transport services; travel agency services

- It takes longer to produce the relevant input-output tables; results are generally published not less than five years after the reporting year.
- Eurostat does not provide consolidated tables covering the whole EU.

Table A- 7 in Annex 3.3 documents the available symmetric input-output tables (SIOT) for the period 1995 to 2005. SIOTs are available for 2005 for only very few countries: the table specifies the year Eurostat expects to receive the respective SIOTs. The year with the best reporting record is 2000 with data for 18 of the 27 member states (11 of the EU-15 countries, with Greece, Luxembourg, Portugal and the UK missing).

3.2.3 Data from transport statistics

Transport data was not the focus of the SEALS study. Nevertheless, transport sector data can be used to estimate the relevant macro-economic parameters and is therefore incorporated into the SEALS database.

Transport statistics concentrate on the actual transportation of goods and do not cover further logistics activities. The following modes of transport have been integrated in the SEALS database:

- Road transport
- Railway transport
- Inland waterway transport
- Maritime transport
- Air transport
- Pipeline transport

Road transport is further disaggregated into “own account” and “for hire or reward” transport. For the other modes of transport, such a differentiation is generally not applicable.

Relevant indicators are in particular the following:

- Traffic performance (vehicle, train/track and vessel kilometres)
- Transport performance (tonne-kilometres)
- Transport volumes (tonnes)

In addition to freight transport, data on passenger transport was also added to the data base. This data was occasionally used to determine the relevant share of logistics in the various NACE subgroups.

In order to link transport data with enterprise data, only **national transport data** is suitable: A transport operator of country A, carrying international freight from country A to country B. Part of this production is in country B, but the driver is employed in country A and the value added is limited to country A. The enterprise also attributes the transport activity to country A. In accordance with the EU directives, the reporting of the transport activity is done in country A, irrespective of the fact that part of the work is done abroad. Therefore, national transport and other data are more closely linked to the data from enterprise and national account statistics than pure territorial data.

3.3 Employment and value added in the EU logistics sector[22]

3.3.1 Procedure of data preparation

In order to be able to present a comprehensive picture of the present status of the logistics sector in the European Union on the basis of structural business statistics, the following procedure was established:

1. Those components in NACE Section I that have nothing to do with freight logistics (e.g. telecommunications, travel agencies) were eliminated.
2. The data gaps in the remaining NACE classes, groups and divisions were filled.
3. Passenger transport in the relevant NACE divisions was separated from freight transport activities.

Estimation of missing data in relevant Sectors of Structural Business Statistics

The relevant NACE groups for estimating the size of the “outsourced logistics” sector are:

- 60.1 Transport via railways
- 60.24 Road freight transport
- 60.3 Pipeline transport
- 61.1 Sea and coastal water transport
- 61.2 Inland water transport
- 62 Air transport

[22] It was originally intended to cover also the number of enterprises and turnover; this idea had to be given up because of quality considerations regarding the data of individual countries.

- 63.1 & 63.2 & 63.4 Cargo handling and storage; other supporting transport activities; activities of other transport agencies
- 64.1 Post and courier activities

In view of the numerous data gaps in Eurostat records in all the years concerned, the objective being to arrive at a comprehensive set of results for all EU member states, the years 2000 and 2005 were chosen (data for 1995 was too sketchy). The five-year time lapse would allow a meaningful analysis of medium-term changes.

In addition to Eurostat data, certain data were taken from:

- the DG TREN/Eurostat publication: Energy and transport in figures, 2007/2008 edition
- UIC statistics (regarding employment in the railway sector)
- National statistical documentation

Wherever possible, missing data was interpolated or extrapolated by existing data in the time series, if just the year 2000 and/or 2005 were missing. Whenever this was not the case, trends and shares (e.g. inland water and maritime transport) were taken from transport statistics and existing data from comparable countries.

Usually, the total of the groups 60.1-60.3, the division 60, and the group 60.2 are available. The estimated number of persons employed (and turnover and value added) can be verified by the difference between the total in division 60 after subtracting Group 60.2 and the (often small / estimated) amount in group 60.3 (pipeline transport).

Data of pipeline transport is particularly sensitive to handle because of the small size of this sub sector (the available data for Romania seems to be out of range) and the varying capital intensity implies that the share of labour in the creation of value-added sometimes varies greatly from country to country, thus reducing the representativity of even large countries. Employment data for 2005 is published by DG TREN in Energy and Transport in Figures 2007/2008. Value added was estimated globally for the whole EU for 2005 based on an estimate by Eurostat for 2004[23]. No estimates could be made for the year 2000. As a result, the only gaps in Table 7 to Table 10 below are those related to pipeline transport.

[23] Eurostat Structural Business Statistics: Annual detailed enterprise statistics on services (Annex 1) - (Nace: H, I, J and K)) last update: 28.08.08

Data submission of NACE-Group 63.2 is not mandatory, but the sum of groups 63.1, 63.2 and 63.4 is available for all countries. Turnover, employment and value added in sector 63.2 are available for 10 countries, so the missing data was estimated by means of the existing shares. The share of goods transport value added in total value added is about 15 %-points higher than the share of goods turnover in total turnover. The share of persons employed in the goods transport sector in total employment was slightly (2-5 %) higher than the "turnover share".

Filtering out passenger transport shares

It is crucial to overcome the problem of the mixture of passenger and freight transport activities in the structural business statistics. This is especially relevant for rail transport (NACE 60.1), sea and coastal waterway transport (61.1), inland water transport (61.2) and air transport (62). The separation cannot be done from available statistical data, neither from Eurostat nor national sources.

Annual reports of major European transport operators (rail and air transport) were collected with the intention of finding representative relationships (ratios) of value added (and persons employed) to transport performance or transport volumes in both goods and passenger transport. Unfortunately, value added and persons employed are often not stated separately for passenger and goods transport. Turnover is often stated separately, so the calculated share of goods transport turnover in total turnover was used as a help function to obtain shares for passenger transport of value added and persons employed.

NACE Group 60.1 turnover was separated in the railway transport sector by using the collected annual reports. Turnover per tkm was calculated for these companies and extrapolated to the whole country, using the total tonne-kilometres performed within a country (transport statistics). For countries for which no company reports were obtained, the share was estimated by considering country characteristics (e.g. similar shares for East European countries). As the annual reports suggest, the share of goods transport value added in total value added was lower (on average 6-7 %-points) than the share of goods transport turnover in total turnover. The share for persons employed was assumed to be the same as for turnover, because the annual reports do not indicate a clear difference.

The share of goods transport in sea and coastal transport (NACE 61.1) was assumed to be 85 % (for value added and employed) except for landlocked countries. This value is consistent with the figures collected from Sweden and the United Kingdom[24]; both countries have a significant level of inter-island passenger and freight (ro-ro) transport. The ratio was applied to all except landlocked countries. It is in general a rather conservative assumption.

In the absence of suitable national data, the share of goods transport in IWW transport (NACE 61.2) was assumed to be about 90 % (for value added and persons employed). This is also a conservative assumption.

NACE division 62 (air transport) turnover was separated based on data from company annual reports. Turnover per tonne was calculated for these companies and extrapolated to the whole country, using the amount of tonnes loaded and unloaded within the country (transport statistics). The share of goods transport value added in total value added was estimated to be lower (on average 4-5 % - points) than the share of goods transport turnover in total turnover. The share of persons employed was assumed to be the same as for value added.

It was also necessary to estimate and then exclude supporting activities for passengers in the total of supporting activities. The NACE branch 63.2 consists of three sub-branches: other supporting activities for land transport (NACE 63.21), for water transport (63.23) and for air transport (63.23) (see Table 5). For the seven countries with available data for persons employed in these sub-branches, the shares of already estimated goods transport in the relevant transport branches 60 (land transport), 61 (water transport) and 62 (air transport) were applied to the sub-branches of branch 63.2 in order to estimate the shares of supporting activities of goods transport. The resulting average share of goods transport in branch 63.2 was around 50 % for most cases. Therefore, for all other countries without sub-branch data the original employment volumes in branch 63.2 were reduced globally by 50 % (for Malta, the available (lower) goods transport related share of Cyprus was applied.). The shares obtained for employment values were subsequently applied to value added in branch 63.2.

Enterprise statistics for scheduled air transport in Germany indicate a negative value added of 2 billion EUR for 2005, most likely due to accountancy practices of the global air passenger business of the main carrier Lufthansa. In order to produce a more realistic value of air freight transport activities, we multiplied the estimated number of German air cargo employees by the weighted average value of French and UK employees (88’000€) which appear to be more plausible at 74’000€ and 113’000€ respectively. This value is in

[24] Department for Transport UK: Transport Statistics Great Britain 2007. www.dft.gov.uk; Swedish Institute for Transport and Communications Analysis (Sika): Water Transport 2005. www.sika-institute.se

line with the 97'000€ of value added per employee (passenger and freight transport combined) as reported by Lufthansa for 2005.

For Belgium, a study published by the National Bank of Belgium (BNB)[25] estimates the national logistics sector by a similar approach to that outlined above. The overall results for value added of the logistics sector in Belgium of the two studies differ by some 6 to 7 %. The main differences result from basic statistical data. The exact data sources of the BNB study are not identified; the SEALS study uses Eurostat data.

Table A- 3, Table A- 4, Table A- 5 and Table A- 6 in Annex 3.2 show the resulting shares of freight transport and supporting logistics activities by country.

3.3.2 Size of the commercial logistics sector

The following Tables 7-10 contain the currently best estimates of the importance of the commercial transport and logistics sector in the 27 member states of the European Union. Estimated values[26] are shown in italics.

[25] Frédéric Lagneaux: Economic Importance of Belgian Transport Logistics, Working Paper Document N°125; published by National bank of Belgium, January 2008
[26] The estimated values are to be understood as approximative. They were not rounded in order not to eliminate small values.

Table 7: Number of persons employed 2005

Country	Transport via railways	Freight transport by road for hire or reward	Transport via pipelines	Sea and coastal water transport	Inland water transport	Air transport	Supporting and auxiliary transport activities, transport agencies*	Post and courier activities	Total outsourced logistics	Total employment (National accounts)	Outsourced logistics share
BE	*6'414*	63'191	*274*	*537*	*709*	*1'088*	*40'414*	46'688	*159'316*	4'225'000	3.8%
BG	*21'631*	48'681	*264*	*4'675*	*855*	*167*	*32'383*	*18'200*	*126'856*	3'495'000	3.6%
CZ	*37'733*	*105'000*	673	-	*1'035*	*244*	*26'100*	*48'000*	*218'785*	4'992'000	4.4%
DK	*997*	40'397	*113*	*11'050*	*108*	*930*	*25'196*	35'466	*114'256*	2'762'000	4.1%
DE	*22'718*	289'918	858	*20'563*	*8'168*	*8'474*	*394'286*	414'597	*1'159'583*	38'851'000	3.0%
EE	*3'256*	13'218	-	*935*	*56*	*63*	*8'209*	4'942	*30'678*	604'000	5.1%
IE	*321*	*17'000*	-	*1'615*	*106*	*228*	*13'552*	*13'000*	*45'822*	1'958'000	2.3%
GR	*1'529*	*41'513*	100	*16'391*	*900*	*156*	*31'071*	17'189	*108'850*	4'536'000	2.4%
ES	*4'277*	390'000	-	*5'839*	*204*	*1'298*	*168'479*	101'583	*671'680*	19'264'000	3.5%
FR	*35'338*	341'268	*1'381*	*11'336*	*3'109*	*7'463*	*222'244*	282'085	*904'223*	25'116'000	3.6%
IT	*17'872*	339'770	3'008	*19'929*	*2'572*	*1'353*	*245'398*	162'889	*792'791*	24'396'000	3.2%
CY	-	2'415	-	*4'016*	-	*166*	*4'057*	1'114	*11'767*	366'000	3.2%
LV	*13'660*	16'220	394	*623*	*18*	*93*	*14'144*	8'517	*53'669*	1'026'000	5.2%
LT	*10'194*	31'441	*410*	*1'422*	*127*	*87*	*11'170*	9'765	*64'616*	1'461'000	4.4%
LU	*812*	7'613	-	30	*42*	*2'624*	*1'919*	*3'100*	*16'140*	308'000	5.2%
HU	*19'886*	68'370	588	32	*1'105*	*254*	*23'303*	42'776	*156'315*	3'879'000	4.0%
MT	-	*1'000*	-	*638*	-	*153*	*3'440*	*944*	*6'174*	152'000	4.1%
NL	*2'260*	114'843	117	*5'950*	*11'227*	*8'360*	*60'483*	*85'000*	*288'239*	8'231'000	3.5%
AT	*23'965*	57'576	109	7	*341*	*697*	*37'769*	30'592	*151'056*	3'873'000	3.9%
PL	*80'938*	195'361	3'427	*1'631*	*1'124*	*375*	*55'265*	*107'725*	*445'846*	13'169'000	3.4%
PT	*1'231*	62'214	*26*	*847*	*1'320*	*759*	*28'461*	18'523	*113'381*	5'100'000	2.2%
RO	*26'805*	68'050	7'882	*1'000*	*2'787*	*203*	*57'266*	37'007	*201'000*	9'267'000	2.2%
SI	*6'037*	*18'500*	-	*169*	*25*	*26*	*6'437*	*6'500*	*37'695*	924'000	4.1%
SK	*28'189*	10'021	*370*	-	*660*	*24*	*7'276*	17'853	*64'392*	2'084'000	3.1%
FI	*4'075*	39'569	-	*6'650*	*186*	*421*	*20'762*	24'413	*96'077*	2'398'000	4.0%
SE	*3'803*	67'730	-	*12'683*	*957*	*713*	*41'778*	55'477	*183'141*	4'349'000	4.2%
UK	*8'528*	308'938	429	*14'112*	*1'050*	*4'666*	*233'874*	303'623	*875'220*	28'779'000	3.0%
EU15	*134'141*	*2'181'540*	*6'415*	*127'539*	*31'000*	*39'230*	*1'565'685*	*1'594'225*	*5'679'775*	174'139'000	3.3%
EU12	*248'330*	*578'277*	*14'008*	*15'141*	*7'792*	*1'853*	*249'049*	*303'343*	*1'417'793*	42'363'000	3.3%
EU27	*382'471*	*2'759'817*	*20'423*	*142'680*	*38'792*	*41'083*	*1'814'734*	*1'897'568*	*7'097'568*	216'502'000	3.3%

*NACE Groups 63.1, 63.4 and "Goods transport part" of 63.2 estimates in italics - not relevant

Source: Eurostat, national statistics and own estimates

Table 8: Number of persons employed 2000

Country	Transport via railways	Freight transport by road for hire or reward	Transport via pipelines	Sea and coastal water transport	Inland water transport	Air transport	Supporting and auxiliary transport activities, transport agencies*	Post and courier activities	Total outsourced logistics	Total employment (National accounts)	Outsourced logistics share
BE	9'987	62'026	:	520	700	2'253	33'683	48'500	157'669	4'091'000	3.9%
BG	23'997	31'222	:	4'520	829	411	40'979	15'398	117'356	3'239'000	3.6%
CZ	60'758	87'500	:	-	1'035	354	19'373	50'000	219'019	4'940'000	4.4%
DK	1'347	43'988	:	8'980	173	2'337	22'456	37'301	116'582	2'764'000	4.2%
DE	22'684	270'781	684	10'005	7'482	4'913	272'834	318'457	907'839	39'144'000	2.3%
EE	5'810	9'391	-	1'360	-	24	8'244	5'100	29'929	572'000	5.2%
IE	614	12'783	-	1'445	108	278	8'155	12'000	35'384	1'697'000	2.1%
GR	1'763	55'565	100	17'280	940	958	22'050	13'169	111'824	4'255'000	2.6%
ES	9'777	301'618	-	5'949	131	1'534	112'253	114'098	545'361	16'412'000	3.3%
FR	45'056	314'664	1'251	10'921	2'777	6'817	210'728	301'000	893'215	24'332'000	3.7%
IT	29'477	308'637	520	13'477	3'951	1'573	181'141	180'630	719'406	22'930'000	3.1%
CY	-	2'433	-	2'889	-	90	3'183	979	9'575	315'000	3.0%
LV	13'787	8'667	:	170	18	41	12'417	7'473	42'573	944'000	4.5%
LT	14'056	19'426	:	1'748	234	105	9'746	9'167	54'482	1'399'000	3.9%
LU	1'106	5'517	-	400	680	2'196	1'404	3'066	14'370	264'000	5.4%
HU	25'979	26'564	:	5	1'800	380	13'885	45'515	114'128	3'844'000	3.0%
MT	-	843	-	654	-	79	3'855	858	6'288	146'000	4.3%
NL	2'230	122'083	151	5'818	6'258	8'317	54'253	83'952	283'063	8'115'000	3.5%
AT	25'747	47'650	:	2	245	631	20'742	38'634	133'651	3'766'000	3.5%
PL	87'766	189'000	:	3'400	1'080	419	54'450	117'000	453'116	15'749'000	2.9%
PT	1'611	45'735	-	1'027	518	1'103	21'412	18'207	89'612	5'030'000	1.8%
RO	61'238	53'930	:	3'400	4'500	271	28'451	36'000	187'790	8'629'000	2.2%
SI	7'231	17'000	-	128	23	34	6'300	7'000	37'715	905'000	4.2%
SK	37'207	8'338	:	-	-	15	5'130	19'350	70'040	2'025'000	3.5%
FI	5'352	38'027	-	6'951	227	557	15'297	28'184	94'596	2'297'000	4.1%
SE	5'962	63'487	23	10'793	971	847	33'635	58'101	173'818	4'301'000	4.0%
UK	7'362	328'959	353	13'138	1'841	6'138	185'345	290'527	833'665	27'483'000	3.0%
EU15	170'076	2'021'520	:	106'706	27'002	40'454	1'195'388	1'545'826	5'106'972	166'876'000	3.1%
EU12	337'831	454'314	:	18'274	9'518	2'222	206'013	313'840	1'342'012	42'556'000	3.2%
EU27	507'907	2'475'834	:	124'980	36'520	42'676	1'401'400	1'859'666	6'448'983	209'432'000	3.1%

*NACE Groups 63.1, 63.4 and "Goods transport part" of 63.2 estimates in italics - not relevant : could not be estimated

Source: Eurostat, national statistics and own estimates

Table 9: Value added at factor cost in outsourced logistics sub sectors (in million EUR) 2005

Country	Transport via railways	Freight transport by road for hire or reward	Transport via pipelines	Sea and coastal water transport	Inland water transport	Air transport	Supporting and auxiliary transport activities, transport agencies*	Post and courier activities	Total outsourced logistics	Total value added (National accounts)	Outsourced logistics share
BE	256	3'075	25	541	37	92	2'792	1'848	8'666	266'542	3.3%
BG	82	271	:	69	14	2	261	55	754	18'016	4.2%
CZ	430	1'700	:	0	5	12	521	425	3'094	90'762	3.4%
DK	54	2'048	:	3'212	18	52	1'875	1'357	8'616	176'933	4.9%
DE	1'024	11'837	381	5'177	664	751	24'956	13'572	58'361	2'005'740	2.9%
EE	72	163	-	0	0	2	264	41	542	9'892	5.5%
IE	12	730	-	98	2	17	1'199	1'200	3'257	142'545	2.3%
GR	58	1'100	-	952	-	6	1'004	511	3'630	177'819	2.0%
ES	175	12'527	:	466	5	81	8'349	2'455	24'057	809'305	3.0%
FR	844	12'187	:	1'216	145	549	12'089	11'762	38'792	1'490'030	2.6%
IT	569	11'842	1'642	2'218	108	126	10'462	7'084	34'052	1'235'074	2.8%
CY	-	41	-	125	-	7	133	36	342	12'284	2.8%
LV	130	167	:	16	0	7	393	33	746	11'575	6.4%
LT	137	363	:	46	2	1	202	42	793	18'681	4.2%
LU	47	388	-	4	5	351	106	300	1'201	26'531	4.5%
HU	212	805	183	4	16	5	590	472	2'287	76'591	3.0%
MT	-	20	-	15	-	15	198	25	273	4'152	6.6%
NL	39	6'156	:	1'455	644	694	4'652	2'553	16'193	449'621	3.6%
AT	1'083	2'567	131	5	19	38	2'976	1'366	8'186	218'176	3.8%
PL	815	1'938	564	71	35	22	1'030	1'172	5'648	213'157	2.6%
PT	17	1'382	-	108	14	52	1'545	533	3'650	129'625	2.8%
RO	238	435	:	8	22	3	500	155	1'360	70'519	1.9%
SI	41	386	-	8	0	2	203	150	790	24'292	3.3%
SK	308	128	:	-	13	-0	132	162	743	34'289	2.2%
FI	198	1'921	-	427	7	35	1'147	848	4'583	138'031	3.3%
SE	196	2'995	:	759	34	40	2'085	1'726	7'835	250'112	3.1%
UK	376	14'191	:	2'608	39	526	16'825	11'080	45'644	1'589'440	2.9%
EU15	4'948	84'945	:	19'246	1'742	3'409	92'062	58'195	264'546	9'105'525	2.9%
EU12	2'464	6'417	:	363	106	76	4'426	2'769	16'622	584'209	2.8%
EU27	7'412	91'362	3'600	19'609	1'848	3'486	96'488	60'963	284'768	9'689'734	2.9%

*NACE Groups 63.1, 63.4 and "Goods transport part" of 63.2 — estimates in italics — - not relevant — : could not be estimated

Source: Eurostat, national statistics and own estimates

Table 10: Value added at factor cost in outsourced logistics sector (in million EUR) 2000

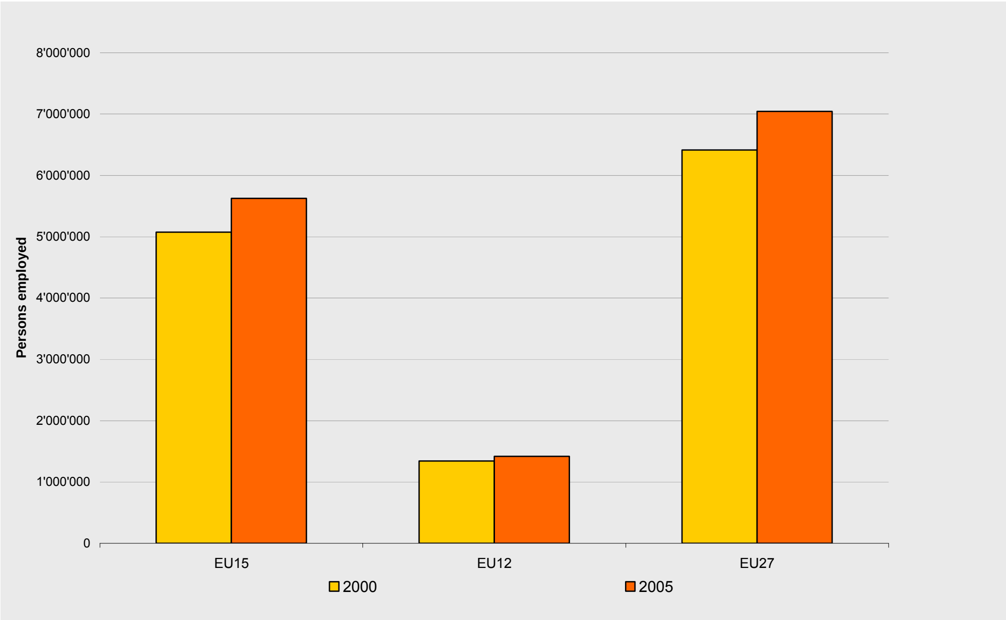
Country	Transport via railways	Freight transport by road for hire or reward	Transport via pipelines	Sea and coastal water transport	Inland water transport	Air transport	Supporting and auxiliary transport activities, transport agencies*	Post and courier activities	Total outsourced logistics	Total value added (National accounts)	Outsourced logistics share
BE	*393*	2'782	16	*84*	*34*	*79*	*2'157*	*1'735*	*7'280*	221'013	3.3%
BG	*46*	183	:	*9*	*3*	*1*	*83*	38	*362*	12'316	2.9%
CZ	*318*	*1'300*	:	0	*7*	*1*	*327*	320	*2'273*	56'245	4.0%
DK	*47*	1'974	:	*1'630*	*9*	*144*	*1'774*	1'251	*6'829*	149'109	4.6%
DE	*739*	11'615	176	*1'899*	*429*	*413*	*16'194*	11'915	*43'381*	1'845'450	2.4%
EE	*33*	70	-	*33*	-	*0*	*214*	*27*	*378*	5'414	7.0%
IE	*20*	646	-	*81*	*2*	*22*	*554*	*800*	*2'124*	93'241	2.3%
GR	*50*	*1'000*	-	*700*	*34*	*35*	*477*	353	*2'649*	121'442	2.2%
ES	*433*	8'100	:	*342*	*2*	*92*	*5'659*	1'817	*16'445*	567'664	2.9%
FR	*884*	*10'701*	173	*581*	*118*	*384*	*10'076*	*11'100*	*34'016*	1'244'211	2.7%
IT	*790*	9'896	39	*1'166*	*189*	*79*	*7'950*	5'342	*25'451*	1'029'294	2.5%
CY	-	39	-	*81*	-	*5*	*108*	25	*257*	9'328	2.8%
LV	*118*	83	:	*1*	*0*	*1*	*279*	*28*	*511*	7'533	6.8%
LT	*85*	101	:	*34*	*2*	*1*	*120*	31	*374*	10'901	3.4%
LU	*50*	237	-	8	*20*	*269*	*84*	278	*946*	19'278	4.9%
HU	*208*	373	:	0	*9*	*4*	*163*	281	*1'038*	44'498	2.3%
MT	-	21	-	*28*	-	*8*	*94*	*16*	*167*	3'750	4.5%
NL	*28*	5'658	:	*735*	*626*	*447*	*3'840*	*2'246*	*13'580*	372'273	3.6%
AT	*927*	2'136	45	3	*14*	*36*	*1'275*	1'368	*5'805*	185'496	3.1%
PL	*683*	1'938	:	*90*	*18*	*9*	*939*	*810*	*4'486*	163'131	2.8%
PT	*13*	1'014	-	*62*	*8*	*49*	*919*	484	*2'549*	107'112	2.4%
RO	*355*	164	:	*9*	*16*	*2*	*278*	*98*	*922*	34'923	2.6%
SI	*98*	197	-	*2*	*0*	*1*	*144*	91	*534*	18'140	2.9%
SK	*205*	48	:	-	*3*	*0*	*62*	*96*	*413*	19'825	2.1%
FI	*212*	1'643	-	*492*	*8*	*36*	*730*	724	*3'845*	116'611	3.3%
SE	*312*	2'920	1	*657*	*24*	*61*	*1'830*	2'018	*7'823*	226'619	3.5%
UK	*355*	14'640	108	*2'205*	*116*	*686*	*12'266*	11'192	*41'570*	1'379'830	3.0%
EU15	*5'253*	*74'962*	:	*10'644*	*1'636*	*2'830*	*65'787*	*52'624*	*213'735*	7'678'643	2.8%
EU12	*2'150*	*4'516*	:	*287*	58	34	*2'809*	*1'861*	*11'715*	386'004	3.0%
EU27	*7'403*	*79'478*	:	*10'931*	*1'694*	*2'863*	*68'597*	*54'484*	*225'451*	8'064'647	2.8%

*NACE Groups 63.1, 63.4 and "Goods transport part" of 63.2 — estimates in italics — - not relevant — : could not be estimated

Source: Eurostat, national statistics and own estimates

Across all 27 EU member states, the logistics sector employed in 2005 some 7 million persons, 5.6 million (80 %) in the EU-15 countries (representing 3.2 % of the total labour force) and 1.4 million in the 12 new member states (3.3 %). Despite a considerable variation of the share of the commercial logistics sector in both the old and the new member states between roughly 2 % and 5 %, the average importance of employment in the logistics sector is the same in the old and new member states.

Figure 12: Employment in outsourced logistics sector (without pipeline transport)



Source: Eurostat, national statistics and own estimates

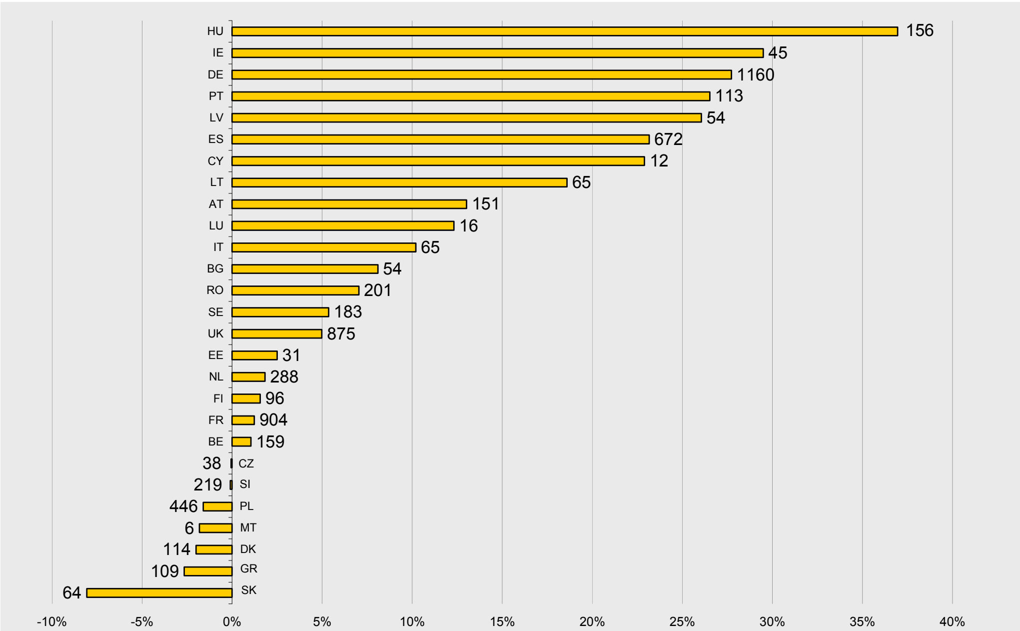
With 6.4 million persons employed in 2000, the increase between 2000 and 2005 was almost 10 %, compared to an increase in total employment of 3.4 % during the same period.

In Figure 13, changes in employment are plotted by country. Hungary has the best track record with an increase in employment of 37 %, followed by Ireland (29 %) and Germany (27 %). Italy (10 %) takes a middle position, while the growth in France and in the UK is very modest. Five countries including Denmark and Greece show a negative development.

The growth in Hungary is a combined impact of increased commercial road freight transport (+157 %) and supporting logistics services (+ 68 %) which by far outweigh decreases in rail transport (-23 %), IWW transport (-39 %), air transport (-33 %) as well as post and courier activities (-6 %). In contrast, the road freight transport branch in neighbouring Slovakia increased employment only by 20 %. In spite of substantial increases in air freight transport and supporting logistics services (+42 %), the combined increases were not sufficient to outweigh reduction of employment in rail freight transport (-24 %) and postal and courier activities (-8 %).

Of the 628,000 net employments created between 2000 and 2005 in all sub sectors except pipelines, almost 500,000 were registered in four countries: Germany (252,000), Spain (126,000), Italy (73,000) and Hungary (42,000). The United Kingdom and France created on balance only 20,000 and 11,000 additional jobs.

Figure 13: Change in employment 2000 to 2005 by country



Values next to the bars indicate the total employment (in thousand persons) in outsourced logistics 2005

Source: Eurostat, national statistics and own estimates

Germany created on balance new jobs in all sub sectors except in railway transport where the employment situation was unchanged. The additional jobs appeared predominantly in logistics support services (121,000) and post and courier services (96,000) while the transport sector added only 35,000 jobs.

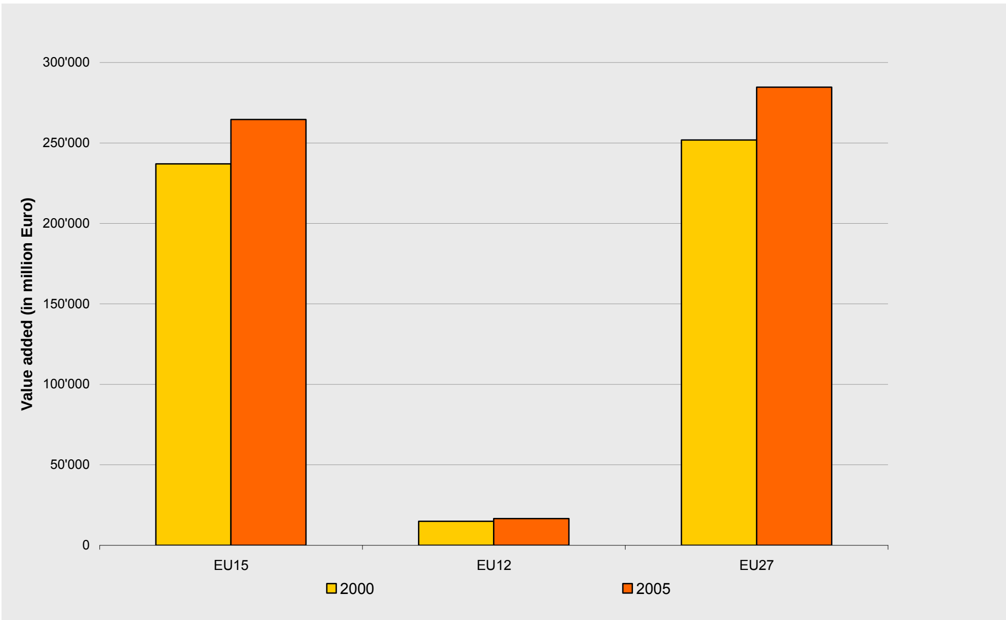
The logistics sector produces slightly less than 3 % of GDP in both old and new member states. In absolute terms its contribution was 284 billion EUR, of which 93 % were produced in the old and 7 % in the new member states (Figure 14). The growth from 2000 to 2005 was 24 % in nominal terms or 12 % in real terms. The logistics sector grew faster than the EU economy as a whole (+20 % at current prices).

Germany as the most populated and centrally located member state represents 20 % of total value added and 16 % of employment. The four largest countries (Germany, France, Italy and the United Kingdom) combine 62 % of value added and 52 % of employment.

The transport branches contribute a stable 45 % to the sector's value added, whereas in 2005 34 % come from the supporting activities (up from 30 % in 2000) and 21 % from postal and courier services (down from 24 %).

Within the transport sector, commercial road transport operators contributed 72 % in 2005, followed by sea and coastal shipping at13 %, rail transport 6 %, air and pipeline transport 3 % each and inland waterway transport 1 %.

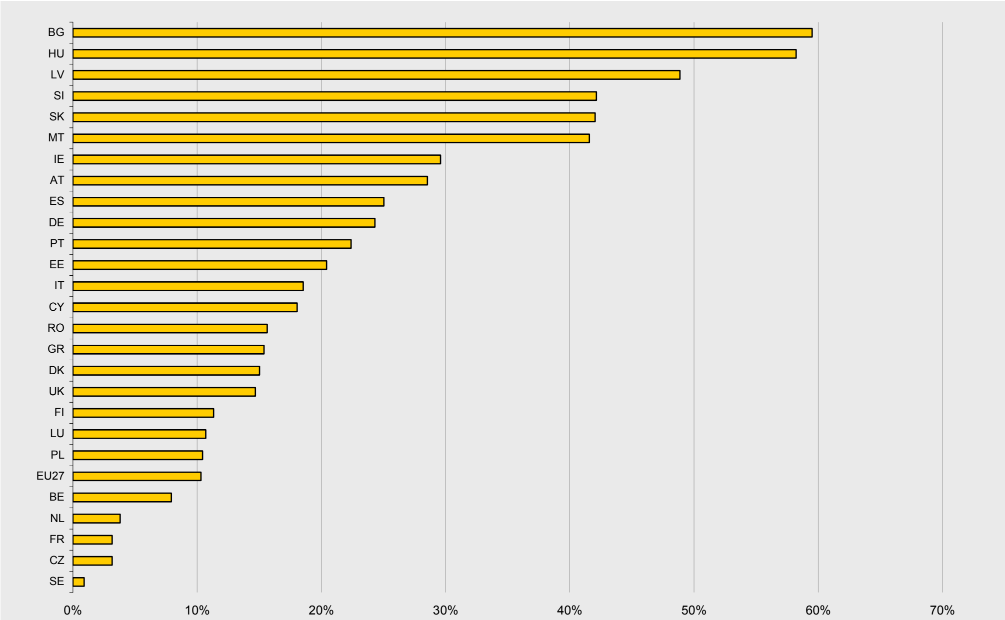
Figure 14: Value added (in constant prices 2005) in the outsourced logistics sector (without pipeline transport)



Source: Eurostat, national statistics and own estimates

In Figure 15, changes in value added (in constant prices) are shown by country. In all countries, the evolution was positive. The weighted average for the EU27 was 10 %. Lithuania leads the list with 90 % followed by Bulgaria (60 %) and Hungary (59 %). Seven of the 12 new member states rank highest with increases over 40 % during the five-year period. The other new member states mix with the old member states. The bulk of the countries record a growth between 10 % and 30 %; five countries (Belgium, the Netherlands, France, Czech Republic and Sweden) remained below the 10 % mark.

Figure 15: Change in value added (in constant prices) in the EU-27 from 2000 to 2005 by country



Source: Eurostat, national statistics and own estimates

Rail transport produces the lowest value added per employee because of its unprofitability, requiring high levels of subsidisation (Table 11). The contribution of the transport sub sectors in 2005 was 48 % as regards employment and 44 % in terms of value added. Logistics support services counted for one quarter (26 %) of employment and one third (34 %) of value added.

Table 11: Weight of sub sectors in employment and value added in 2005, EU27

EU27	Persons employed	Value added	Value added per employee
Rail	5.4%	2.6%	19'400
Road	39.0%	32.5%	33'100
Sea	2.0%	7.0%	137'400
IWW	0.5%	0.7%	47'600
Air	0.6%	1.2%	84'800
All Transport	47.5%	44.0%	36'800
Supporting activities	25.6%	34.3%	53'200
Post and courier activities	26.8%	21.7%	32'100
Total logistics sector	100.0%	100.0%	39'700

Source: Eurostat, national statistics and own estimates

This means that the outsourced logistics support activities including storage and warehousing produce a much higher value added per employee (53’200 EUR) than both transport and postal/courier services; the overall average was slightly less than 40’000 Euro.

Value added per employee in the new member states is on average approximately one quarter of that in the old member states. The ratio is 1 : 6 for maritime transport but 1 : 2 for air transport

Table 12: Weight of sub sectors in employment and value added in 2005, EU15

EU15	Persons employed	Value added	Value added per employee
Rail	2.4%	1.9%	36'900
Road	38.5%	32.1%	38'900
Sea	2.2%	7.3%	150'900
IWW	0.5%	0.7%	56'200
Air	0.7%	1.3%	86'900
All Transport	44.3%	43.2%	45'500
Supporting activities	27.6%	34.8%	58'800
Post and courier activities	28.1%	22.0%	36'500
Total logistics sector	100.0%	100.0%	46'600

Source: Eurostat, national statistics and own estimates

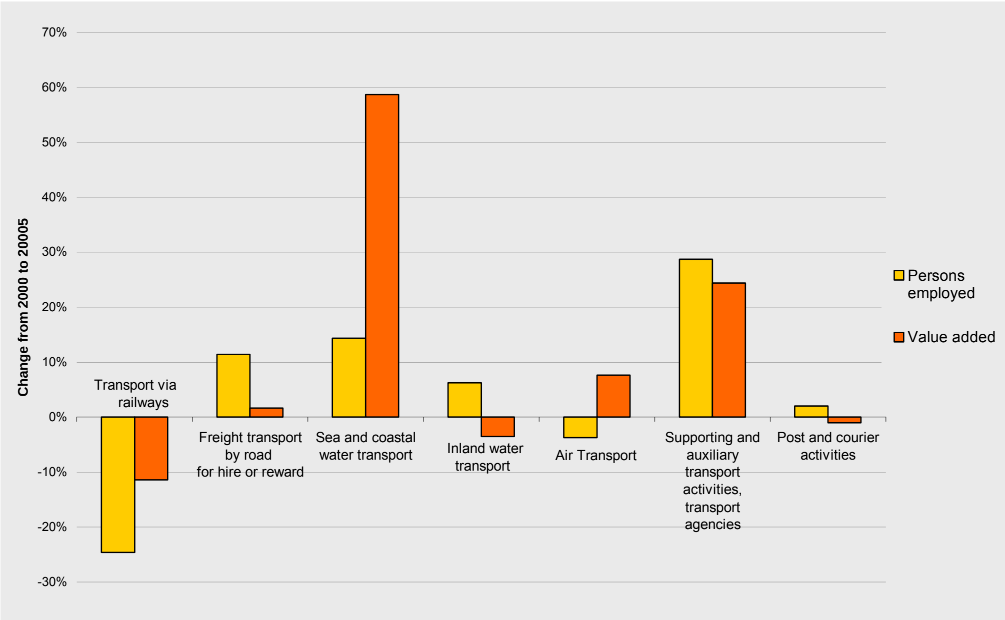
Table 13: Weight of sub sectors in employment and value added in 2005, EU12

EU12	Persons employed	Value added	Value added per employee
Rail	17.7%	14.8%	9'900
Road	41.2%	38.6%	11'100
Sea	1.1%	2.2%	24'000
IWW	0.6%	0.6%	13'600
Air	0.1%	0.5%	41'300
All Transport	60.6%	56.7%	11'100
Supporting activities	17.7%	26.6%	17'800
Post and courier activities	21.6%	16.7%	9'100
Total logistics sector	100.0%	100.0%	11'800

Source: Eurostat, national statistics and own estimates

The comparison of employment and value added by activity between the years 2005 and 2000 (Figure 16) presents a diverse picture. Employment in the rail sector dropped sharply, in the air sector modestly. It increased sharply in the supporting and auxiliary services sector. As regards value added in real terms, rail and inland waterway transport had negative results, road transport slightly positive results. The best performances are recorded for maritime transport (almost +60 %), supporting and auxiliary services (+34 %) and air transport (+8 %). Postal and courier services remained almost unchanged with regard to both employment and value added (although significant shifts from state-run postal services to private post and courier services have taken place).

Figure 16: Change in employment and value added in the EU from 2000 to 2005 by mode of transport (in constant prices)



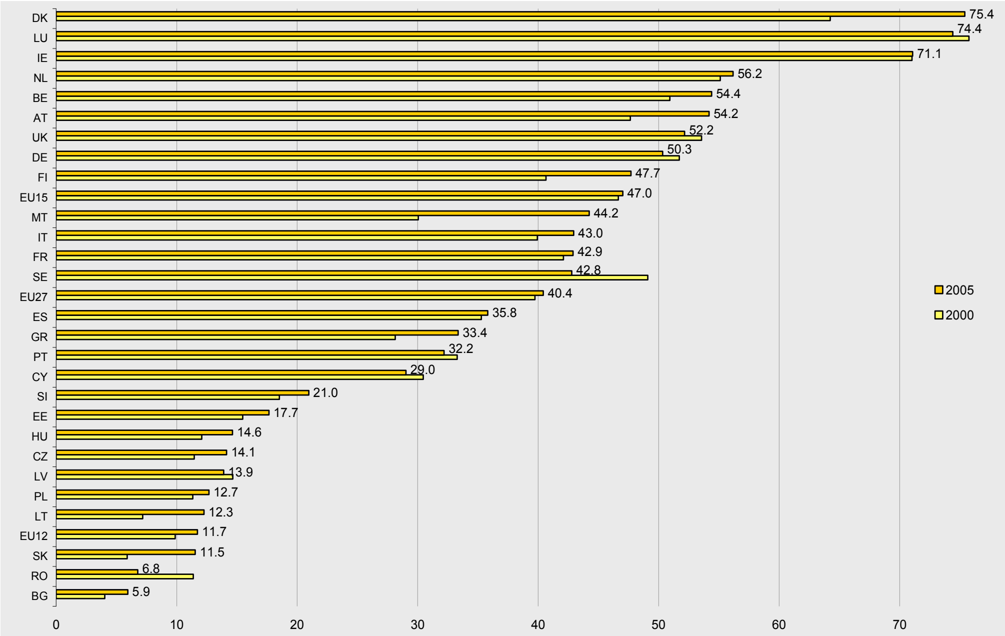
Source: Eurostat, national statistics and own estimates

Combining value added and employment, an important indicator for the productivity of the labour force can be established as shown in Figure 17.

The variation of this indicator in 2005 was between 6,000 EUR (Bulgaria) and 75,000 EUR (Denmark) in constant prices. The average of the EU-27 countries is approximately 40,000 EUR. Of the EU-15 countries, Spain, Greece and Portugal are slightly below this average. In real terms, the average of EU-15 countries increased only marginally between 2000 and 2005 while the EU-12 countries increased by 15 %.

Many questions arise when having a closer look at the detailed employment and value added tables above. The figures reveal great differences between countries even if we look separately at old and new member states. We have tried to cluster countries in order to derive a clearer picture for the analysis. In the framework of the SEALS strategic study it is, however, impossible to investigate and interpret the situation and past developments in detail.

Figure 17: Value added per person employed for each country 2000 and 2005 in constant prices (in thousand EUR of 2005)



Source: Eurostat, national statistics and own estimates

It must once again be stressed that the enterprise data relate to the main purpose of the company even if non-logistics activities are included. In addition, logistics enterprises do employ persons not linked to logistics activities. Employment data drawn from employment records as used in the micro-economic analysis may therefore show quite different results.

3.4 Trends in the commercial road freight sector

Mainly for reasons linked to the enlargement of the European Union in 2004, it has not been possible to produce ten-year or even five-year time series of key indicators in order to identify longer-term trends. In a recent publication, Eurostat produced five-year time series of key variables of the commercial (for hire or reward) road freight transport sector[27] which are reproduced in Figure 18

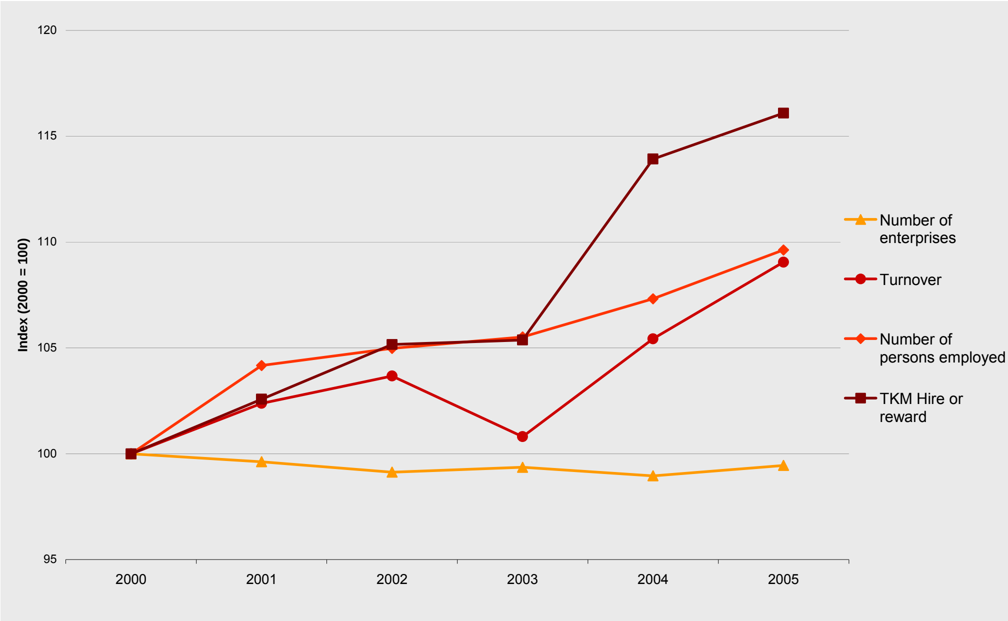
[27] Eurostat, Statistics in Focus, N° 97/2008

below as an example of what is aimed at for a thorough analysis. The indicators are at the level of the whole EU:

- number of enterprises
- number of persons employed
- turnover
- transport performance (tonne-kilometres)

While the first three parameters are from structural business statistics, the last one is from transport statistics. The turnover index has been calculated on the basis of constant price information. The data is for EU-27 countries except Greece, other missing data were estimated.

Figure 18: Evolution of number of enterprises, turnover, number of persons employed and tonne-kilometres of transport for hire and reward in the EU-15 (without Greece) for freight transport by road (NACE I6024), base index 2000=100



Source: Eurostat

With the exception of the number of enterprises[28] which has been stagnating over the period of 2000 to 2005, all other indicators show a positive trend, Employment increased moderately, indicating an increase in the average size of enterprises (+10 %). Turnover declined in 2003, due to a slow-down of eco-

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[28] The reservations regarding the quality of statistical data on the number of enterprises expressed earlier (see footnote 20) are not maintained for data for the whole EU.

nomic growth but increased by some 9 % in real terms during the five year period. Transport performance stagnated in 2003 but showed an unusually strong growth in 2004. Turnover per tonne-kilometre slightly declined (by 6 %).

3.5 Logistics intensity

The objective of this section is to estimate logistics shares in the inputs for production in key NACE sections in which the Commission has expressed specific interest. Basic data can be drawn from SIOTs established in the framework of national accounts statistics. The sectoral break-down in these SIOTs is not very detailed. Section I is subdivided into the five divisions 60 to 64. Since division 64 is dominated by telecommunications, this part which also includes postal and courier services cannot be taken into account. The remaining four NACE divisions are:

- 60 – Land transport (rail, road, pipeline transport)
- 61 – Water transport (sea and inland waterway transport)
- 62 – Air transport
- 63 – Supporting and auxiliary transport services; travel agency services

The input data again combines the purchase of passenger and freight transport and related services, so that the values for (business-related) passenger transport and for freight transport cannot be separated.

As indicated above, the analysis of the share of transport inputs in total inputs of seven NACE branches could only be achieved for the year 2000.

Bulgaria, Cyprus, Luxembourg and Malta have never submitted SIOTs to Eurostat nor made available such data via the internet and thus had to be left out.

The rest of the EU-27 submitted SIOTs, but for five of them the table for the year 2000 is missing: United Kingdom (replaced by the SIOT of the closest year: 1995), Greece (1998), Portugal (1999), Latvia (1998) and Romania (2003).

Only five countries have so far submitted a SIOT for 2005: Germany, France, Slovenia, Finland and Sweden. Germany and France were chosen for comparing the situation in 2005 with that of 2000 (the values of France for the year 2000 are at 1999 prices).

Understandably, the transport input flows in absolute monetary terms (Figure 19) are dominated by the EU-15 countries. The share of EU-12 countries is still significantly less than 10 %.

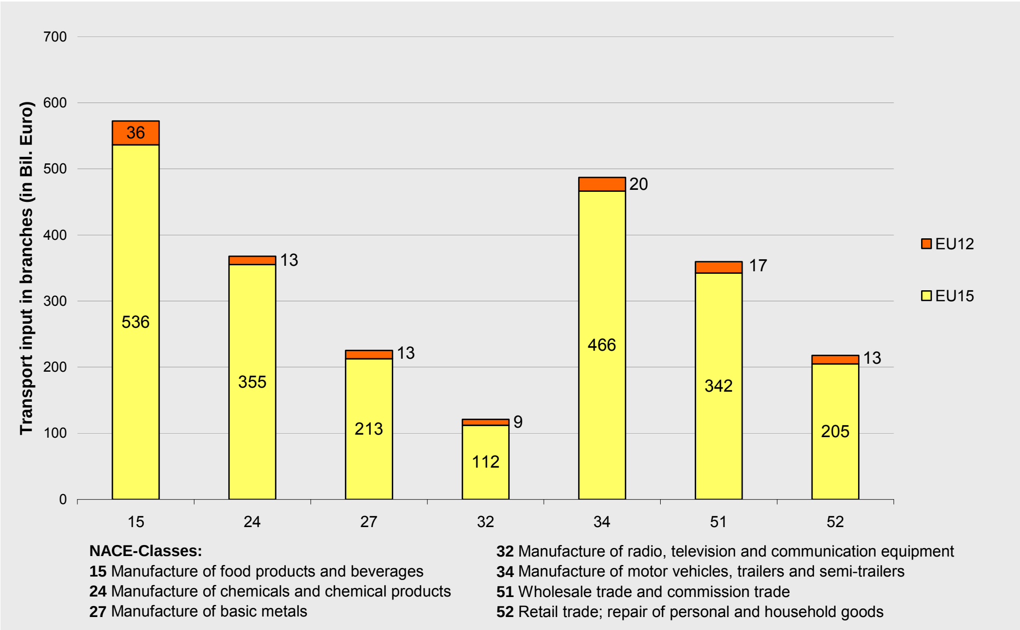
The importance of transport inputs is highest in the food and the automobile sectors. It is much lower in retail activities than in wholesale activities due to the shorter distances in retail.

The shares of logistics inputs in total inputs are quite different from the absolute figures; this ratio represents the logistics intensity of a given sector.

As depicted in Figure 20 the tertiary sector has a much higher logistics intensity than either the primary or the secondary sector. The logistics intensity of these two sectors is similar, but in manufacturing the share of transport is lower and the share of support activities is higher than in the primary sector.

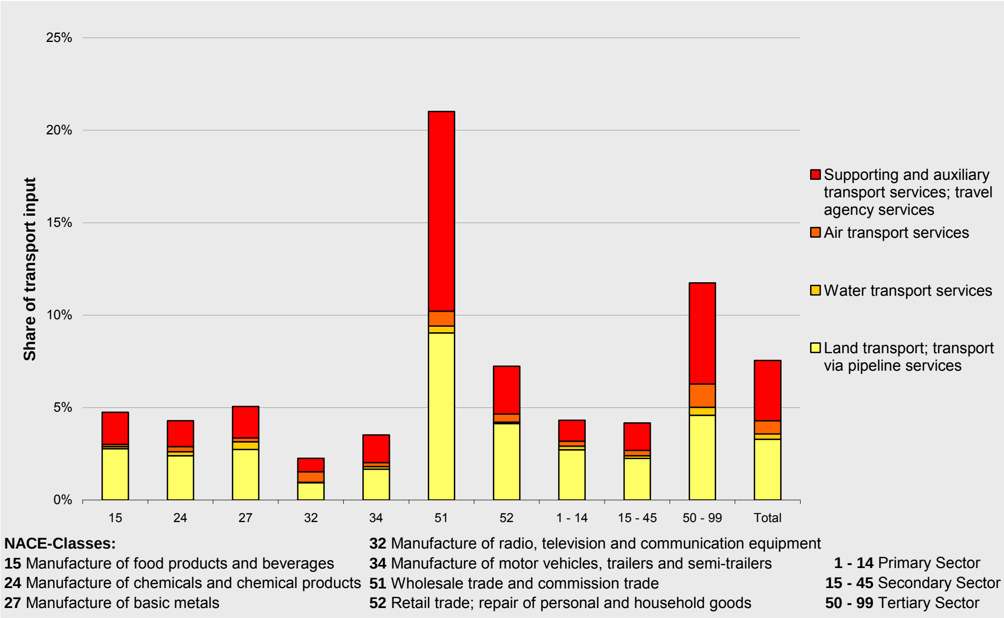
Amongst the selected seven sectors, the logistics intensity is lowest in the manufacturing of radio, television and communications equipment branch and highest in wholesaling with over 20 %. In the latter sector, over half of transport and logistics costs are support activities; most of the remaining part is land transport.

Figure 19: Transport inputs in selected NACE divisions, year 2000 (in billion EUR)



Source: Eurostat (EU15 excluding Luxembourg, EU12 excluding Bulgaria, Cyprus, Malta)

Figure 20: Share of transport inputs in selected NACE divisions in all EU-27 countries, year 2000 (in %)

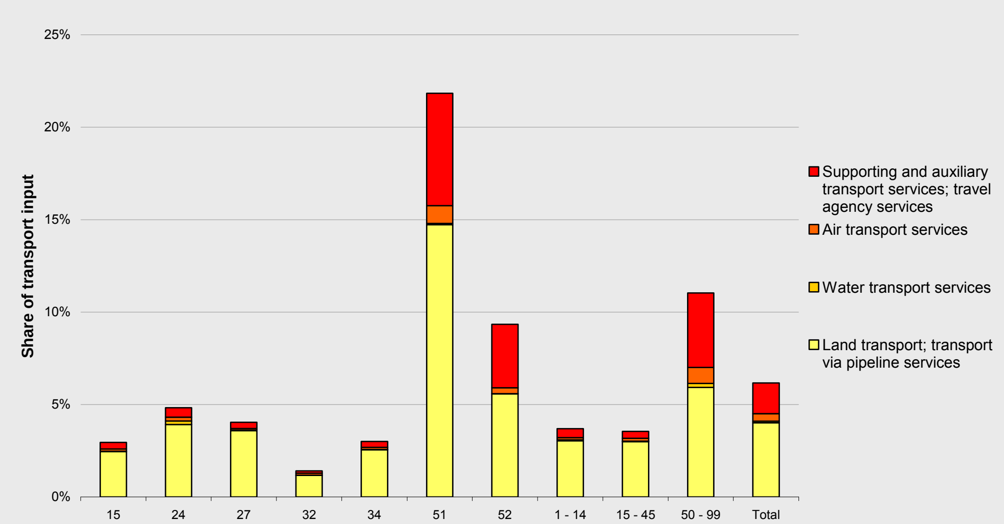


Source: Eurostat (EU27 excluding Luxembourg, Bulgaria, Cyprus, Malta)

The tertiary sector has the highest share of air transport inputs, but it is probable that most of it lies in passenger airfares.

Logistics intensities in the new EU-12 countries (Figure 21) are similar to those of all 27 member states, however with a significantly smaller share of support activities.

Figure 21: Share of transport inputs in selected NACE divisions in EU-12 countries, year 2000 (in %)



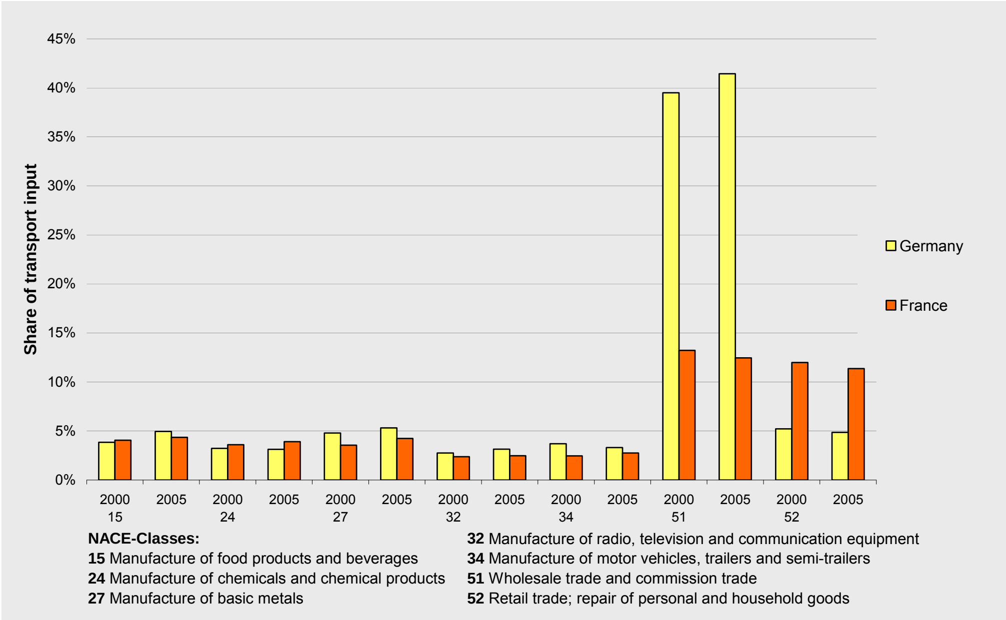
NACE-Classes:
15 Manufacture of food products and beverages
24 Manufacture of chemicals and chemical products
27 Manufacture of basic metals
32 Manufacture of radio, television and communication equipment
34 Manufacture of motor vehicles, trailers and semi-trailers
51 Wholesale trade and commission trade
52 Retail trade; repair of personal and household goods
1 - 14 Primary Sector
15 - 45 Secondary Sector
50 - 99 Tertiary Sector

Source: Eurostat (EU12 excluding Bulgaria, Cyprus, Malta)

Table A- 8, Table A- 9 and Table A- 10 in Annex 3.4 plot for each of the selected economic sectors the share of transport costs in total input by country. Clear characteristics allowing us to cluster the countries do not emerge.

Transport intensities in France and in Germany (Figure 22) are similar, except in the trade sectors. With around 40%, the logistics intensity in the German wholesale sector is three times that of France. In retail it is the opposite, albeit at a lower level. It is evident that the retail sectors are organised quite differently in France and Germany, with large-scale shopping facilities in the urban outskirts in France and small low-cost supermarkets in residential areas in Germany. Whether this alone is a plausible explanation for the differences shown cannot be established with certainty. In absolute monetary terms, the logistics costs of the wholesale and retail trade combined amounted in the year 2000 to 124.5 billion EUR in Germany and 95.6 billion EUR in France. These figures correspond clearly to the populations of the two countries.

Figure 22: Comparison of shares of transport inputs in Germany and France, 2000 and 2005 (in %)



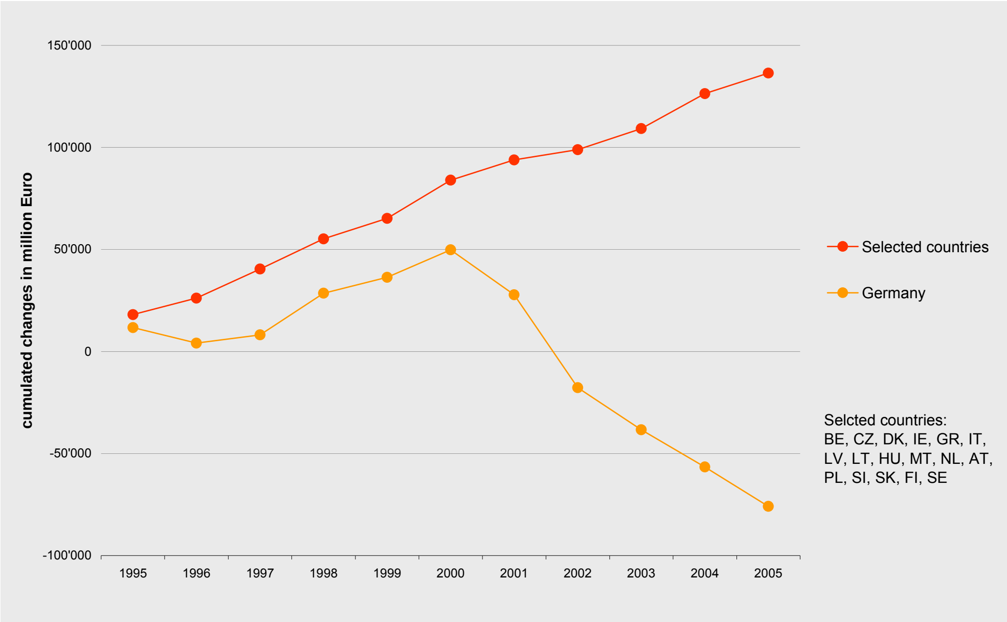
Source: Eurostat

3.6 Changes in inventories

One would expect that modern production and logistics processes reduce the requirements for keeping stocks for production and consumption purposes. The terms of reference for the SEALS study put emphasis on this aspect.

National accounts statistics do not enumerate stocks, neither in quantities nor in values. The only indicator is the change in inventories. Appropriate data for a full 10-year period (1995 – 2005) is available from Eurostat for only 18 countries. The data for these 18 countries combined is reflected in the red line of Figure 23. We note an increasing tendency over time of the value of inventories but cannot figure out whether or not there would be a decrease in real terms. In Germany, in contrast, we have a very clear negative trend since 2001 of diminishing inventory values of around 20 billion EUR per year.

Figure 23: Changes in inventories 1995 - 2005



Source: Eurostat, Destatis (German figures including acquisitions less disposals of valuables)

We have consulted the German Federal Statistical Office (Destatis) on the particularities of the German data. As a matter of fact, the official survey of inventories was discontinued some 15 years ago. Since then, inventory changes are estimated. In addition, the inventory estimates may be adjusted in a reconciliation procedure of national account variables in order to achieve consistency. The data shown in the above figure should therefore not be taken at face value.

Because of the level of aggregation and somewhat doubtful procedures for deriving this macro-economic variable, it does not have much explanatory value. We therefore recommend not to use it as a logistics indicator. The subject of inventories will be revisited in the micro-economic analysis in Chapter 4.

3.7 Prospects of future data availability

3.7.1 New NACE classification

A new revision of the NACE classification (revision 2) was decided by the EU in December 2006[29] which will be applied from 2008 onwards. The forthcoming revised system separates as far as possible freight and passenger transport and thus remedies a major weakness of the present classification. Freight transport and logistics activities will be found in the future section “H” which will be structured as shown in Table 14. The new NACE classification excludes communications activities and allows filtering out freight logistics activities (the freight activities are marked in yellow). Enterprises providing infrastructure services for both passengers and freight and some other activities that cannot be separated are limited to classes 52.21, 52.22 and 52.23 (marked in blue).

The new classification thus represents a much better basis for the measurement of the economic importance of the logistics sector. But we shall have to wait until late 2010 (national accounts from 2011 ongoing) to obtain first results for the reporting year 2008 at the EU level.

[29] Regulation (EC) No. 1893/2006, dated 20 December 2006

Table 14: NACE revision 2: Section "H" – Transportation and storage

Division/Group/Class		ISIC Rev.4
49	Land transport and transport via pipelines	
49.1	Passenger rail transport, interurban	4911
49.10	Passenger rail transport, interurban	
49.2	Freight rail transport	
49.20	Freight rail transport	4912
49.3	Other passenger land transport	
49.31	Urban and suburban passenger land transport	4921
49.32	Taxi operation	4922
49.39	Other passenger land transport n.e.c	4922
49.4	Freight transport by road and removal services	
49.41	Freight transport by road	4923
49.42	Removal services	4923
49.5	Transport via pipeline	
49.50	Transport via pipeline	4930
50	Water transport	
50.1	Sea and coastal passenger water transport	
50.10	Sea and coastal passenger water transport	5011
50.2	Sea and coastal freight water transport	
50.20	Sea and coastal freight water transport	5012
50.3	Inland passenger water transport	
50.30	Inland passenger water transport	5021
50.4	Inland freight water transport	
50.40	Inland freight water transport	5022
51	Air transport	
51.1	Passenger air transport	
51.10	Passenger air transport	5110
51.2	Freight air transport and space transport	
51.21	Freight air transport	5120
51.22	Space transport	5120
52	Warehousing and support activities for transportation	
52.1	Warehousing and storage	
52.10	Warehousing and storage	5210
52.2	Support activities for transportation	
52.21	Service activities incidental to land transportation	5221
52.22	Service activities incidental to water transportation	5222
52.23	Service activities incidental to air transportation	5223
52.24	Cargo handling	5224
52.29	Other transportation support activities	5229
53	Postal and courier activities	
53.1	Postal activities under universal service obligation	
53.10	Postal activities under universal service obligation	5310
53.2	Other postal and courier activities	
53.20	Other postal and courier activities	5320

Source: Official Journal of the European Union

3.7.2 Producer price indices

The European Union, in response to an OECD initiative, is implementing a system of service producer price indices (SPPI). Regulation (EC) No. 1158/2005[30] prescribes the sectors to be covered and the schedule for implementation. Quarterly price indices have to be transmitted to Eurostat for NACE (rev. 1.1) sectors, starting with reporting in 2008 for the year 2006:

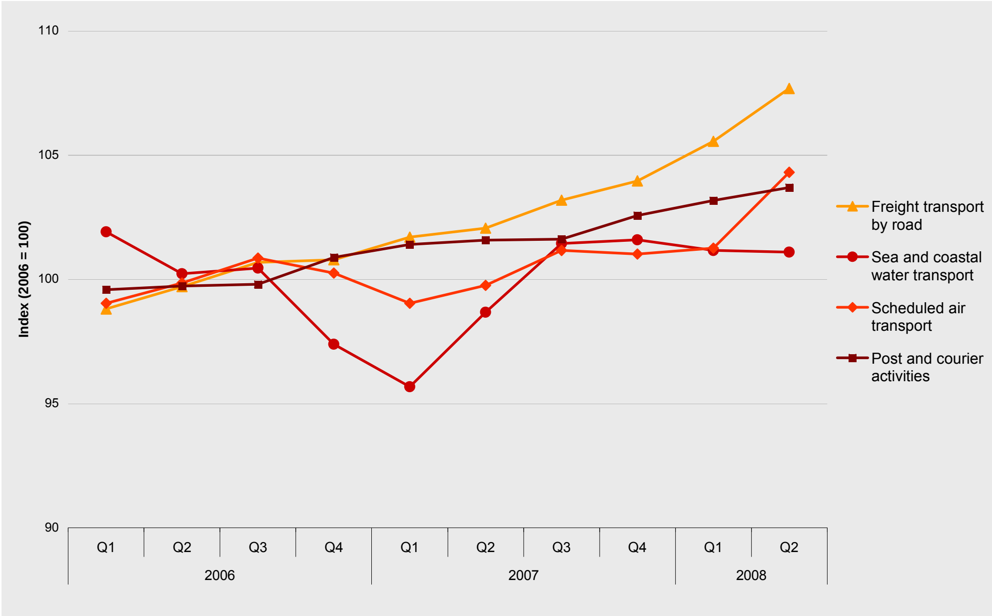
- 60.24 Road freight transport services
- 61.1 Coastal and transoceanic water transport services
- 62.1 Air transport services
- 63.11 Cargo handling services
- 63.12 Storage services
- 64.11 Postal services
- 64.12 Courier services

In this new reporting system, price indices for "freight only" services are to be reported for road transport; sea and air transport again combine passenger and freight transport ; rail, inland waterway and pipeline transport are not covered. Reporting is still sporadic. Some countries still benefit from derogations; others have failed to meet their obligations.

Nevertheless, Eurostat has recently published [31] quarterly SPPIs for the EU-27 of which four sectors are relevant for transport activities (Figure 24). In this figure the indices are plotted from the 1st quarter of 2006 to the 2nd quarter of 2008. The indices reflect current prices. Prices of road freight and courier services show more or less continuous modest increases while maritime transport prices declined significantly to the 1st quarter 2007 but subsequently recovered to the end of 2007, followed by another slight decrease. Air transport prices moved similarly to maritime transport in 2007, but to a less degree.

[30] REGULATION (EC) No 1158/2005 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 6 July 2005 amending Council Regulation (EC) No 1165/98 concerning short-term statistics
[31] Eurostat, Statistics in focus, N° 103/2008

Figure 24: Service Producer Price Indices, EU-27 (2006=100)



Source: Eurostat

Germany has developed a very systematic approach to **production price indices for freight transport and logistics**[32]. Price indices will be developed for the transport sub sectors sea, road, rail, air, IWW, freight handling and warehousing; weighted by turnover, these sub-indices will be combined into a “price index freight transport and logistics”.

- Road transport indices are presently published for distance classes (up to 50 km; 50 – 150 km; over 150 km; cross-border traffic); it is envisaged to produce price indices for different vehicle types (e.g. for the transport of petroleum fuels in tanks; of containers; of vehicles etc).
- Rail transport price indices are planned: transport services by railway undertakings operating as carrier of single wagon trains and bloc trains will be broken down by cargo type (mining and quarry products, automobiles, chemicals, construction materials/wastes; agricultural and forestry products; others); traction in combined transport will be split into container transport and piggyback transport; traction for third parties (single wagon and block trains as well as servicing of private rail sidings).
- An index for sea and coastal transport exists already.
- Price indices for inland waterway transport are produced for Rhine navigation; they are considered to be sufficient.

[32] Methodological Report "The new SPPIs for freight transport and logistics", in "Wirtschaft und Statistik" (Economy and Statistics) of the Federal Statistical Office of Germany, 11/2007, page 1097

- Air cargo indices have already been implemented with data from airway bills. They are to be broken down by major destination regions.
- Price indices for cargo handling and container handling services are also envisaged

The German programme of price indices for freight transport and logistics is rather comprehensive. Similar programmes are expected to be implemented sooner or later in other EU member states in accordance with the above mentioned EU Regulation.

3.8 Comparison EU - USA

Because of differing statistical systems and definitions, comparisons of EU data with those of overseas countries have proven to be presently impossible. However, in order to provide a general picture of the situation in the EU and of that in the USA as the largest single country economy, a comparison of value added, employment as well as of value added per employee is shown below in Table 15 to Table 17. The data for both areas include passenger transport in the air, rail and water transport modes.

Table 15: Comparison of employment EU – USA

Employment	USA		EU27	
	1000 employees	share of total employment	1000 persons employed	share of total employment
	2005			
Transportation and warehousing	6'184	4.4%	10'630	4.9%
Air transportation	574	0.4%	400	0.2%
Rail transportation	282	0.2%	881	0.4%
Water transportation	61	0.0%	214	0.1%
Truck transportation	2'033	1.4%	2'753	1.3%
Supporting activities	925	0.7%	2'612	1.2%
Post and courier activities	1'475	1.0%	1'882	0.9%
Total employment	141'730	100.0%	216'502	100.0%

Source: USA: Bureau of Economic Analysis; Bureau of Labour Statistics; EU: Eurostat;

The overall picture with regard to employment is quite similar. The shares of transport and warehousing in total employment at 4.4 % in the US and 4.9 % in the EU are of a similar order of magnitude. The relative weights of air and rail transport are reversed. Water transportation is much more important in Europe than it is in the US. The share of supporting activities is almost double in the EU compared to the US.

Table 16: Comparison of value added EU – USA

Value added	USA		EU27	
	in billion €	share of total value added	in billion €	share of total value added
	2005			
Transportation and warehousing	291.8	3.4%	439.7	4.5%
Air transportation	38.6	0.4%	27.2	0.3%
Rail transportation	26.8	0.3%	31.9	0.3%
Water transportation	8.0	0.1%	25.0	0.3%
Truck transportation	94.7	1.1%	90.9	0.9%
Pipeline transportation	7.6	0.1%	3.6	0.0%
Supporting activities	101.7	1.2%	147.9	1.5%
Total value added	8'682.5	100.0%	9'689.7	100.0%

Source: USA: Bureau of Economic Analysis; Bureau of Labour Statistics; EU: Eurostat;

At the average 2005 exchange rate, the US economy produced 10 % less value added than the EU in that year, with however one third (35 %) less manpower. However, the situation is quite different in the transport and warehousing sector, where the US produces, compared to the EU, two thirds (66 %) of value added with a 42 % smaller labour force. The labour productivity in terms of value added per full-time employee in this sector is 14 % higher in the US than in the EU, while it is economy-wide 37 % higher as shown in the following table.

Table 17: Comparison of value added per employee EU – USA

Value added per employee	USA	EU27
	in €	
	2005	
Transportation and warehousing	47'200	41'400
Air transportation	67'300	67'900
Rail transportation	95'200	36'200
Water transportation	130'900	117'100
Truck transportation	46'600	33'000
Supporting activities	110'000	56'600
Total economy	61'300	44'800

Source: USA: Bureau of Economic Analysis; Bureau of Labour Statistics; EU: Eurostat;

While the value added per full-time employee is very similar in the air sector, this indicator is much higher in the full commercial rail sector in the US (95’000 EUR against 36,200 EUR in 2005). But the road haulage sub sector also produces over 40 % more value added per full-time employee. The indicator is almost double in the US in the sub sector of supporting activities.

4 Micro-economic analysis

4.1 Data sources

The micro-economic analysis relies mainly on company data and some statistics to fill data gaps. This part of the report contains five main sections, three of which contain a quantitative analysis of the logistics costs, stock development turnover in the specific industries and performance of the logistics companies to show qualitative results in respect of the main characteristics of the logistics sector and the reasons for modal choice.

The data sources are of different types. In the quantitative analysis, the sources of information are specific data from the companies themselves (questionnaires, project results, studies, annual reports, balance sheets etc.) plus statistics (mainly from Eurostat) to fill the gaps. To work out the cost structures of the different transport modes and the EU member states, available data from various sources including the questionnaires, annual reports, national statistics, studies[33], project results etc. were used:

- Road: In addition to studies drawn up through desk research, a “real life” picture of the cost structure of logistics service providers in the EU27 could be obtained from detailed questionnaires sent out during the project as well as from earlier project results.
- Rail: The main sources were annual reports, desk research, discussions with market players and national statistics.
- Inland waterways: the sources here were mainly company balance sheets and national statistics.
- Sea freight: In addition to annual reports and national statistics, the results rely on a study by HSH Nordbank[34].
- Air freight: To get a representative cost structure, the results were derived from national statistics and annual reports.
- Warehousing: The cost structures of warehouses could be derived from Fraunhofer ATL’s benchmarking database. Also, market reports from

[33] A selection of the studies analysed: Max Herry: Transportpreise und Transportkosten der verschiedenen Verkehrsträger im Güterverkehr, Kammer für Arbeiter und Angestellte Wien, 2001; BGL: Jahresbericht 2006/2007, Bad Homburg, 2007; Michael Otremba: Internationale Wettbewerbsfähigkeit im Straßengüterverkehr : Eine Untersuchung zur künftigen Wettbewerbsposition Deutscher Strassengüterverkehrsunternehmen nach der EU-Osterweiterung, Hamburg: Deutscher Verkehrs-Verlag, 2004.

[34] HSH Nordbank: Betriebskosten 2007 – Untersuchung der Betriebskosten deutscher Containerschiffe, November 2007.

Goodman, King Sturge and JonesLangLasalle served as a basis for rents and real estate costs in the different EU member states[35].

The performance indicators for the different transport modes were derived from individual company analyses. The number of companies analysed is shown in *Table 18*.

Table 18: Number of analysed companies in the logistics sector

NACE	Industry	Austria	Balkan**	Baltic states	BeNeLux	Czech Republic	France	Germany	Hungary	Iberian Peninsula	Italy	Poland	Scandinavia	UK	Sum
601	Transport via Railways*	3	29	14	10	5	8	53	6	18	27	25	21	98	**317**
6024	Freight Transport by road	21	144	114	418	157	1.450	568	42	998	0	178	385	507	**4.982**
611	Sea & Costal Water Transport*	0	22	16	55	0	58	102	0	91	126	11	168	240	**889**
612	Inland water transport*	0	4		46	0	20	46	0	0	6	0	5	22	**149**
62	Air transport*	0	21	18	24	0	45	24	3	54	40	12	53	160	**454**
631	Cargo Handling & Storage	0	35	39	214	16	281	134	14	161	413	37	108	172	**1.624**
634	Activities of other transport agencies	10	120	54	226	72	761	1.071	73	373	521	87	634	285	**4.287**
641	Post & Courier Activities	0	16	9	23	18	15	40	4	33	18	9	31	47	**263**
Sum		**34**	**391**	**264**	**1.016**	**268**	**2.638**	**2.038**	**142**	**1.728**	**1.151**	**359**	**1.405**	**1.531**	**12.965**

* including passenger transportation
** Bulgaria, Romania, Slovenia, Greece

Source: Fraunhofer ATL, companies extracted from the database of Bureau van Dijk[36]

The developments of stocks in the economic sectors (NACE code in brackets) “food products and beverages (15)”, “chemicals and chemical products (24)”, “basic metals (27)”, “radio, television and communication equipment apparatus (32)” and “motor vehicles, trailers and semi-trailers (34)” plus “retail trade (52)” have also been taken from individual company analyses (see *Table 19*).

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[35] To be found on the websites www.kingsturges.com/research and www.research.joneslanglasalle.com/

[36] The database is a pan-European database containing financial information on more than 11 million public and private companies in 41 European countries. It combines data from over 30 specialist regional information providers. For more information, see http://www.bvdep.com/en/AMADEUS.html.

Table 19: Number of analysed companies in the different industries

NACE	Industry	Austria	Balkan*	Baltic states	BeNeLux	Czech Republic	France	Germany	Hungary	Iberian Peninsula	Italy	Poland	Scandinavia	UK	Sum
15	Food products and beverages	-	1.765	465	448	426	4.841	236	537	4.990	5.242	1.600	936	600	**22.086**
24	Chemicals and chemical products	-	423	53	242	144	1.222	113	136	1.440	2.161	450	310	356	**7.050**
27	Basic metals	-	179	78	90	100	444	146	48	770	1.311	215	189	157	**3.727**
32	Radio, TV, comm. equipment apparatus	-	88	43	44	60	56	79	77	234	872	75	207	179	**2.014**
34	Motor vehicles, trailers, semi-trailers	-	104	46	22	85	70	73	50	529	898	178	324	88	**2.467**
52	Retail trade	-	2.957	998	1.281	1.444	1.493	662	2.101	13.599	14.045	1.709	2.694	2.669	**45.652**
Sum		**0**	**5.516**	**1.683**	**2.127**	**2.259**	**8.126**	**1.309**	**2.949**	**21.562**	**24.529**	**4.227**	**4.660**	**4.049**	**82.996**

* There was no data available for Austria
** Bulgaria, Romania, Slovenia, Greece

Source: Fraunhofer ATL, companies extracted from the database of Bureau van Dijk

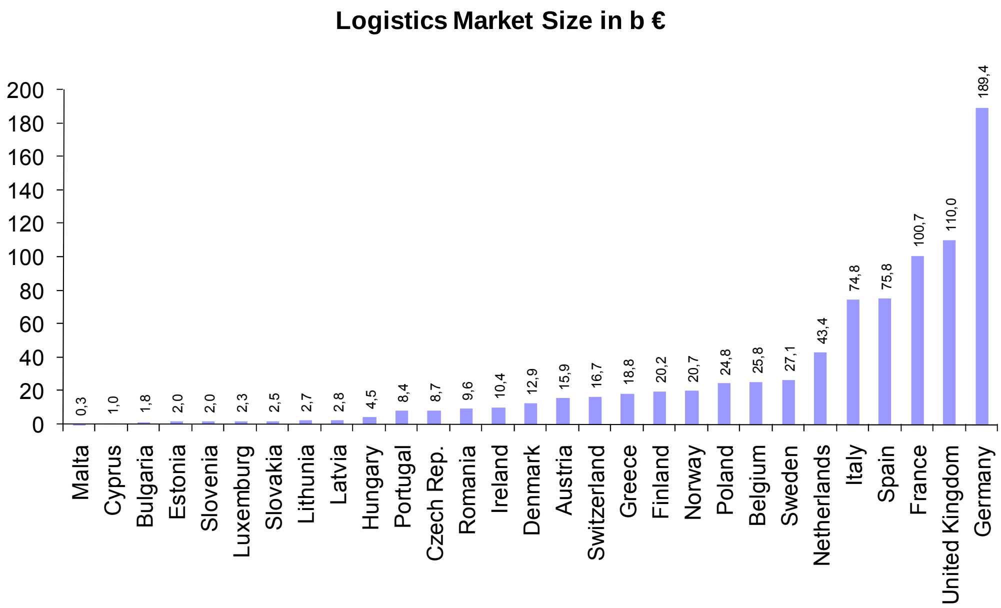
The number of the companies analysed for the stock changes is sufficient to get representative results. In the logistics sector, the number of companies is sometimes too small to obtain representative findings (especially in the railway, inland waterways, air traffic and postal and courier market), but a general conclusion is possible.

4.2 Characteristics of the logistics sector – expenditures and structure

Expenditures in the European logistics market (including Norway and Switzerland, as they are integrated in the logistics networks) totalled 836 billion EUR in 2006 (EU27 799 billion EUR, EU15 736 billion EUR). Germany was the largest market, accounting for 189 billion EUR or nearly 25 % of the EU27 market (see Figure 25). These are the results of the study of Klaus/Kille 2007, in which the market sizes in Europe were estimated in two ways: using the registered freight vehicles and carried tonnages divided by modes on the one hand, and the revenues by industries and their different logistics expenses on the other hand[37].

[37] The basis for the estimation of this study on the European market is the German issue of the study "Die Top 100 der Logistik", last published in October 2008. Here, it was possible to estimate the market using a third yardstick - employees in logistics and their value added. With this basis and the tonnages in the different transport modes, it was possible to get separate numbers on national expenditures by including the differences of the European countries in employment costs, average tour distances and a development factor. A similar approach was conducted in this study to estimate the cost structures in transportation and warehousing.

Figure 25: Expenditures in logistics markets in Europe in 2006 (in billion Euros)



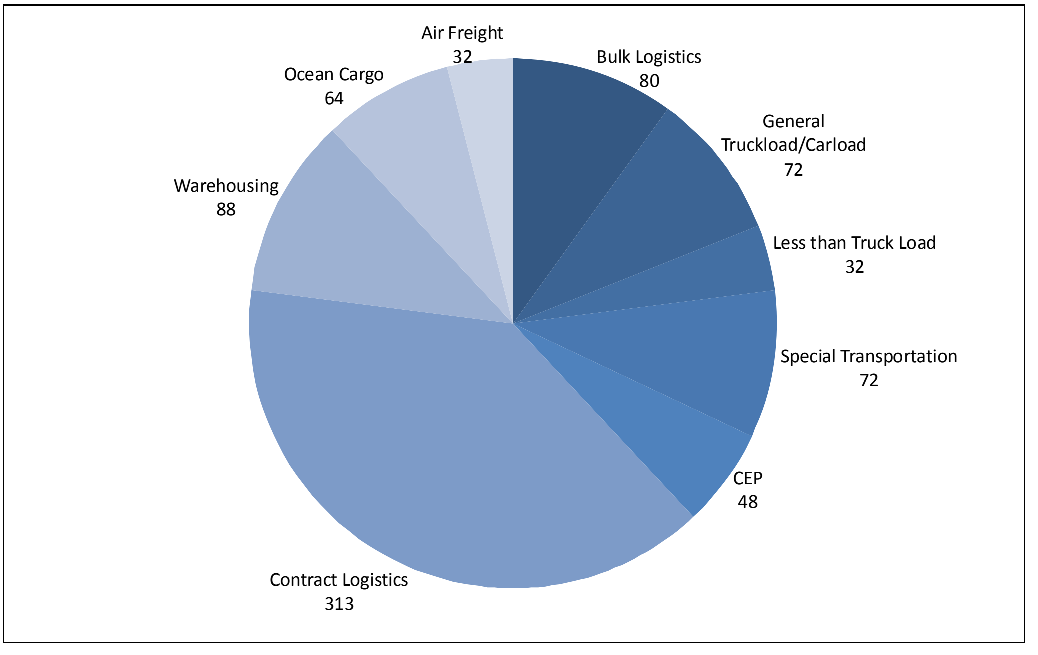
Source: Klaus/Kille 2007

The whole logistics market can be divided into nine market segments (plus the mail market, which is mostly allocated to the communication market). These nine markets are briefly described in Section 2.1. The sizes of the market segments are shown in *Figure 26*. The largest market is for so-called contract logistics. Contract logistics is defined as service packages, which

- Focus on the integrated management and execution of several logistical and (sometimes) non-logistical functions in a complex package of services (differentiating the contract logistics segment from the “mono-functional” segments of transportation),
- Require a significant degree of individualisation in the design and execution of those services, in many cases specific investments,
- Cover a longer-term relationship between the contract logistics client and the service provider, usually backed by a written contract for at least one but more often for several years – unlike purely “transaction-based” business relationships, which can be broken off at any time,
- Have a significant volume of business – in practice, turnover of at least 500,000 EUR a year per contract.

The primary production resources in the contract logistics services are material handling centres – often located on the premises of the industrial contract client –, central and regional warehouses and cross-docking centres, vehicle fleets, load-carriers and packaging systems, complex IT systems for inventory management and supply chain planning, and dedicated personnel.

Figure 26: Logistics market segments in Europe (in billion EUR)



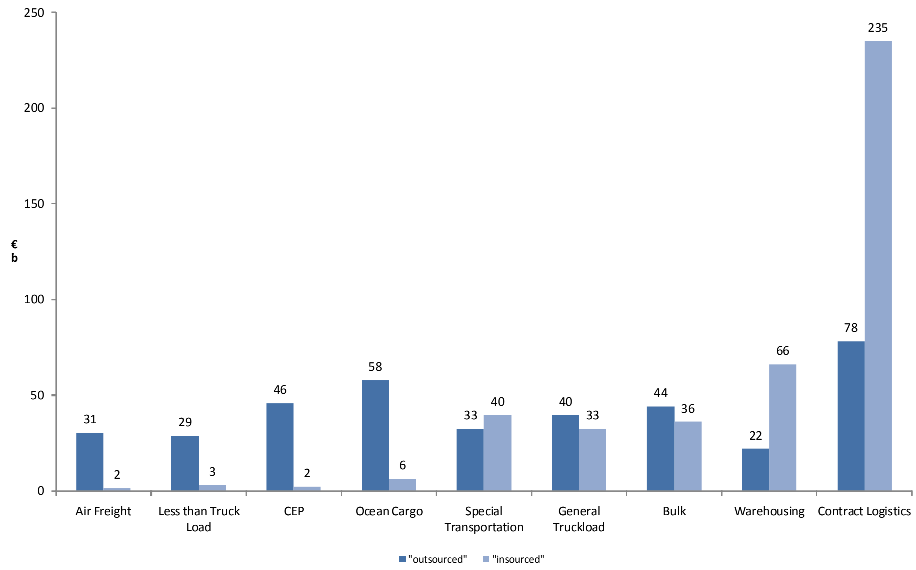
Source: Klaus/Kille 2007

Besides this segmentation, the logistics market volume can be divided into in-house and outsourced parts (as in described in section 2.1):

- The in-house part covers logistics activities, which are covered by the industry and retail companies themselves. This involves mostly warehousing, administration and planning functions. A smaller share of the transportation activities (especially between own production and warehousing sites, in the retail sector or in connection with after sales services) is also still not outsourced.
- The outsourced market is handled by the logistics service providers. This area is growing continuously as the drivers discussed in Section 2.2 continue to shape the sector.

In Klaus/Kille 2007, it is concluded that about 50 % of the whole logistics market in Europe is outsourced. Individual market segments have reached different outsourcing levels (see *Figure 27*).

Figure 27: Logistics market segments in Europe and their outsourcing degree (in billion EUR)



Source: Klaus/Kille 2007

The figures show clearly why the contract logistics market is so attractive for logistics service providers: New contracts can be won from logistics services that were previously handled in-house – in contrast to other markets where business from competitors has to be captured. The main reason for the still large share of in-house logistics in this market is that many core competencies such as after-sales logistics, special picking & packing processes etc. are included here (see definition of contract logistics above).

Also, the degree of concentration in the market segments varies. Bulk logistics, with its large number of small and regionally active companies, has a structure that is obviously different from the consolidated CEP market. The company data was either provided by the companies themselves, collected by desk research or – if there wasn't any other way to get the data – estimated by the authors.[38] It should be added that the very high degrees of concentration in sea and air freight is justified by the market structure itself: it consists of carriers like Hapag-Lloyd, CMA-CGM, MSC, or Grimaldi in ocean freight, Lufthansa, Air France, or British Airways in the air freight market and freight forwarders like Schenker, Kühne + Nagel, DHL, or Geodis, who act as brokers

[38] Only data of 13% of all companies had to be estimated.

and do not carry the goods themselves. This means revenues are often double-counted. This could be excluded in the market size calculation by Klaus/Kille in 2007, because the estimations were done using macro-data.

Table 20: Key figures on the European logistics market by segment (2006)

	Market Size (in bn. €)	Outsourced Size (in bn. €)	Sum of Top 10 (in bn. €)	Concentration degree (regarding outsourced market, in %)
Bulk Logistics	80,3	44,2	8,8	20%
General Cargo	72,3	39,8	13,0	33%
LTL	32,1	28,9	11,3	39%
Special Transportation	72,3	32,5	9,8	30%
CEP	48,2	45,8	35,6	78%
Contract Logistics	313,3	78,3	31,1	40%
Warehousing and terminal activities	88,4	22,1	8,4	38%
Ocean Freight	64,3	57,8	56,8	98%
Air Freight	32,1	30,5	22,0	72%
Mail	59,0	59,0	51,2	87%

Source: Klaus/Kille 2007

4.3 Logistics costs

In this section, the cost structures of the transport modes plus warehousing are reviewed. As they vary a lot between EU member states, the comparison of one year (2006) and the development in two countries will be discussed in detail. To make the results comparable, the analysis relies on costs per tonne, because this is the unit that matches all the calculated cost structures in transportation and warehousing processes.

The cost structure of the transport modes is described with regard to six areas:

- **Personnel costs:** Mainly the driver costs in the road sector. In the other sectors, supporting activities such as goods handling in air- or seaports are also included.
- **Fuel costs:** For rail transportation, electricity is also included.

- Interests, leasing, depreciation costs: Mainly for vehicles, trailers etc. Here, constant costs over a specific period of time were assumed.
- Other variable costs: Here, maintenance costs and track or port rents etc. are included.
- Taxes and insurance.
- Administration costs: Planning, managing and administering transport operations

In addition, warehousing activities contain these five segments:

- Personnel costs
- Real estate costs, including renting or investment
- Storage equipment costs for e.g. forklifts, shelves, conveyor belts
- Energy costs
- Other costs for e.g. facility management

The number of combinations (eight years, 27 countries, five transport modes plus warehousing activities - altogether more than 1,200 combinations, which should be verified by a sufficient number of “micro-data” from companies) is too broad to handle in the traditional way via questionnaires or interviews. So, the “heart” of the methodology used to calculate the cost structures in all EU member states according the main five transport modes plus warehousing and their development from 1999 to 2006 is to find a way to use macro-data in combination with micro-data as verification.

To be precise: the goal was to show the cost structure in Germany, France and Great Britain as well as in Malta, Cyprus and Bulgaria and all the other European Union member states. As the degree of the quality of the given data in the smaller or less developed markets is poor, a way to define the cost structures of given countries is required. To handle the complexity, only the main cost elements are analysed over a period of time. As described above, in respect of transportation, only personnel and fuel/energy, and in respect of warehousing only personnel and real estate costs show significant changes here.

The basis for further calculation is one reference country for which adequate data is available: in this case, the country is Germany, for which many studies exist (see each chapter)[39]. On this basis, the gap between Germany and the other countries in respect of the different cost elements is derived from market data from different market players and studies as described in each chapter. For the development of personnel and fuel costs over a specific period of time,

[39] As described above, this approach to estimate the expenditures in logistics has been successfully used for the European countries in Klaus/Kille 2007.

statistics from Eurostat have been used. The other costs, such as administration and other variable costs as well as taxes etc., are kept at constant values. The assumption is that the administration and other variable and taxes/insurance costs have changed only marginally on the one hand and on the other only make up a small share. Also, investment in the fleet has stayed at a comparable level in the past.

With the assumptions indicated above (only a few cost elements have changed during the period under review), the cost structure and the absolute costs can be calculated and the results as far as their development over a specific period of time is concerned can be analysed.

This methodology was chosen because it is hard to form a complete picture from studies, questionnaires or interviews (see also the explanation above). To keep the results close to “real life”, they are validated by questionnaires sent to the logistics service providers, as well as interviews and other sources from desk research. As the goal of the project is to compare the performance of logistics of EU member states, it seems to be a good approach to compare the costs of Romanian road transport with the costs of the German road transport to show if the gap between the different costs gets smaller during the period under review. Hence, it is assumed that the different expenditures (which make up the cost structure) are of national origin: i.e. the personnel is of the nationality of the specific member state and the fuel and equipment such as trucks, ships etc. is purchased in the specific member state. Otherwise, it is not possible to estimate, how the share of e.g. the foreign drivers is developing during the period under review. So, we suggest using a methodology for further monitoring that relies on statistical data to make it possible to monitor changes in cost structures over a number of years. Another advantage is that it is not necessary to conduct further research in the short term, although the assumed cost structures should be verified once more after a few years. Of course, this may lead to different results than those published in other (national) reports. But the big picture in respect of the development and comparison of country cost shares is expected to be realistic.

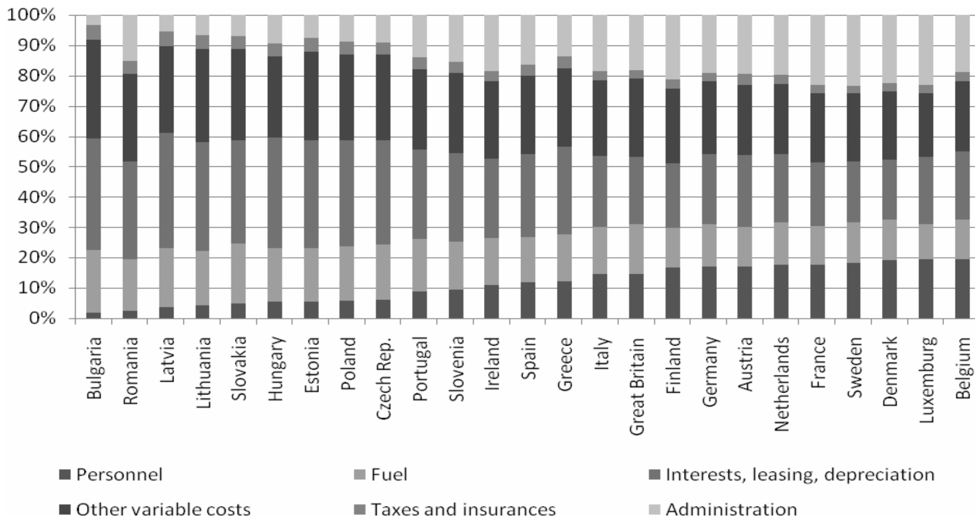
This is clearly an initial approach, and one which has inaccuracies in some parts of the analysis (e.g. the combination “Bulgarian Inland Waterways in 2001”), but the results are a good basis for further research. Also, the calculated figures may vary from those of companies’ reports. The aim of this study was to build a monitoring system that could be used later without doing the work all over again. The methodology should be revised and validated in the near future with recent data from companies to see if the development of the calculated costs conform with the actual costs of the companies.

4.3.1 Rail

The source for the cost structure of the rail sector was the analysis of several annual reports like Deutsche Bahn and SNCF, the interview with one market player, a study on the cost structure in railway transportation of Germany and Austria[40] plus surveys of Destatis, the German national statistics office, on the structure of the rail companies in Germany. These sources were the basis for the cost structure estimates in the rail sector.

The share of the personnel costs is up to 20 % (see *Figure 28*). We note a very high variation of personnel costs which is a main element of competition. For example, the share of the energy costs in the EU member states is more constant (varying between 12 and 21 %).

Figure 28: Cost structure of rail transportation in the EU member states 2006, sorted by personnel costs



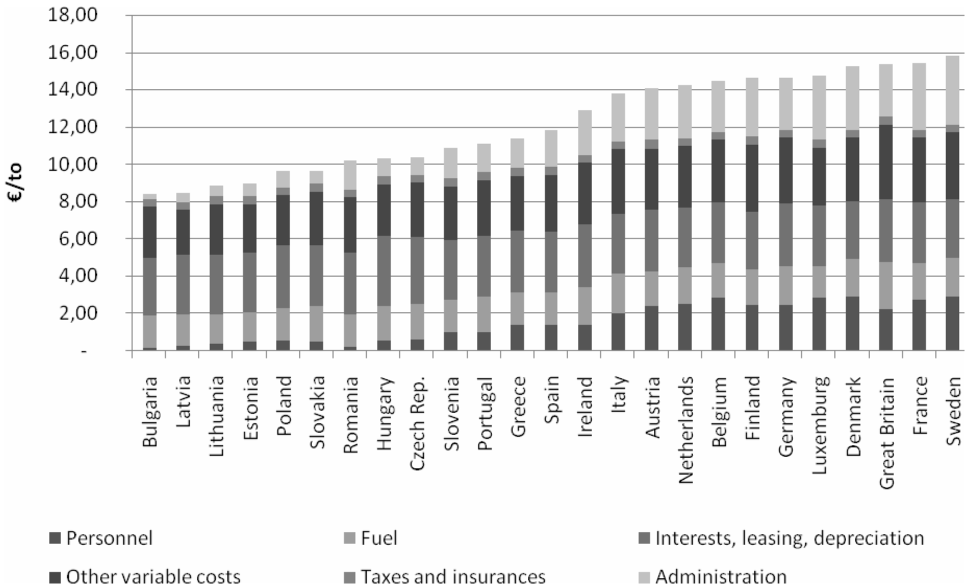
Source: Fraunhofer ATL, based on national statistics, annual reports and studies (see footnote No. 33)

The lowest costs per tonne transported on railways can be found in Bulgaria and Latvia with 8.40 EUR and 8.44 EUR respectively, the highest in France and Sweden with 15.42 EUR and 15.80 EUR respectively in 2006 (see *Figure 29*). Hence, the costs in the Western European countries are up to nearly 90% higher than in the Eastern EU member states. Looking on the country with the highest costs of the Eastern European countries (Slovenia) and the lowest of

[40] Max Herry: Transportpreise und Transportkosten der verschiedenen Verkehrsträger im Güterverkehr, Kammer für Arbeiter und Angestellte, Wien 2001

the Western European countries (Portugal), the difference is only about three percent.

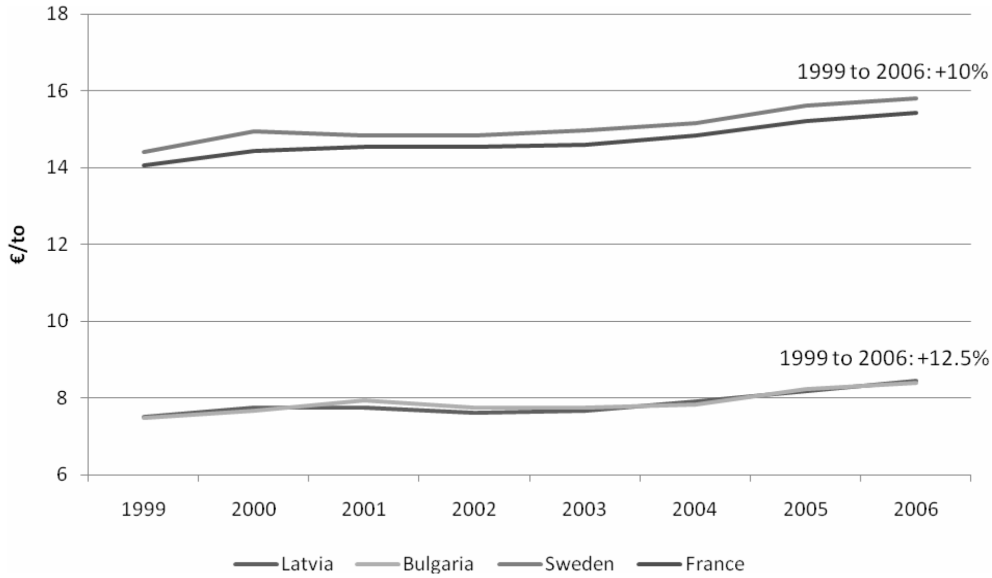
Figure 29: The cost structure of rail transportation in the EU member states 2006



Source: Fraunhofer ATL, based on national statistics, annual reports and studies (see footnote No. 33)

The development of the costs was very moderate with only about 1.5 % growth p.a. (see *Figure 30*). Only the two countries with the highest and the lowest costs per tonne are shown. Overall, in the Czech Republic (the EU member state with the highest rate), the growth of costs amounts to about two percent p.a. In contrast, costs in Great Britain only grew by one percent p.a. These relatively small inflation rates can be explained by the fact that personnel and energy costs have a lower share in the total costs in rail freight than in other markets, in particular that of road freight (see below).

Figure 30: Development of the €/to rates for four EU member states



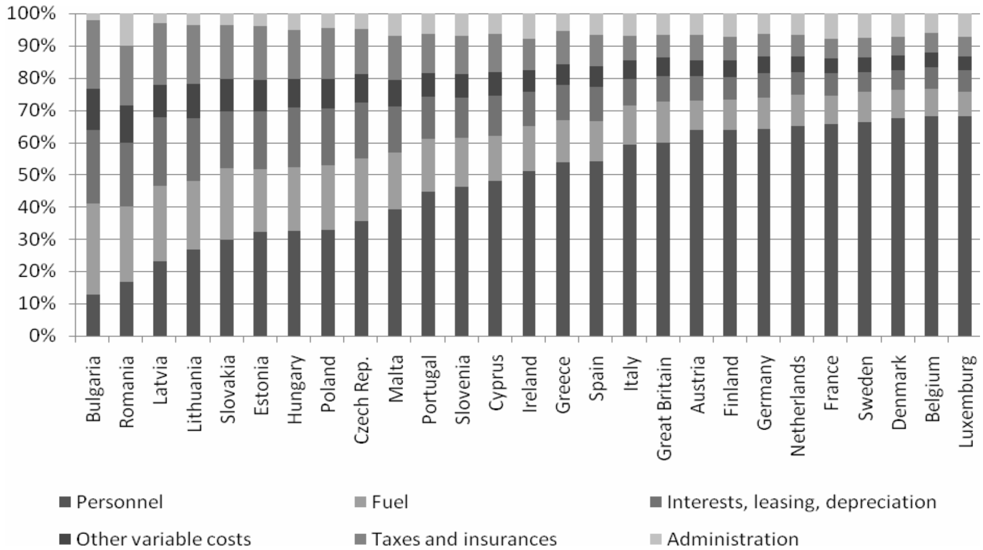
Source: Fraunhofer ATL, based on national statistics, annual reports and studies (see footnote No.33)

4.3.2 Road

In the road sector, a higher number of players are involved. Therefore, the cost structures within a country can vary at a higher degree than in other transport modes. On the other hand, it is the sector with the largest share in respect of transport volumes (see macro-economic analysis above). As most companies in the road sector, in contrast to e.g. the railway companies like Railion or SNCF Fret, offer various services (such as warehousing, brokering or value-added services) making up a relatively high share of revenues, the annual reports or balance sheets cannot be taken as benchmark. Therefore, the sources are mainly micro-data from various companies, the results of about ten questionnaires, some studies on cost structures plus surveys by the national statistics office of the structure of the road freight companies in Germany. These sources were the basis for the cost structure estimates in the road sector.

The share of the personnel costs in the road sector is clearly higher than in the rail sector. It ranges from 13 to 68 % (see *Figure 31*), a smaller variation than in the rail sector – but still a quite dominant competition factor. Therefore the aforementioned rising fuel costs only have a greater impact on overall costs in the “low cost” countries such as the Eastern European member states (where shares around 20 % are common in 2006, compared to half of that share in Western Europe).

Figure 31: The cost structure shares of road transportation in the EU member states 2006, sorted by personnel costs

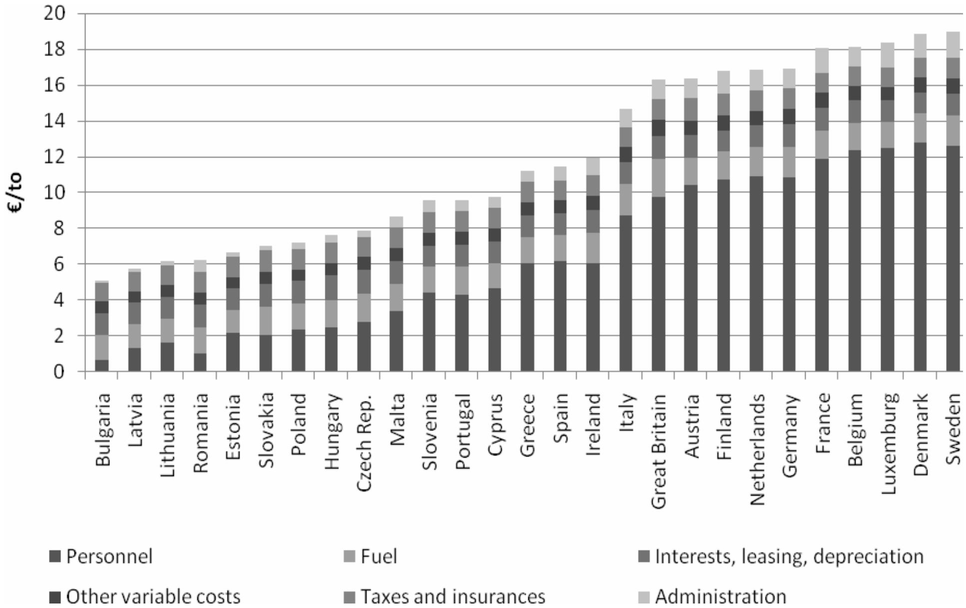


Source: Fraunhofer ATL, based on project results, questionnaire and studies (see footnote No. 33)

The lowest costs per tonne transported on road can be found in Bulgaria and Latvia with 5.10 EUR and 5.77 EUR respectively, the highest in Denmark and Sweden with 18.88 EUR and 18.96 EUR respectively in 2006 (see *Figure 32*). The extremely wide variation can be mainly explained by lower personnel costs in Eastern Europe, which represent a large share of the overall costs. Looking at the country with the highest costs of the Eastern European countries (Slovenia) and the lowest of the Western European countries (Portugal), the difference is less than one percent. There is also a large range of overall costs within Western Europe (EU15) in comparison with Eastern European regions (the new member states of 2004 and 2007): nearly 90 % and nearly 100 % respectively. This clearly shows the differences that still exist between the EU member states.

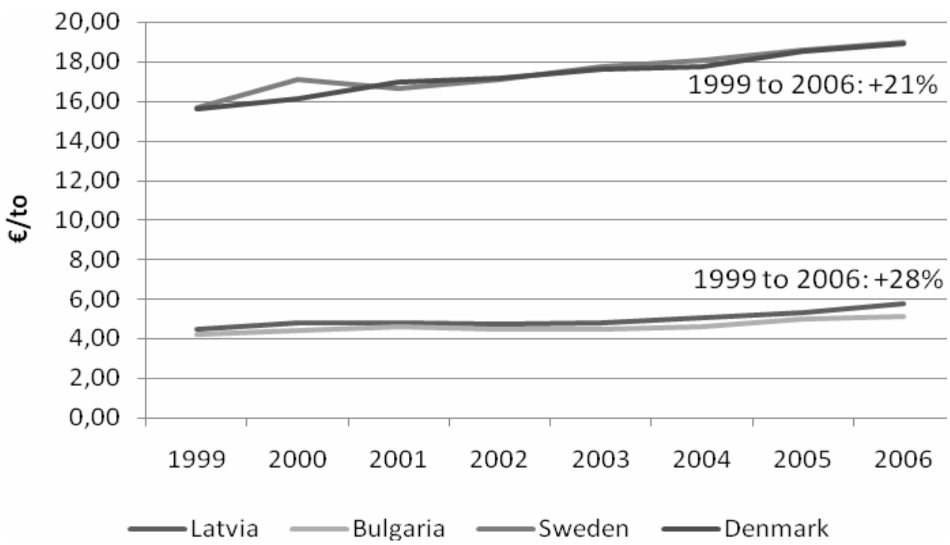
The development of the costs was very moderate, with only three to four percent growth p.a. (see *Figure 33*). Only the two countries with the highest and lowest costs respectively per tonne are shown). The highest growth rate was identified in the Czech Republic, with nearly six percent p.a.; the lowest in Spain with below two percent p.a. The main reasons are continuously growing personnel and fuel costs, which make up a large element of the cost structure.

Figure 32: The cost structure of road transportation in the EU member states 2006



Source: Fraunhofer ATL, based on project results, questionnaire and studies (see footnote No. 33)

Figure 33: Development of the €/to rates for four EU member states



Source: Fraunhofer ATL, based on project results, questionnaire and studies (see footnote No. 33

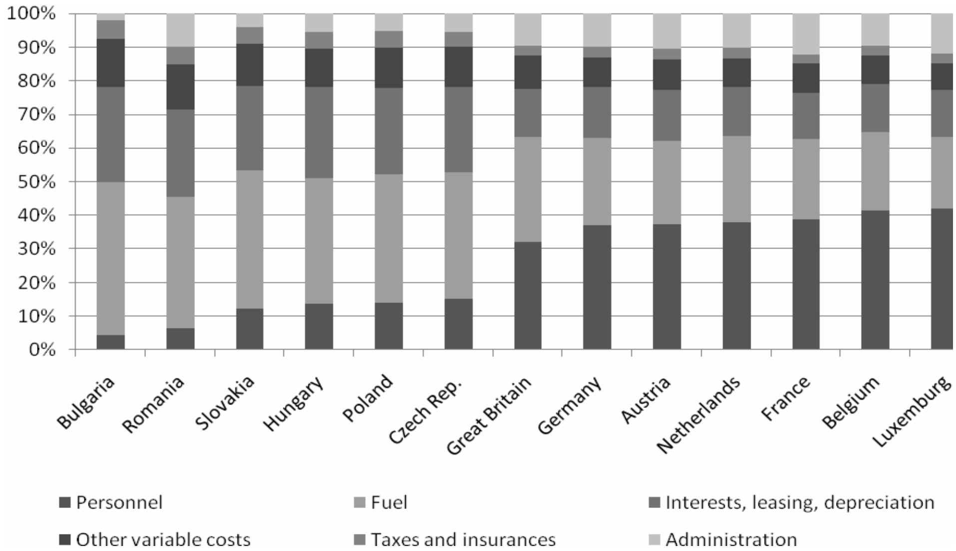
4.3.3 Inland Waterways

Only a few countries in the EU have an adequate infrastructure for inland waterway transportation. In the following chapter, only those EU member states which have a domestic and export volume of more than 100,000 tonnes are included in the analysis. In total, only 13 countries have significant traffic on their inland waterways.

Besides analysing the balances of certain companies and the surveys of the national statistical bureaux on the structure of the inland waterway companies, the main input in respect of the cost structure was a report by the European Commission[41]. With these inputs, the shares of the costs could be estimated.

The share of the personnel costs in the inland waterway segment lies between its equivalent in rail and road transport and varies between 5 % and 42 % (see *Figure 34*). The gap between the Western and Eastern European countries is significant.

Figure 34: The cost structure shares of inland waterway transportation in the EU member states 2006, sorted by personnel costs

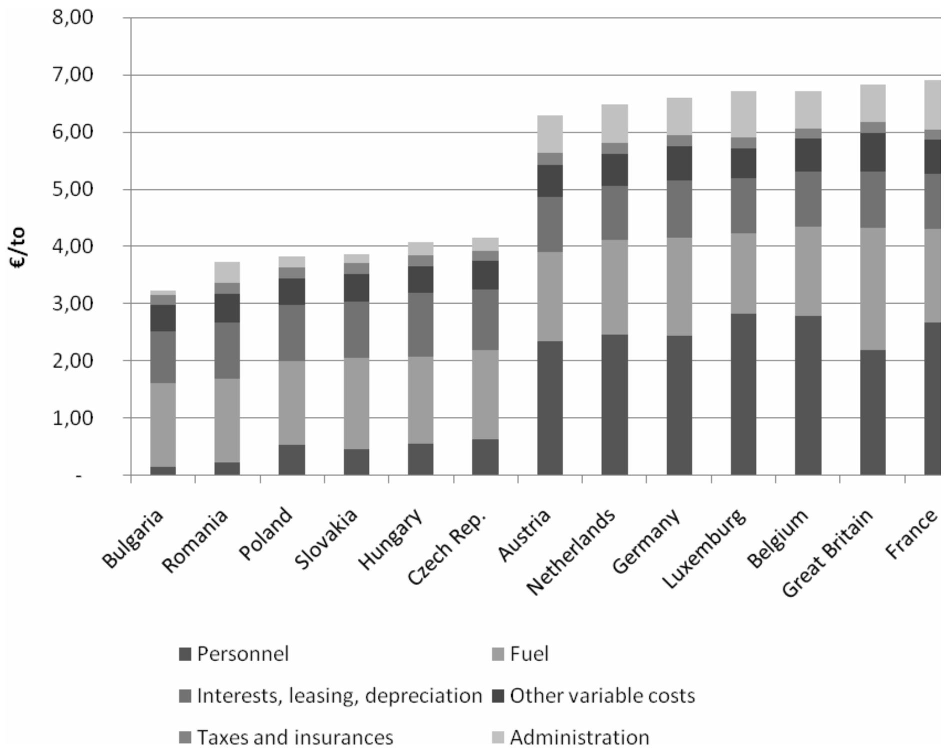


Source: Fraunhofer ATL, based on national statistics, annual reports and studies (see footnote No. 33)

[41] Central Commission for Navigation on the Rhine; European Commission – Directorate General for Energy and Transport: Market observation for inland navigation in Europe 2006-2, September 2007, http://ec.europa.eu/transport/iw/observatory/doc/2006_02_marketobs_en.pdf

The total costs per tonne vary between 3.23 EUR in Bulgaria and 6.90 EUR in France. The differences between Western and Eastern Europe can be seen clearly in *Figure 35*. The Western country with the lowest costs (Austria) still accounts for 50 % more than the highest one in Eastern Europe (the Czech Republic). The variation within these two regions, with 10 % in the "high cost" and nearly 30 % in the "low cost" countries, is relatively modest. If the youngest member states (Romania and Bulgaria) are excluded, the difference between Poland and the Czech Republic falls to less than 10 %.

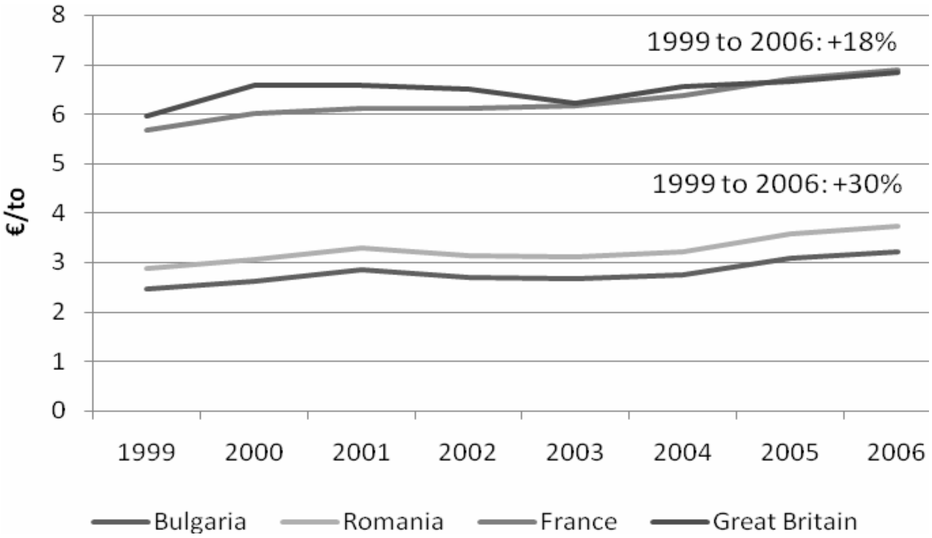
Figure 35: The cost structure of inland waterway transportation in the EU member states 2006



Source: Fraunhofer ATL, based on national statistics, annual reports and studies (see footnote No. 33)

The development of the costs was very moderate with only three to four percent growth p.a. (see *Figure 36*). Only the two countries with the highest and lowest costs per tonne are shown. Once more, the Czech Republic has the highest cost increase with nearly six percent p.a. In Great Britain, the costs stayed nearly stable with an increase of slightly more than two percent a year. In general, the costs of the Eastern European countries rose at a higher rate than the average (4.5 %).

Figure 36: Development of the €/to rates for four EU member states



Source: Fraunhofer ATL, based on national statistics, annual reports and studies (see footnote No. 33)

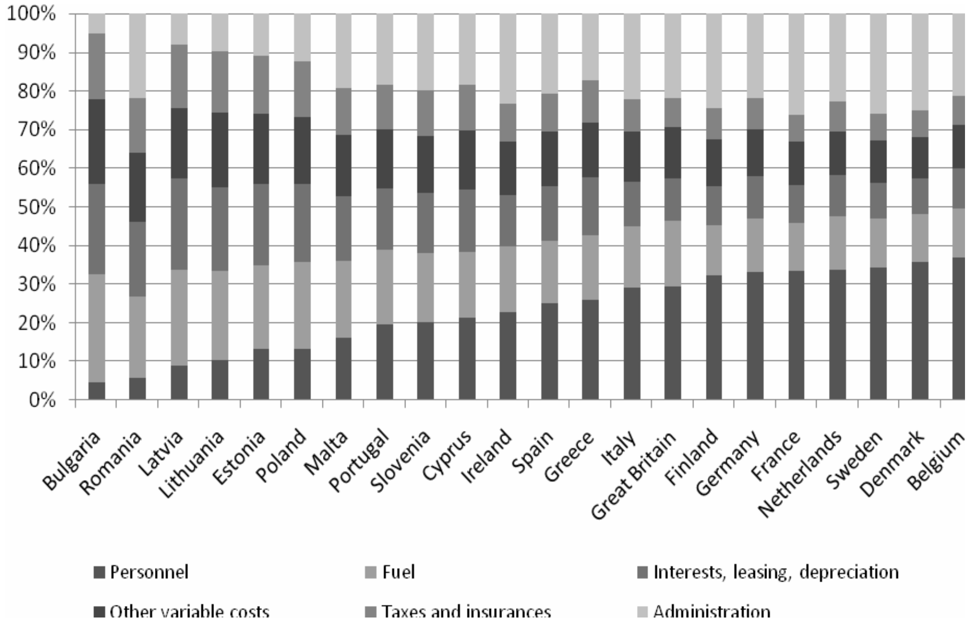
4.3.4 Sea

Sea freight, similar to air freight, is a market that is hard to capture because it is globally oriented. Therefore the results of both this chapter and the following one have to be understood as very rough indications. Besides analysing the surveys of the national statistical bureaux on the structure of sea and coastal shipping companies, the main input in respect of the cost structure was a study of ocean container ships[42]. With these inputs, the shares of the costs could be roughly estimated.

The share of the personnel costs in this segment is possibly between five and 37 % (see *Figure 37*). It is assumed that the administration costs are higher than in other transportation modes because of the global orientation.

[42] HSH Nordbank: Betriebskosten 2007 – Untersuchung der Betriebskosten deutscher Containerschiffe, November 2007.

Figure 37: The cost structure shares of sea/ocean freight transportation in the EU member states 2006, sorted by personnel costs

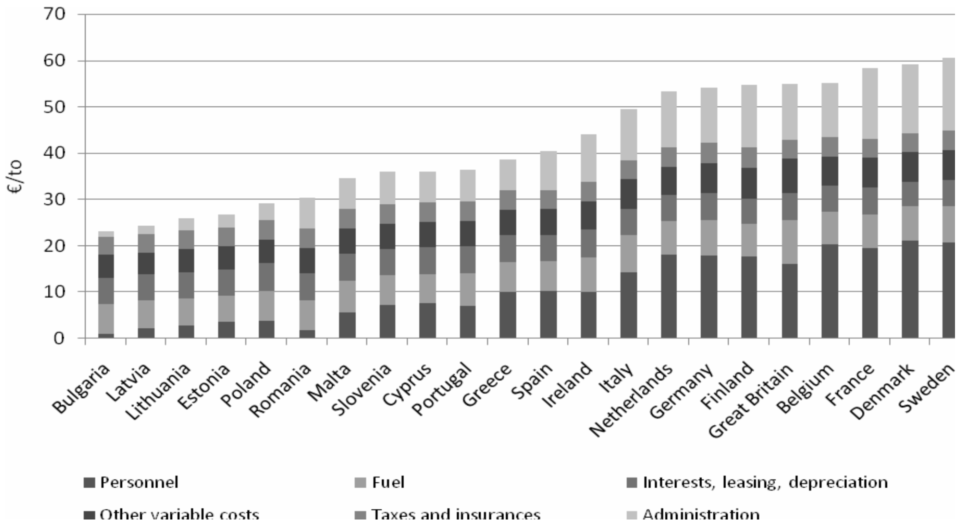


Source: Fraunhofer ATL, based on national statistics, annual reports and studies (see footnote No. 33)

The transport and handling costs per tonne in the EU countries with sea ports vary between 23 (in Bulgaria) and 61 EUR (in Sweden). The main reason for this large variance may be the lower additional costs in ports like administration, handling etc. This is the reason for Spain, Portugal or Greece being important ocean freight countries, although the distances to the European metropolitan areas are larger than from the “high cost” ports in Rotterdam or Hamburg.

Here, the differences between those three countries and the next new member states in the row are very low. In Spain, the costs come to about 40 €, in Slovenia, they are 36 EUR (see *Figure 38*).

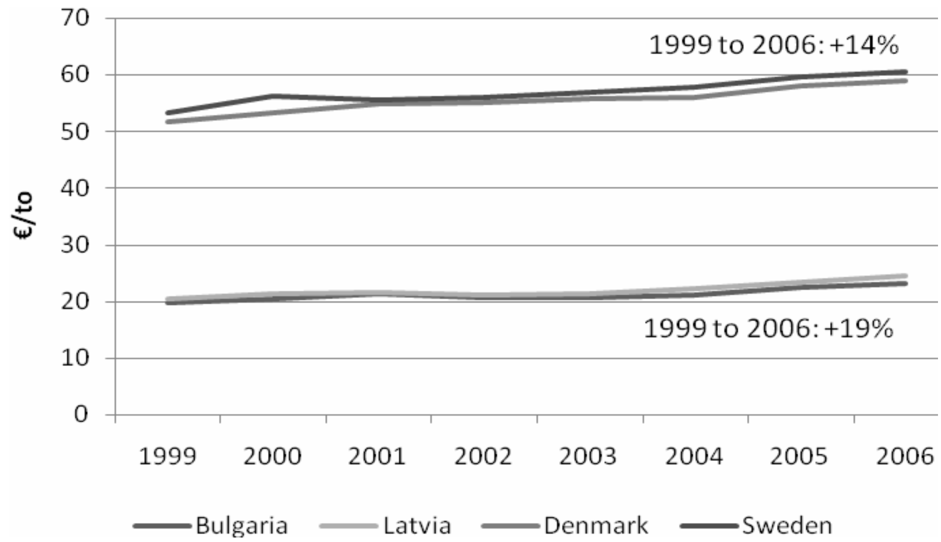
Figure 38: The cost structure of sea/ocean freight transportation in the EU member states 2006



Source: Fraunhofer ATL, based on national statistics, annual reports and studies (see footnote No. 33)

The development of the costs was very low with only two percent growth p.a. (see *Figure 39*). Only the countries with the highest and the lowest costs per tonne are shown. This is comparable with the rail sector. Besides the low impact of fuel and personnel costs, higher utilisation of some routes and an increase in ship sizes might also be reasons for this stagnating cost curve.

Figure 39: Development of the €/to rates for four EU member state



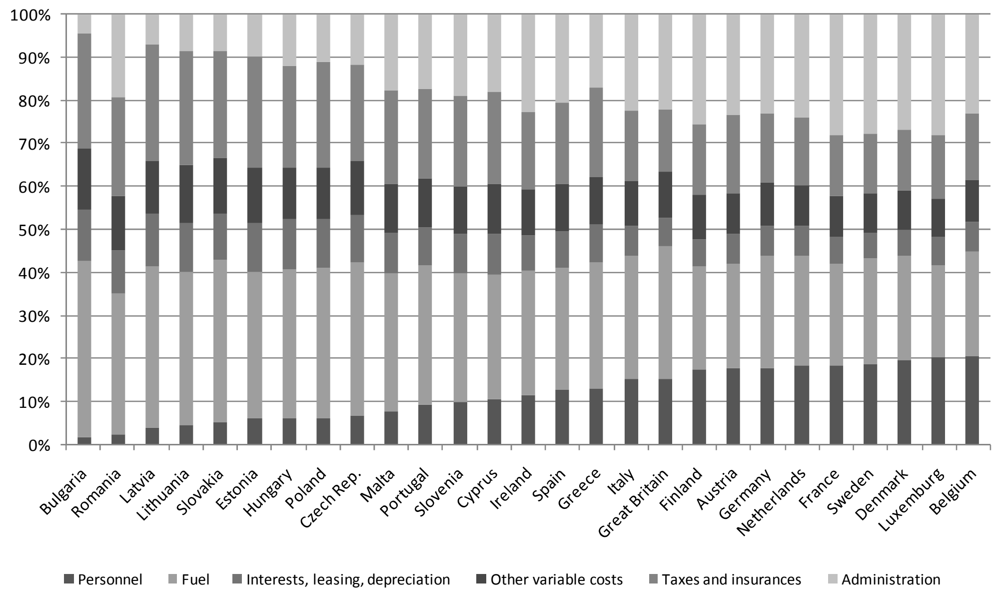
Source: Fraunhofer ATL, based on national statistics, annual reports and studies (see footnote No. 33)

4.3.5 Air

As mentioned, the capture of cost structures in global transportation chains brings many difficulties. The analysis of companies and of their balance sheets does not provide data for Europe alone because they have many activities abroad, although the focus was on an analysis of the annual reports and surveys of the national statistical bureaux on the structure of the air transport companies. With these inputs, the shares of the costs could be estimated roughly.

Personnel costs in this segment are estimated between two and 21 % (see *Figure 40*). As with the maritime freight sector, it is also assumed that administration costs are higher than in other transportation modes because of the global orientation.

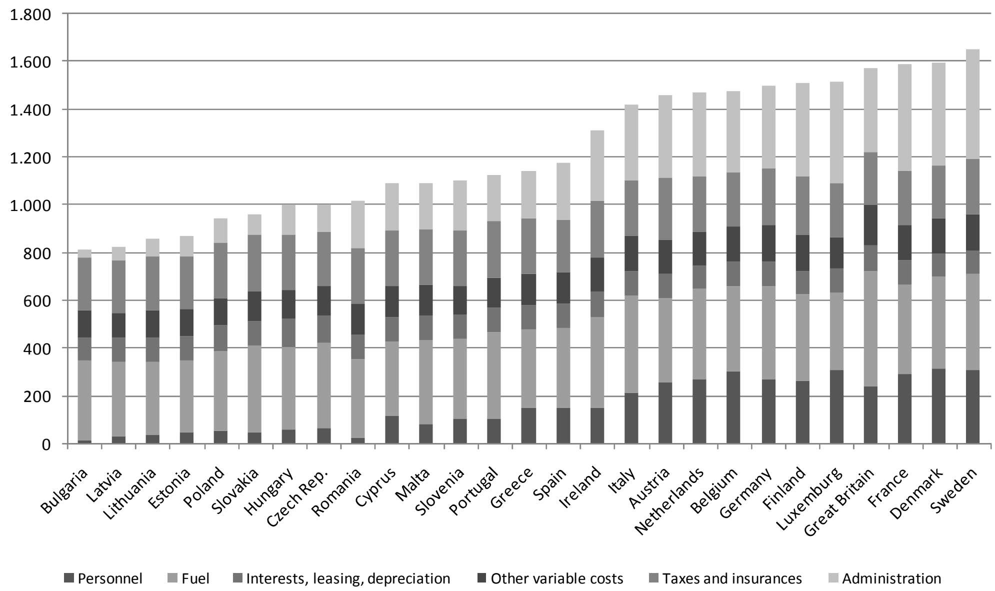
Figure 40: The cost structure shares of air freight transportation in the EU member states 2006, sorted by personnel costs



Source: Fraunhofer ATL, based on national statistics, annual reports and studies (see footnote No. 33)

The costs per tonne are between about 800 EUR (in Bulgaria and Romania) and 1,600 EUR (in Great Britain, France, Denmark and Sweden) (see *Figure 41*). As the personnel costs do not make up such a high share of the overall costs, the range is lower than in many other sectors. For that reason, airports in large metropolitan areas are still highly attractive, although costs may be lower in smaller airports.

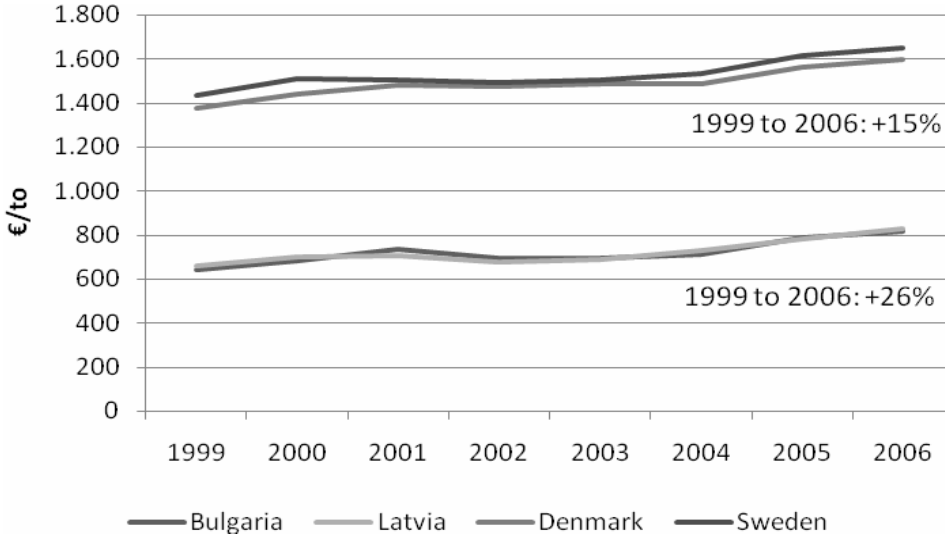
Figure 41: The cost structure of air freight transportation in the EU member states 2006



Source: Fraunhofer ATL, based on national statistics, annual reports and studies (see footnote no. 33)

The costs in the air cargo segment grew on average by ca. 2.5 % p.a. (see *Figure 42*). Only the two countries with the highest and lowest costs per tonne are shown. This is comparable with the sea sector. As in most other transport modes, rising fuel costs and their great influence on the overall costs are the main factor for increases in the Western member states.

Figure 42: Development of the €/to rates for four EU member states



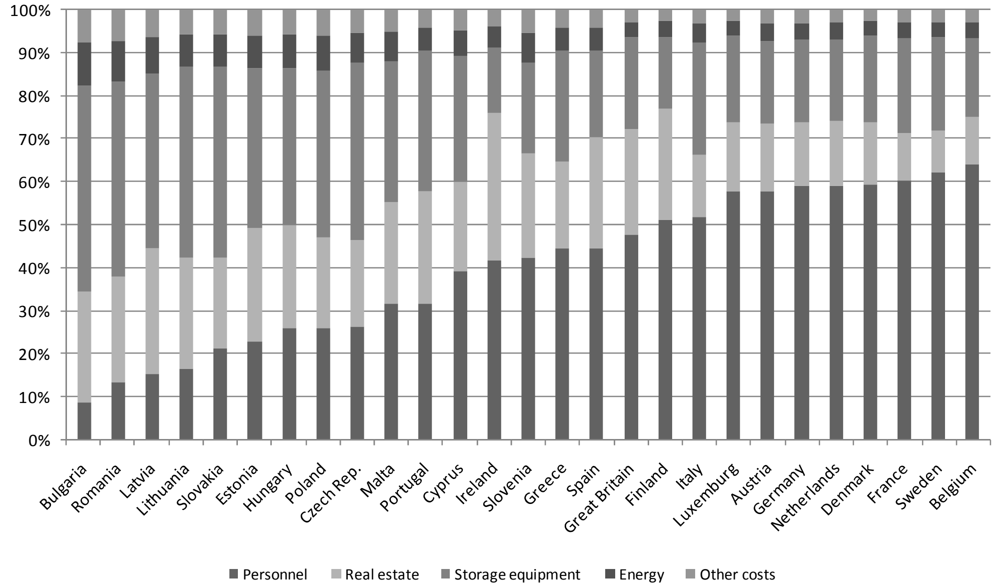
Source: Fraunhofer ATL, based on national statistics, annual reports and studies (see footnote No. 33)

4.3.6 Warehousing

The following part shows the warehousing cost structures of the EU member states (see *Figure 43*). The sources are a combination of company data from Fraunhofer ATL databases and reports on the European real estate market from Goodman, JonesLangLasalle and DTZ. This combination should bring deep and realistic insights into the warehousing cost structures.

Belgium has the largest share of personnel costs, followed by Sweden and France. The new member states Bulgaria and Romania, on the other hand, again have the lowest shares.

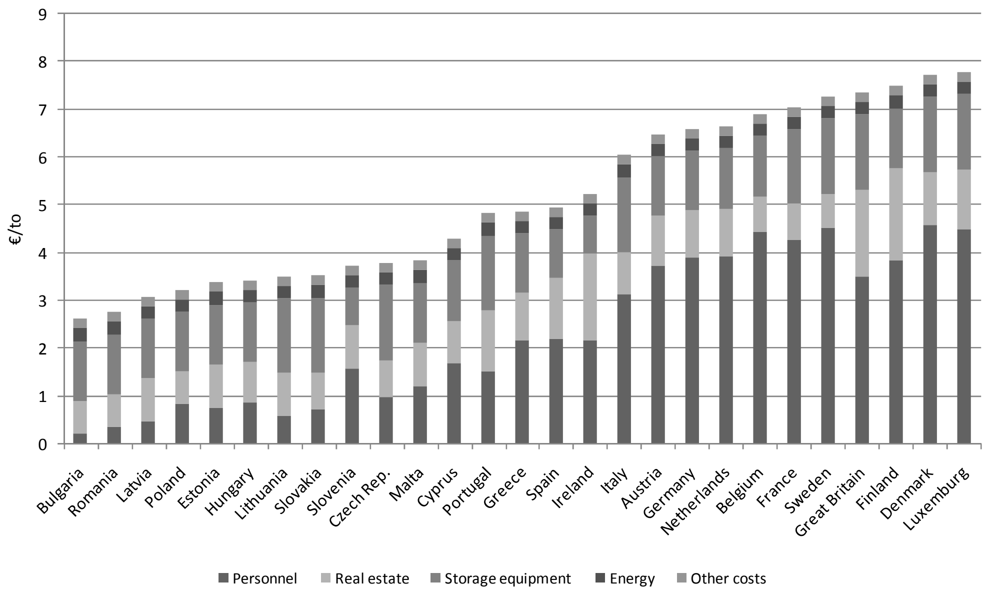
Figure 43: The cost structure of warehousing in the EU member states sorted by share of personnel costs in 2006



Source: Fraunhofer ATL, based on project results and studies (see footnote No. 33)

The absolute size of warehousing costs per tonne in each country differs from the personnel cost ranking: Luxembourg, Denmark and Finland have the highest costs per tonne in the EU. The reason is the combination of high personnel and real estate costs in these countries. The highest real estate costs are in Finland. Absolute real estate costs in Finland are nearly three times higher than in Bulgaria (the one with the lowest).

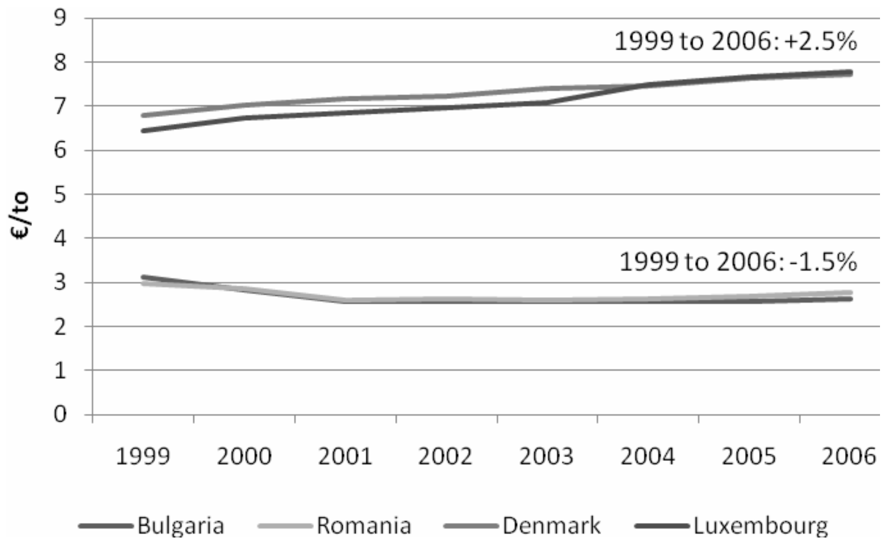
Figure 44: The warehousing costs per year per m² in the EU member states in 2006



Source: Fraunhofer ATL, based on project results and studies (see footnote No. 33)

In respect of the development of costs from 1999 to 2006 e.g. in Luxembourg and Denmark, the growth rate in these "high cost" countries accounts for about 2.5 % p.a. On the other hand, the costs in Bulgaria and Romania decreased by about 1.5 % p.a. The main reason is shrinking real estate costs, which went down by nearly 50 %. Here, the reason for rising costs in the different transport modes becomes obvious: as personnel costs make up a comparable share of the overall costs, the stagnating development in warehousing shows the impact of fuel costs on logistics. Other reasons for the different development in warehousing and transportation might be the optimisation of processes in warehouses (see next chapter about stock turnovers) and the higher availability of the less educated employees needed for warehousing, which pushes the personnel costs less than in the transport sector.

Figure 45: The development of the warehousing costs from 1999 to 2006



Source: Fraunhofer ATL, based on project results and studies (see footnote No. 33)

4.4 Stock Turnover

In order to measure the effectiveness of inventory planning at different companies within the European Union, we used the stock turnover method in our analysis. Stock turnover measures the number of times a company's investment in inventory is utilised during an accounting period and is usually calculated from sales divided by stocks.[43] This should be done because the inventory levels of companies may have increased just because they had more orders and sales to meet. A high ratio may indicate positive factors such as good stock demand and management and a greater sales efficiency. Hence, a company generates its profit on stock faster and should be more competitive. A low ratio may indicate that either stock is naturally slow-moving or problems such as the presence of obsolete stock. A low ratio can also be indicative of potential stock valuation issues. However, it will vary between industries and so it is important to contrast inventory turnover within an industry.

The following results are a first approach to compare the effectiveness of inventory planning and managing in the EU member states and some industries.

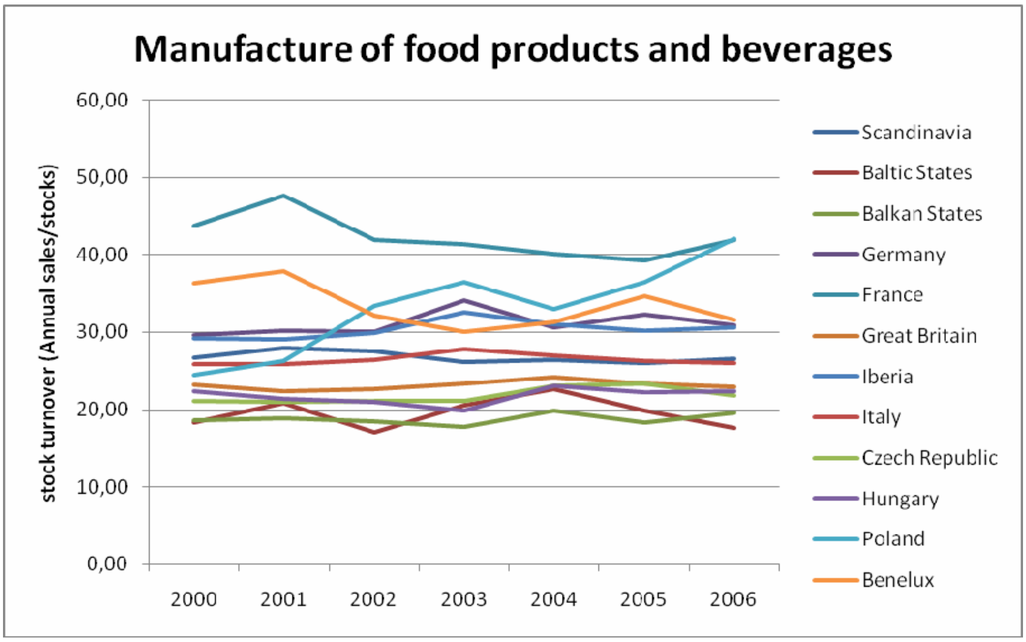
[43] Steven M. Bragg, Business Ratios and Formulas: A Comprehensive Guide S.77, 2003

As the data used for this study are micro-economic data obtained directly from companies[44], the quality of the results are directly linked to the input of those companies. But the large number of data should bring a realistic picture (see *Table 18*).

4.4.1 Manufacture of food products and beverages

To analyse the stock turnover in the food industry, the operating turnover and stocks from approximately 22,000 companies within the European Union were compared. We analysed companies that focus on the following segments: beverages, confectionery, bread and baked goods, meat and dairy products, fruit and vegetables, oils, fats, cereal and farina goods. Due to varying storage times within the individual segments, the storage time was given special consideration in both the food industry as a whole and in specific subcategories such as "the production, processing and preserving of meat products" and "production of beverages". *Figure 46* demonstrates the variations of stock turnover in different countries between 2000 and 2006.

Figure 46: Stock Turnover of European countries in the food industry (NACE 15)



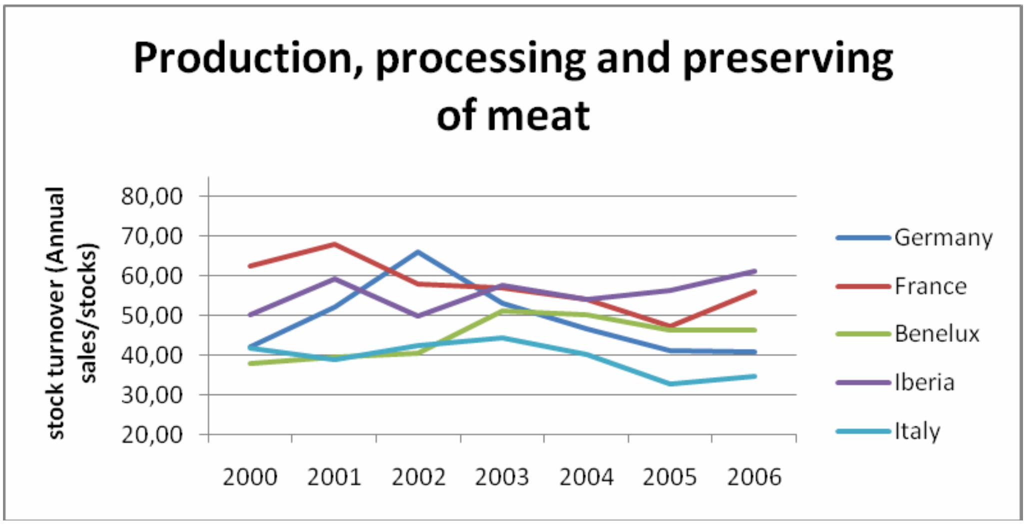
Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

44 The source of the company data is a commercial database of Bureau van Dijk, which contains the balance sheets of 11 million European companies.

The Balkan countries, the Czech Republic, Hungary and the Baltic States experienced noticeable growth in their stock turnover ratio in 2004. On the one hand, this could be due to the economic growth of these countries – in particular the Baltic States – since their accession to the EU. On the other hand, a reason for the decrease in stock turnover in the East European countries may be the optimisation of procurement, production, and sales management. However, the clearest decrease in stock turnover compared to other European countries can be seen in Poland. Between 2000 and 2004, Poland experienced a continuous increase in growth. On average, France still had the highest level in stock turnover at 33.2 per year, but its turnover rates decreased continuously until 2005. This might be due to more competition, because more and more foreign companies such as Kraft or Unilever have gained market shares in France in recent years, whereas consumers previously had an orientation towards "French-made" products.

Figure 47 shows the comparison of stock turnover between Central and South European companies that produce, process and preserve meat and meat products. The figure clarifies the fact that the turnover of stocks declined in almost all the countries examined since 2003.

Figure 47: Stock Turnover: "Production, processing and preserving of meat" (NACE 15.10)



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

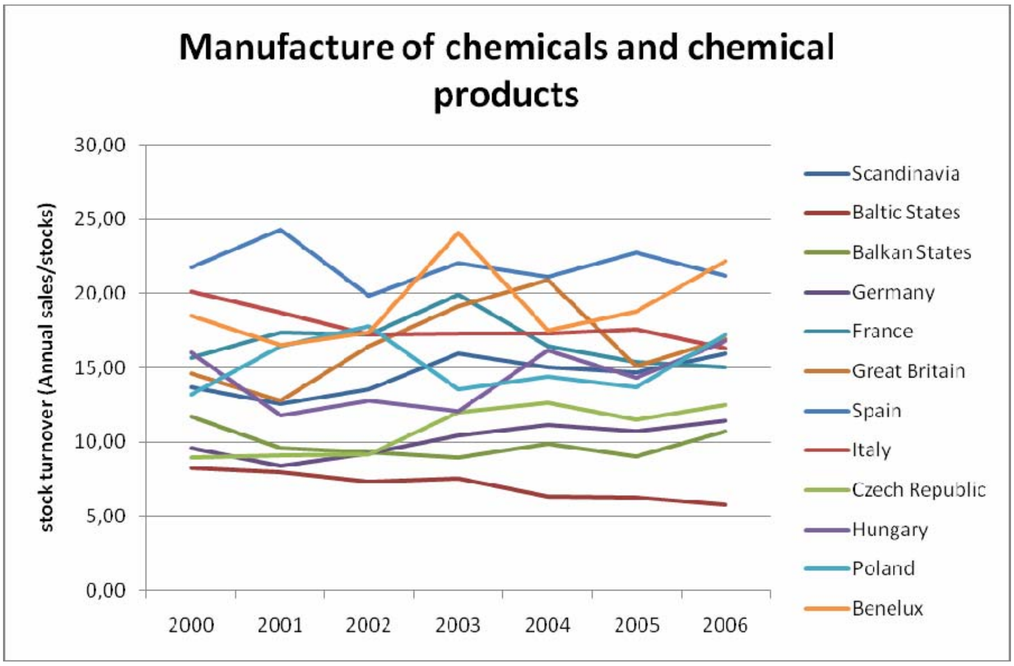
Close to the end of 2005 the turnover of stocks increased again and resulted in increased stock efficiency. The meat market is characterized by cutthroat competition. Hence, there is a lot of pressure on the market because of prices and quality caused by overcapacity in butcheries and also by the food retailer's increased purchasing power. Furthermore, the BSE, bird flu or footand-mouth-disease outbreaks with which Germany and the UK in particular but also other European countries were confronted, damped down the demand for meat products in the past. Consequently, it could have caused a decline in sales for this industry and at the same time a low stock turnover rate.

4.4.2 Chemicals and chemical products

In the sector “Manufacture of chemicals and chemical products” operating revenues and stocks from approximately 7,000 companies from the European Union were compared and their stock turnover rate analysed.

By analyzing *Figure 48*, it becomes obvious that the stock turnover rate in the Baltic States was not only much lower than in other European countries but also fell continuously from 8.27 to 5.75 between 2000 and 2006. In comparison to the Baltic States, which had an average stock turnover ratio of 7 per year, stocks in Great Britain rotated on average 16 times a year. Hence, companies in Great Britain seemed to have a more efficient management of inventory because the more frequently stocks are sold, the less money is required to finance the inventory. British manufacturers were able to increase their stock turnover between 2002 and 2004, but had slow moving stock in 2005 and 2006. Though France – with an average rate of 16.73 per annum – could enhance the inventory efficiency from 15.67 in 2000 to 19.95 in 2003, there was a permanent increase in stocks corresponding with a stock turn from 16.45 in 2004 to 15.03 in 2006. The Czech Republic could use and replace its inventory 8.95 times in 2000 and was able to increase inventory turnover continuously until 2004. Greece’s stock turnover remained nearly constant, with an average ratio of 9.9 per year, whereas Germany enhanced its inventory turnover from a ratio of 9.57 in 2001 to 11.41 in 2006. Even though Germany had a low average inventory turnover of 10.13 per year in comparison to the Baltic States, Greece, Romania and the Czech Republic, it could slightly increase its stock turnover until 2006. On the contrary, Spain, Benelux and Italy had – with an average ratio of 21.88, 19.28 and 17.82 per year respectively – the highest stock efficiency within the investigated period. Nearly all countries could improve their inventory management in 2003. Benelux has even been able to enhance the inventory rate per year from 18.47 in 2000 to 24.10 in 2003.

Figure 48: Stock turnover: "Manufacture of chemicals and chemical products" (NACE 24)



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

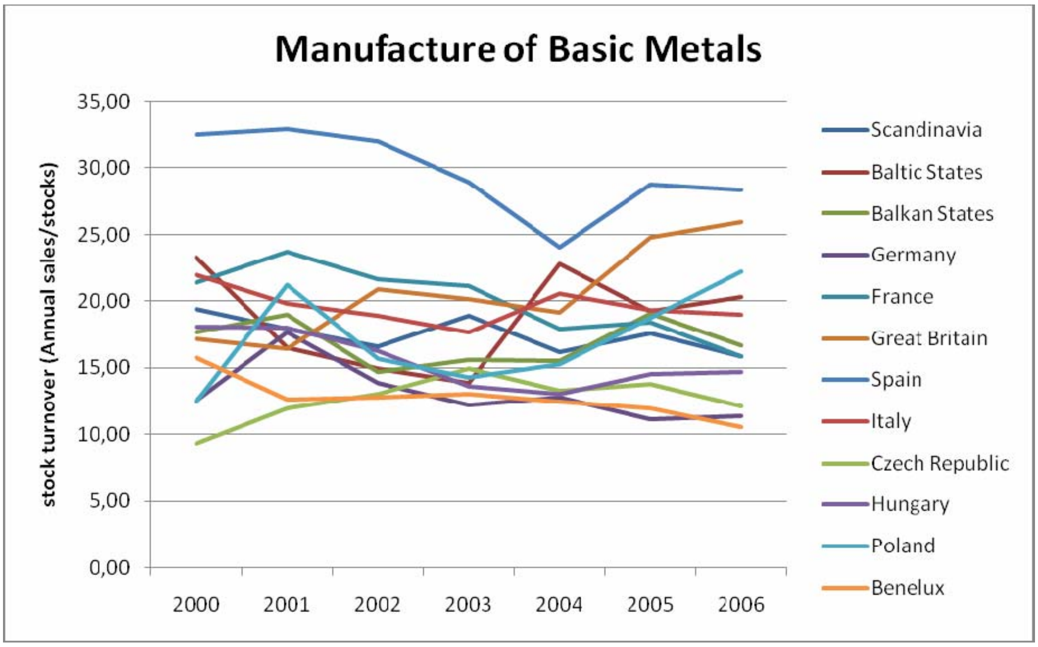
The most reasonable factor could be the consolidation of the market in the past years (e.g. in the pharmaceutical market, Hoechst in Germany merged with Rhône-Poulenc in France, to become Aventis, France, which was then acquired by Sanofi, France; or Glaxo Wellcome, UK, merged with SmithKline Beecham, also UK, to become GlaxoSmithKline etc.), which mostly leads to consolidation of logistics networks and warehouse locations.

4.4.3 Basic metals

In the sector "Manufacture of basic metal" operating revenues and stocks from around 3,700 companies from the European Union were compared and their stock turnover analyzed. The average stock turnover within Europe was 17.83 per year. The most notable changes in stock turnover within this industry occurred in Spain. *Figure 49* clarifies the value of stock turnover ratios, which declined from 32.49 in 2000 to 28.31 in 2006 and which may be an indicator for lower profits during these years, whereas in Spain and Great Britain the most noticeable drop occurred in 2004; the Baltic States had the quickest rise in sales efficiency in this year. Spain– with an average stock turnover of 29.61 per year – had the highest stock efficiency among any other country in the European Union. But also countries like Great Britain (20.66), France (20.01) and Italy (19.59) were able to effectively turn stocks into sales. Since 2001, Great Britain has been able to increase its sales and reduce its stocks with an inventory turnover of 17.81 in 2000 to 25.97 in 2006, illustrating a remarkable growth rate. The Baltic States, with an average stock turnover of 18.74, had a very slow inventory turnover of 13.89 in 2003 but were able to correct their stock management and sales at the end of 2006 with a ratio of 20.39 per year.

In the graph, the worldwide increase in demand for steel in the last years can be identified: The large steel manufacturing countries like UK, Scandinavia, France and Germany could sell their production stocks fast.

Figure 49: Stock turnover: "Manufacture of Basic Metals" (NACE 27)



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

4.4.4 Manufacture of radio, television, and communication equipment and apparatus

The analysis of the sector "Manufacture of radio, television and communication equipment and apparatus" covers approximately 2,000 European companies. In this industry, the companies' operating revenues and stocks were contrasted and particularly evaluated by their stock turnover rates.

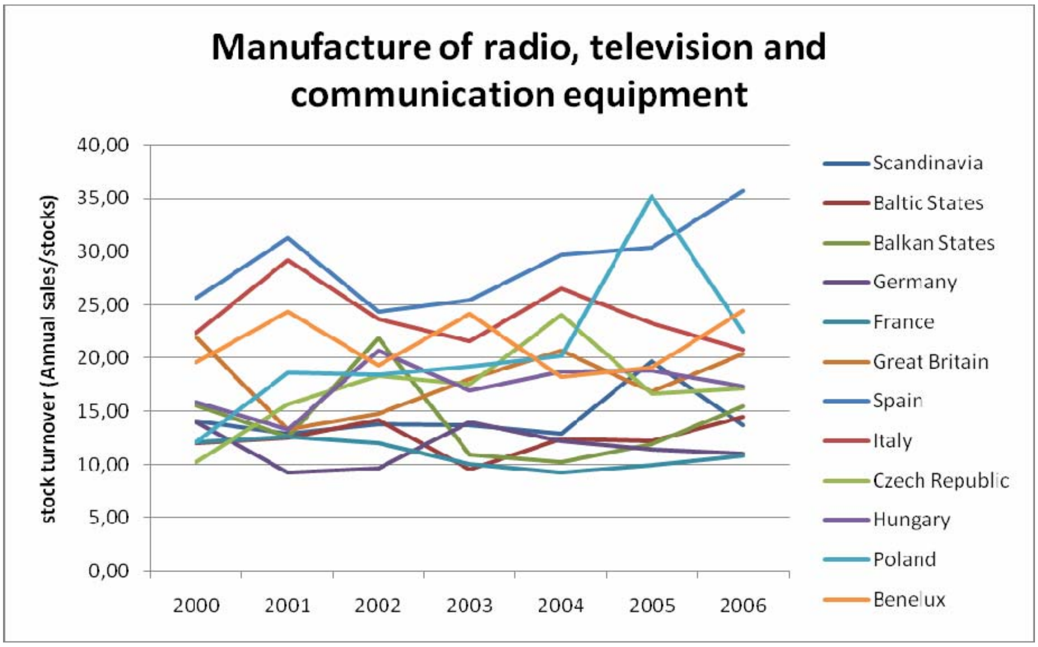
Most notably is the comparison of the inventory turnover of 2001 in which several countries had a rise in their sales efficiency and a good stock demand. Italy for instance enhanced its stock turnover from 22.39 in 2000 to 29.15 in 2001. Also Spain's inventory rose from 25.63 in 2000 to 31.27 in 2001. In contrast stocks were obviously slowly moving in the year 2003 in most countries, which could have been caused by the temporary downturn in economic activity during this year.

While Greece and Romania had a growth ratio up to 21.85 in 2002 inventory dropped down to 10.93 in 2003, on the opposite Germany and Benelux recorded a greater demand in consumer electronics in 2003 and could enhance their stock turnover ratio. But also in 2004 countries like Spain, Italy, Great Britain and the Czech Republic could increase their inventory turnover rate tremendously.

However, the highest growth rate was recorded in Poland in 2005 when the country reached a ratio of 35.16 (previous year 20.13). At the end of 2006 Poland's stock turnover rates declined to 22.49 per year for the first time. Interestingly, the inventory turnover in Scandinavia, Germany and Italy decreased simultaneously, whereas other investigated countries enhanced their stock efficiency.

Comparing the investigated companies, Spain has had the greatest stock efficiency within the investigated period with an average inventory turnover of 28.10 and seemed to receive its profits on stocks more rapidly. *Figure 50* illustrates changes in stock turnover mentioned above.

Figure 50: Stock turnover of "Manufacture of radio, television and communication equipment" (NACE 32)



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

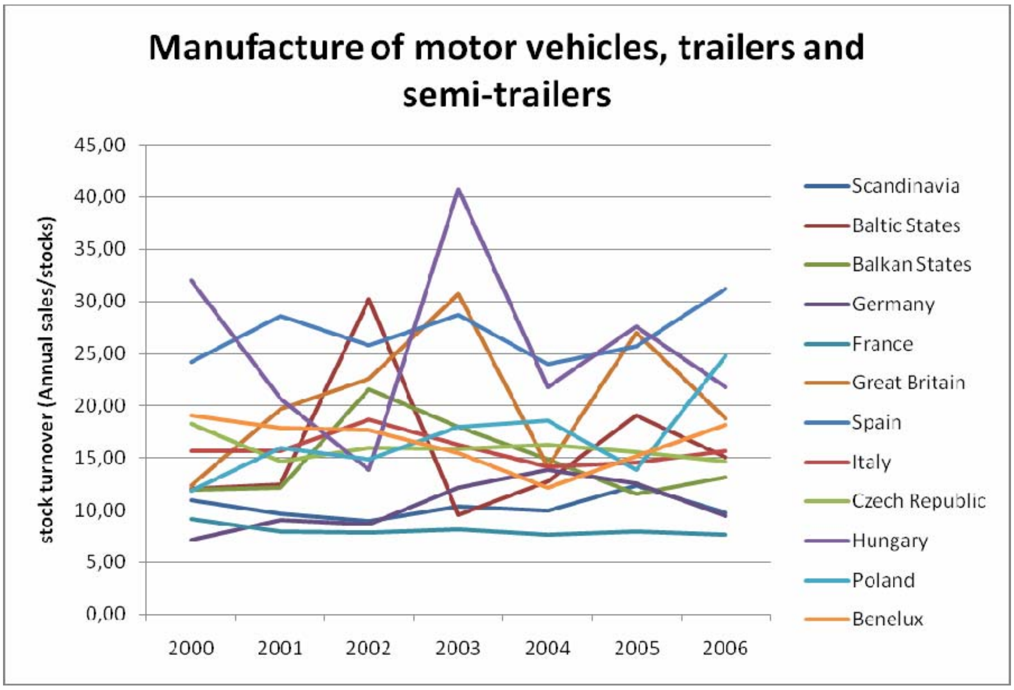
4.4.5 Manufacture of motor vehicles, trailers and semi trailers

The following field can be divided into two diverging groups: whilst some countries remained relatively stable in their stock development, others experienced remarkable boosts and downturns. The results of this analysis of about 2,500 companies are given in *Figure 51*. The “stable” group contains countries such as Spain, which is the best performing country in this field of industry with an average stock turnover of 26.84, and France, which has the lowest stock turnover ratio of all countries covered by this research. Other members, for instance Scandinavia, Germany, Italy and the Czech Republic, remained at a low level, with little if any progress throughout the research period. Hungary, starting from 31.96, experienced an enormous decline in 2002, following a subsequent peak of 40.71 in stock turnover. The overall development of these unstable countries remains almost parallel, with high stock turnover ratios in either 2002 or, more frequently in 2003. In the face of this progression, Hungary and Poland, both of which experienced turbulence in their exchange rates, ended up being the second best performers after Spain at the end of 2006. Great Britain, being the fourth best-practice member of this study, reached its peak of 30.73 in 2004, with a successive decline to 18.80 in 2006.

Other examples, such as the Baltic States and the Balkans, experienced a comparable progression, albeit in a delayed fashion. Although the development of these regions and countries does reveal certain similarities, all countries except for Great Britain, with a result of 20.76 in 2006, were unable to maintain their positive increases or could not recover from decline phases in 2003 to 2005. In terms of average stock turnover ratios, Spain still remains the best performing country with 26.84, followed by Hungary (25.45), Great Britain (20.76) and Poland (16.82). Considering an average of 16.45, the countries or regions unable to follow current evolutions were Germany, France, Scandinavia, the Balkans, the Czech Republic, Italy and the Baltic States.

Comparable to the development of the electronics market, the economic downturn in 2003 had an effect on the investment in vehicles. Production and sales e.g. in Germany were reduced in the years 2003 and 2004 to sell the cars in stock.

Figure 51: Stock turnover: "Manufacture of motor vehicles, trailers and semi-trailers" (NACE 34)



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

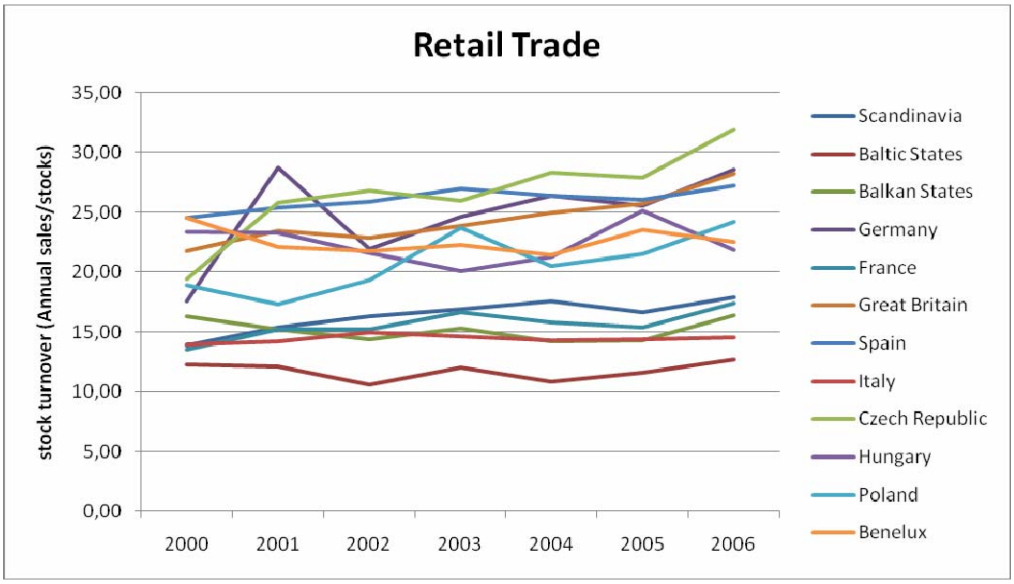
4.4.6 Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods

The analysis of retail trade, encompassing approximately 45,000 European companies, is primarily based upon a comparison of operating revenues and stocks and a subsequent investigation of the stock turnover rate.

The analysis of *Figure 52* clearly shows a group of low-performing countries, including France, Scandinavia, the Balkans, Italy and the Baltic States, ranging from 12.27 to 17.92 with an average of 14.65. While other countries such as the Benelux countries, Hungary and Spain continued at a relatively stable level, others could increase their stock turnover significantly throughout the research period. Considering *Figure 52*, some East European countries could perform better than their western neighbours, probably benefiting from their admittance into the European Union in 2004 and their geographical proximity to Central and Western Europe. The Czech Republic, starting from 19.38 in 2000, reached its peak of 31.95 in 2006, resulting in an average of 26.59 - the most noticeable rise in the whole industry, making the Czech Republic the best performing country in this section. Poland in turn could, after a short recessive drop in 2003, tremendously improve its stock turnover rates from 20.51 in 2004 to 24.19 in 2004. Overall, Poland's stock turnover ratios rose from 18.91 to 24.19. These continually improving performances might be a result of the expansion of the Western European retail chains into these countries, bringing efficiencies and experience from their home countries.

In the group of better performing countries, Germany was able to recover from an extraordinary drop in 2001, subsequently improving its stock efficiency to a maximum of 24.76. Great Britain, which stayed at a comparatively stable level until 2003, rose to 28.23 in 2006, with an overall average of 24.42 in stock turnover ratio. Hungary, processing an ambiguous development, reached its highest peak in 2004 with a stock turnover ratio of 25.30, significantly declining to 21.82 – a lower value in comparison with the start of the study. Spanish companies were able to sustain their comparatively high stock turnover ratios, starting from 24.51 in 2001 to 27.27 in 2006, with just slight volatility in its development.

Figure 52: Stock turnover: "Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods" (NACE 52)



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

4.5 Logistics companies and their performance

In this chapter, a brief characterization of the performance of logistics companies in eight sectors is given:

- Railway transportation: In total, more than 300 companies have been analysed. In this sector, a large share of revenues is generated through passenger transportation. The dominant market player (mostly the - at least formerly - state-owned monopolist) concentrates a large share of logistics activities. Therefore, this company has to be taken into account, although the revenues imply a large share of passenger transportation.
- Freight transport by road: Nearly 5,000 companies could be included in the analysis, which should make a very good national performance indicator.
- Sea & coastal water transport: Similar to rail activities, there are many companies involved in ferry and passenger transportation. The data of nearly 900 companies should give a good picture on this market.
- Inland waterway transport: Also one of the four segments with passenger transportation. In this sector, the share is relatively low, but the number of companies analyzed is, at about 150, perhaps too low overall to get enough “hard data”.
- Air transport: In the last sector, which includes passenger transportation, about 450 companies are in the sample. This market is very similar to the railway sector, as large companies with large market shares exist.
- Cargo handling and storage: This market, with more than 1,600 companies analyzed, implies that the market players are concentrating on warehousing activities.
- Activities of other transport agencies: Mainly broker and forwarder companies are listed in this section. The analysis of more than 4,000 companies should give a good picture of the performance.
- Post and courier activities: Historically attributed to the communications market, the companies in this sector have many logistics activities such as the transportation of parcels and mail. Here (as in the rail sector), mostly one dominant company – the state owned monopolist or at least its privatised successor – can be found in the market. In total, more than 250 companies were identified and analyzed in detail.

The sum of the companies taken into account was nearly 13,000[45]. As a first step, the indicator "profit margins" (and their development from 2000 to 2006) were extracted, as it offers the best view of company performances. In the following part, two approaches were used:

1. The profit margins per company as a benchmarking study and of the whole sector were calculated to derive a picture of the performance of the logistics companies in every EU member state or region,[46] and the development of the overall average of the indicators during the period under review was analyzed. Here, the aim was to show the non-weighted average company profit margin in the sectors and countries. The advantage is that market players with a dominant market share (often found in the rail or postal sector) don't have an impact on the performance of small and medium-sized companies.

2. The profit margins of the whole sector were calculated by adding up the revenues and the profits of the companies. The result shows the weighted profit margin of the sector in each country. Here the advantage is that it shows the profit margin of the whole sector.

Both approaches are shown in the following chapter. The results were – as mentioned – derived from company data from the commercial database AMADEUS. In some sectors, they rely on a large number of data sets (see *Table 18*), but for others only a few data sets were available. This means the results provide what is really an initial look at this performance indicator. The main potential source of error in this analysis is the calculation of profits made by companies in the different countries. The methods might be different in this case. Also some companies, especially in the rail, air and sea sectors, might be taken into account, that generate revenues from passenger transportation could be included.[47] Nevertheless, it gives an initial picture of the profitability of companies in the EU member states.

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[45] The source is the database mentioned in chapter 4.4.
[46] If there were too few companies to analyse in one single country, regions were taken instead (see Table *18*).
[47] This mostly occurs when the freight part of a company is not separated from the whole group.

4.5.1 Rail

The EU-27 average profit margin in railway transport (2000-2006) was 1.05 %. As mentioned, where there is one dominant player in a single country, this might falsify this indicator, because it generates a large share of revenue but the profit margin indicator counts only for one company.

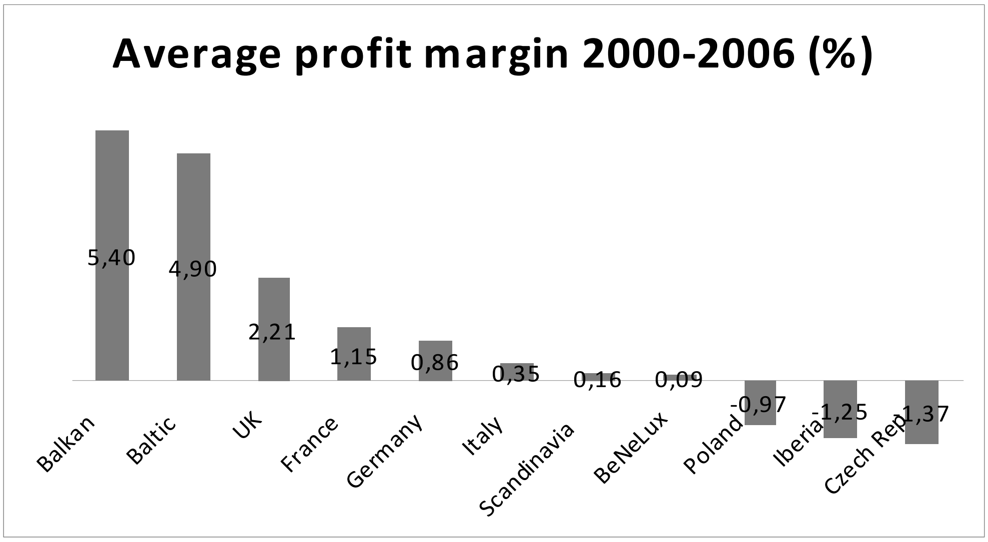
The highest average profit margin over the time frame was identified in South-eastern Europe (i.e. the Balkan countries) and in the Baltic States: about five percent. Their profit margin grew constantly during the period under review – comparable to their average operational revenue per company. While in the Balkan countries, the employment rate was soaring, in the Baltic States the same indicator was decreasing continuously.

As shown in *Figure 53* the lowest average profit margin is in the Czech Republic and on the Iberian Peninsula. In the Iberian Peninsula, the profit margin was unsteady, although it grew positively in the last two years, as did operational revenue and employment. The Czech Republic's average profit margin was about -1.37 %, but it increased constantly and reached over 5 % in the last two years. In the same way, the operational revenue (five percent) grew as well. Since 2004, the employment rate was marginally lower than in the years before. This shows that the performance of these two "under-performing" rail markets is on course for profitability.

German rail companies for example show a positive trend with an average profit margin of nearly one percent (*Figure 54*). The increase of efficiency in the German rail sector is obvious and still ongoing (see the positive development of Railion, the freight subsidiary of Deutsche Bahn). Also, the operational revenue is growing continuously and the employment rate is slightly decreasing, as it has done over the last few years: this might show the reason for the positive development of the profits.

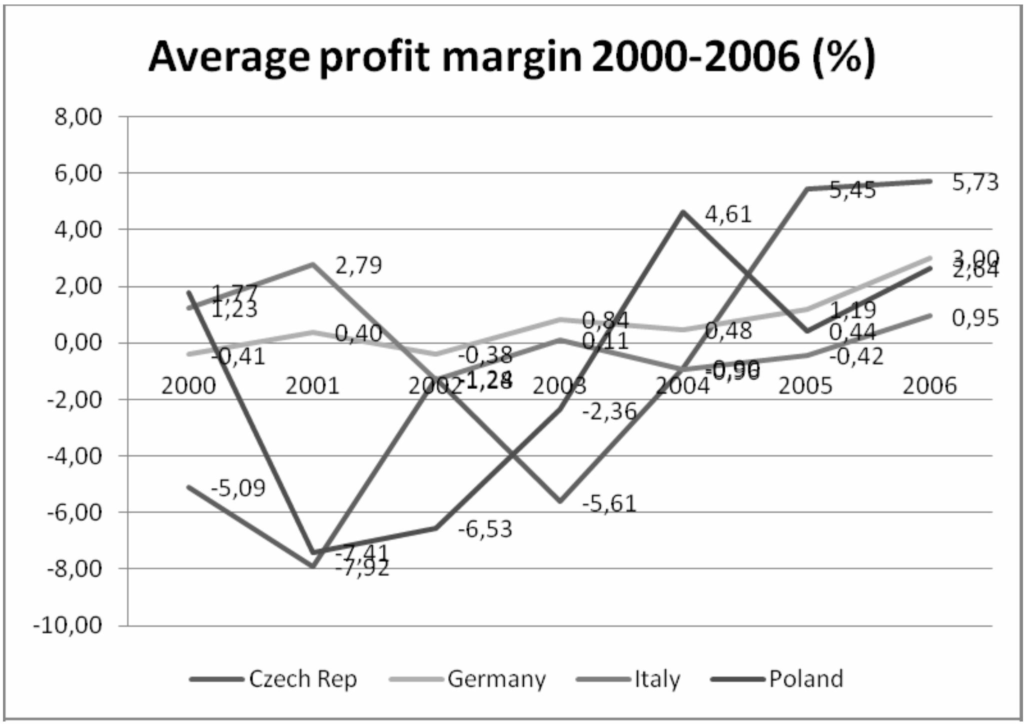
In Italy, the graph of the profit margin rate shows unsteadily movements both above and below zero. It explains the decline of the operational revenue, profit and employment rate. Here, efficiency problems are obvious. Similar to the Czech Republic, companies in Poland were able to generate positive profit margins in 2004 and increase them slowly. As the operational revenue is rising constantly and the employment rate has declined since 2004, structural changes are obvious and appear to have led to a profitable rail sector.

Figure 53: Average profit margins per company from 2000 to 2006 in the rail sector[48]



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

Figure 54: The development of profit margin per company in the rail sector of selected countries from 2000 to 2006

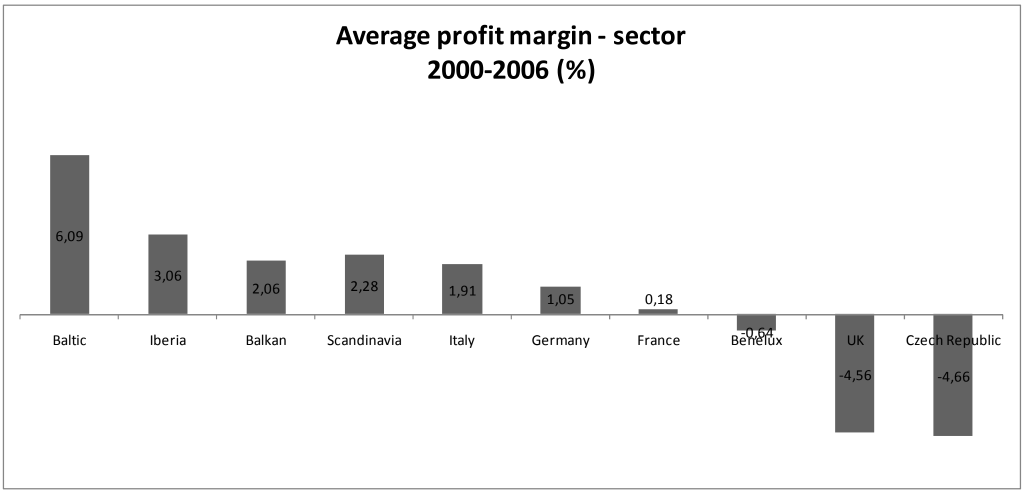


Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

[48] In some numbers, public transportation might be included, as some national rail operators don't have separate legal entities for freight and public transportation.

As illustrated in *Figure 55*, the average profit margin for the whole rail sector in the Baltic States shows the highest rate compared to other countries. In contrast, countries like the Czech Republic and the UK have had an average loss margin of more than -4 % during these years. Compared to the average profit margin per company in Figure 53, Deutsche Bahn, which owns the largest market share in Germany, is more profitable than SNCF, its counterpart in France.

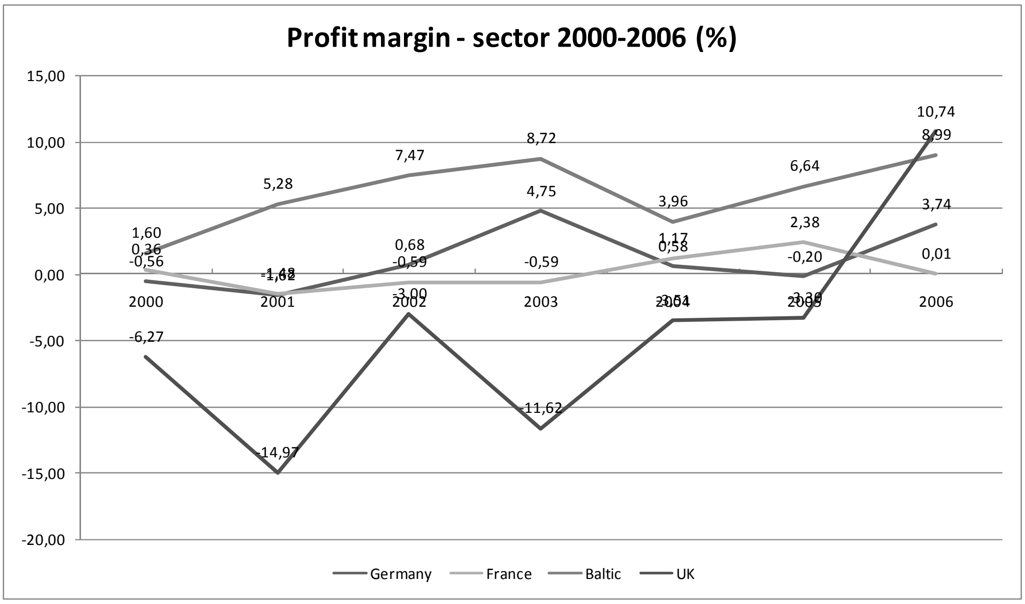
Figure 55: Average profit margin of the whole rail sector from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

The development of the rail sector in most of the countries has been positive, especially in the UK and the Baltic States, which have shown remarkable increases.

Figure 56: *The development of profit margins of the rail sector in selected countries from 2000 to 2006*



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

4.5.2 Road

The average profit margin in road freight transport (2000-2006) in the EU was 3.13 %. In spite of public perceptions to the contrary, this seems to be relatively high. The analysis identified the highest figure in Hungary (5.03 %), followed by the Baltic States (see *Figure 57*).

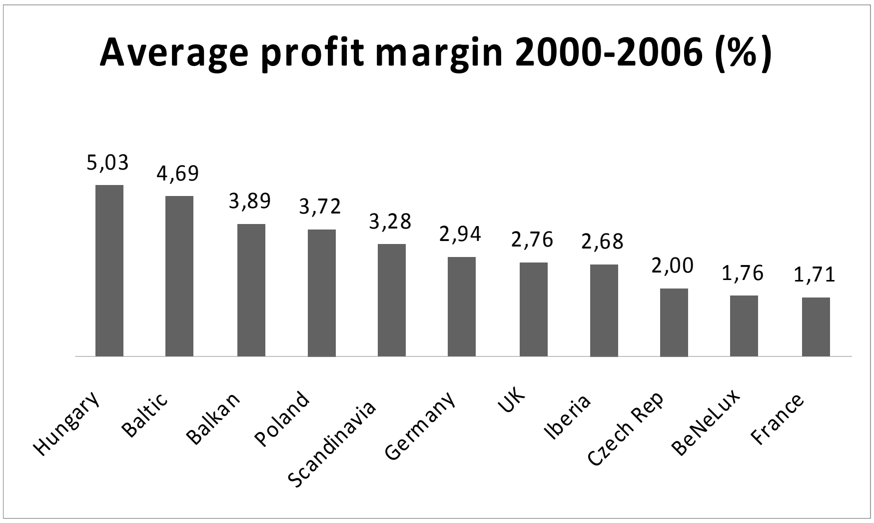
The Hungarians' profit margin increased until 2004, but has declined since then. One possible reason could be that costs have been increasing continuously and new players entered the market. Nonetheless, Hungary is a country with high growth, especially in the operating revenue per company. Since 2000 it tripled.

As shown in *Figure 57*, France and the Benelux countries had the lowest average profit margin in the EU – below two percent. In France, the profit margin fell continuously until 2005, when it reached 0.55 %, although operational revenue and employment per company increased each year.

In contrast, the Benelux companies have continuously increased their average profits since 2000 – parallel to the average employment per company. This shows the rising efficiency of road transport companies in this region.

It also shows the intensive competition coming from the low cost countries of Eastern Europe. The Western European freight transport companies have to offer their services at lower margins to stay competitive.

Figure 57: Average profit margins per company from 2000 to 2006 in the road transport sector



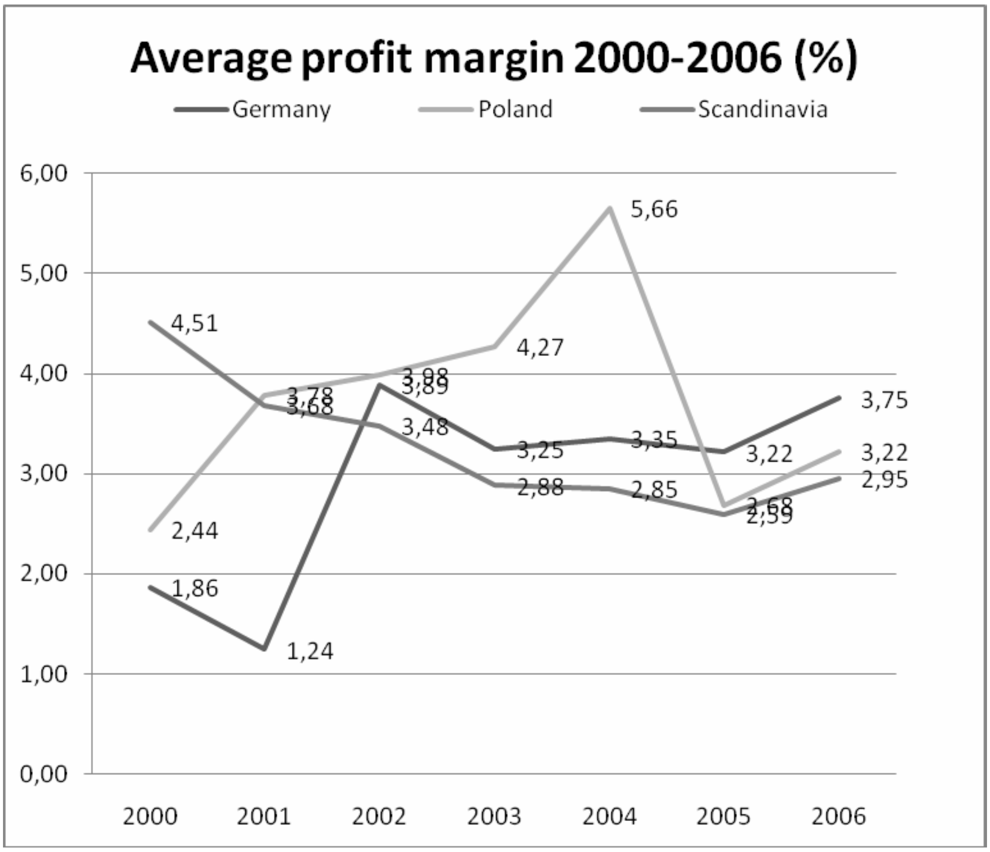
Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

The company sample for Germany shows a positive trend (average profit margins rose by almost three percent from 2000 to 2006) after difficult times at the beginning of the century. The operational revenue per company also rose constantly, as did the average number of employees per company. According to the company sample (which contains a broad range of company sizes), the road transportation sector seems to be progressing well.

In Poland, the average profit margin rose quickly until 2004. In 2005 and 2006, this trend slowed down to “normal”. The impressive rise shows the effects of the reorganisation and growing efficiency of the road sector in Poland - previously companies in the transportation sector were mostly state-owned.

In the Scandinavian countries, the average profit margin fell by about 0.4 % each year until 2005, even though operating revenue, profit and employment rate all showed annual increases. The reason can be found in rising costs.

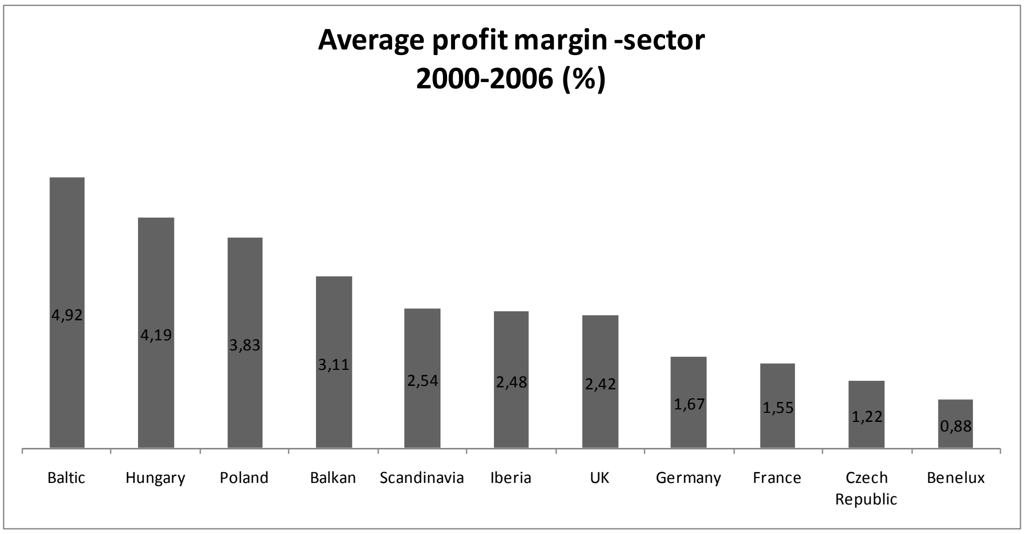
Figure 58: The development of profit margin per company in the road transport sector of selected countries from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

The highest average profit margin in the road sector as a whole can be seen in the Baltic States, Hungary and Poland. The Benelux shows by far the lowest profit margin in the sector. One reason might be that the majority of companies are making bigger profits, because smaller companies, which are often specialised, can charge more for their services. On the other hand, the road freight companies in the Czech Republic are characterised by large companies with low profits (like Cetrans) and small companies with higher profits.

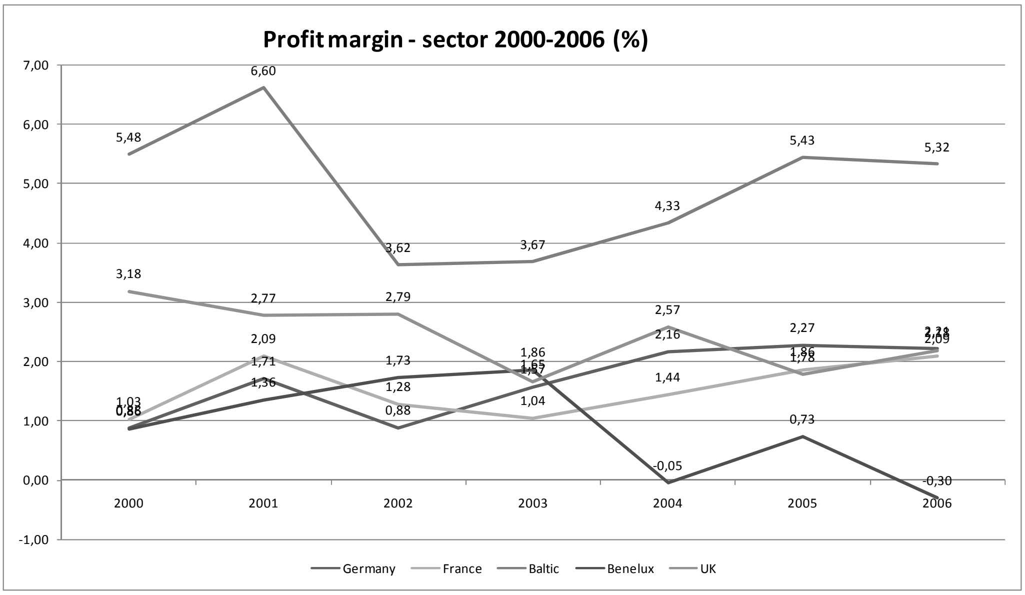
Figure 59: Average profit margin of the whole road sector from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

As seen in the figure above, the road sector in the Benelux countries suffered a continuous downturn in profits (in contrast to Germany's sector, which increased profit step by step). In general, stagnating development can be identified, reflecting the way cost increases are undermining higher productivity.

Figure 60: The development of profit margins of the road sector in selected countries from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

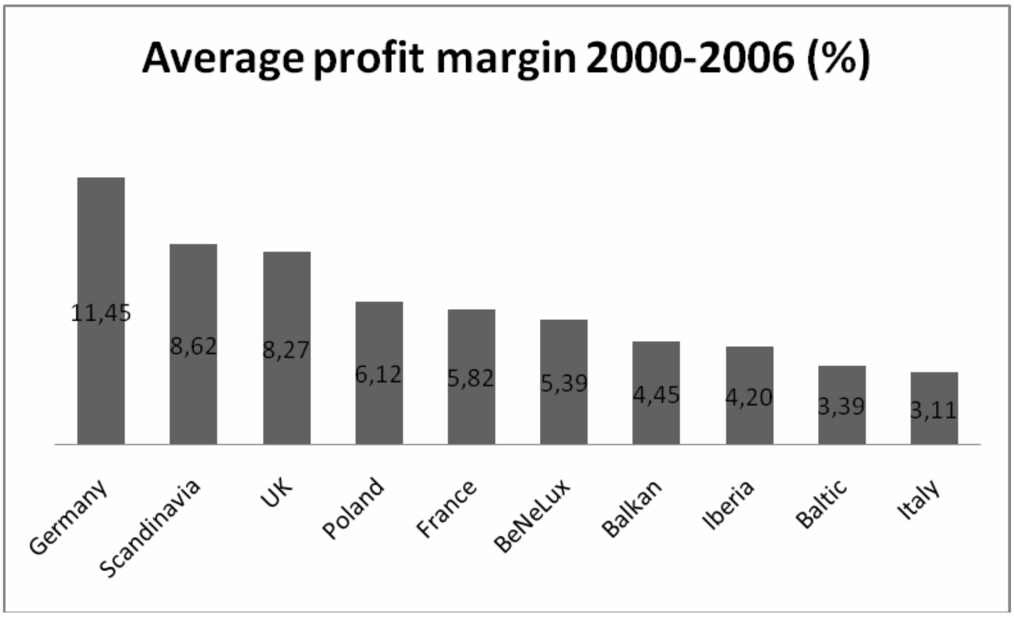
4.5.3 Sea and coastal water transport

The average profit margin in sea and coastal water transport in the EU was an outstanding 6 %. This is due to the fact that many brokers are included in this sector in addition to the carriers. The highest average profits during the period under review were generated in Germany, at nearly twice the average. Germany's companies' operational revenue and employment rate have both risen greatly (from -10 % in 2000 to 25 % in 2006). This is due to the fact that globalisation greatly benefited the sea ports of Hamburg and Bremen and the connected sea freight business.

With the ongoing growth of external trade with the countries around the Baltic Sea, Scandinavia also enjoyed consistently higher profit margins, operational revenues, and employment rates per company. As shown in *Figure 61*, the lowest average profit margin in the EU was identified in Italy (3.11 %) and in the Baltic States (3.39 %). After very low profit margins in Italy in the beginning of the analysed time frame (around zero), it later grew at an above average rate, with revenues increasing and employment decreasing per company.

In contrast, e.g. the Baltic States seem to face harder challenges as the average profit margins are seesawing.

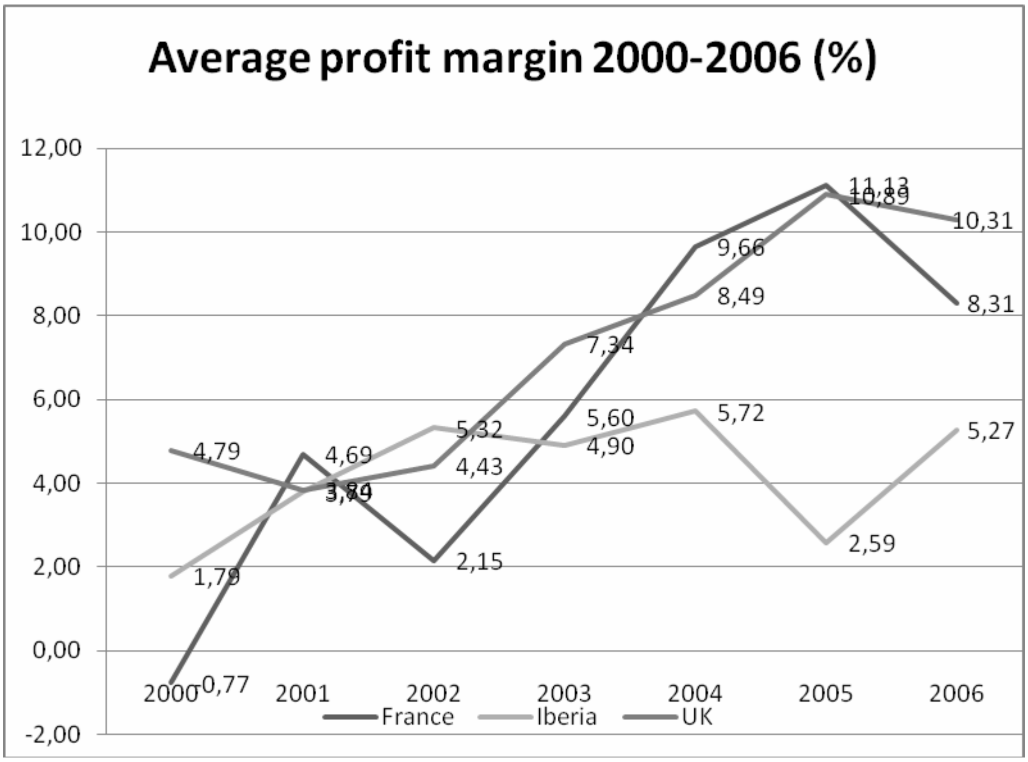
Figure 61: Average profit margins per company from 2000 to 2006 in the sea and coastal transport sector



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

Average profit margins for companies in the Iberian Peninsula, for example, grew slowly (see *Figure 62*) although operational revenues and sinking employment rates increased sharply in each company. In contrast, France and the UK were more able to anticipate the boom in ocean freight markets, where profit margins continuously increased. The employment and operational revenues per company has also grown constantly.

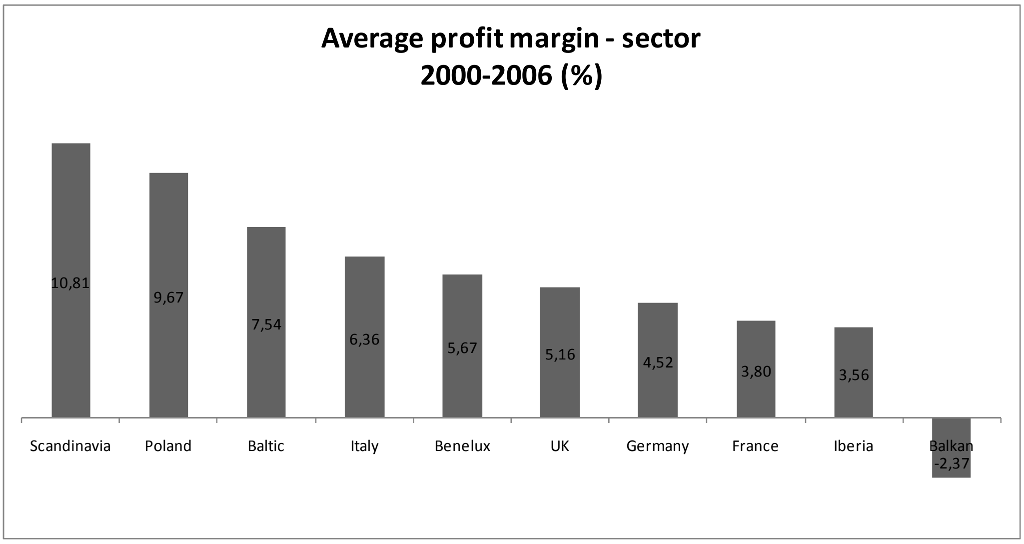
Figure 62: The development of profit margin per company in the sea and coastal transport sector of selected countries from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

Compared to other countries, Scandinavia experienced the highest profit margins in the sea and coastal sector. But other countries such as Poland, Benelux, Italy and the Baltic States also show good results. Apart from the Balkan countries, which have an average loss margin of 1.67 %, all the countries surveyed showed a positive average profit margin between 2000 and 2006. This reflects the boom years of globalisation, which boosted sea transportation and prices.

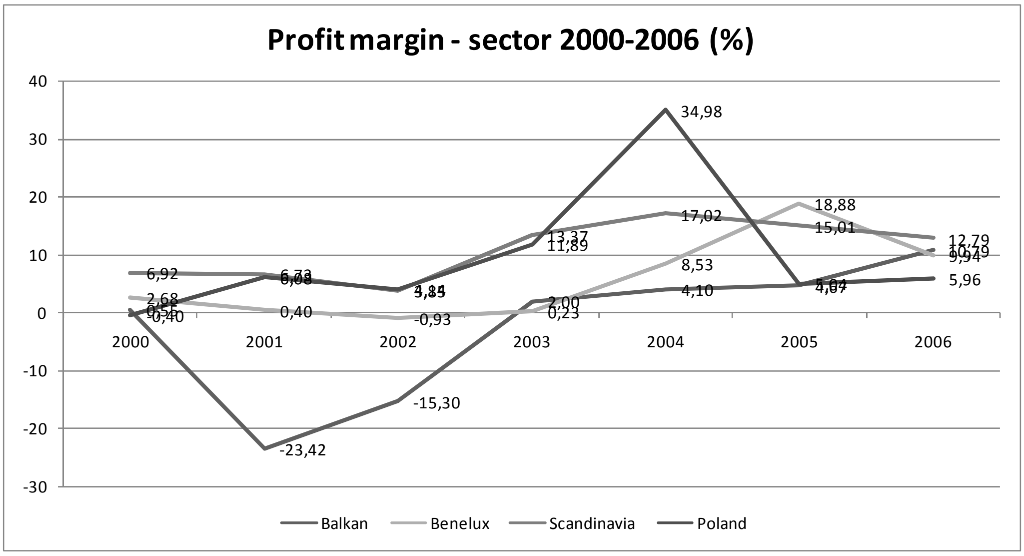
Figure 63: Average profit margin of the whole sea and coastal transport sector from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

Except for the sector of the Balkan countries we have already mentioned (which was able to turn itself around in 2003 by becoming more important on the global seaways), in general, all the countries had positive profits in the sector. It can be seen that increasing competition has been slowing profit growth since 2005.

Figure 64: The development of profit margins of the sea and coastal transportation sector in selected countries from 2000 to 2006



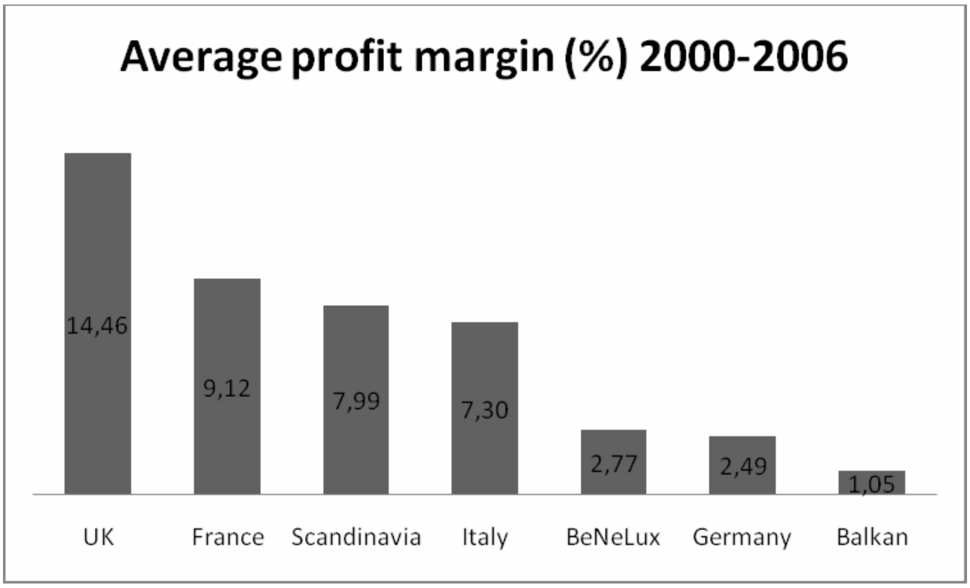
Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

4.5.4 Inland waterway

The average profit margin per company of inland waterway transport of the EU from 2000 to 2006 accounted for 6.5 % – an unexpectedly high rate at this juncture. The highest margin of 14.5 % was found in the small British market; in France it was 9.1 % (see *Figure 65*). In Great Britain, the companies were obviously under pressure, as the number of the employees per company fell by an average four percent a year over this period. In contrast, France's inland waterway sector seems to be a "profitable" and growing market, as the average profit margin accounted for about nine percent and average operational revenues per company have increased by over nine percent a year since 2003 by over 9 % a year. At the same time, the employment rate per company grew at about 4.5 % p.a.

According to the analysis, the lowest average profit margin per company was in Germany (2.49 %) and in the Balkan countries (1.05 %). Although the profit margin and the operational revenue increased slightly in Germany, the number of employees fell continuously at the same rate. Like Germany, the Balkan countries improved their profit margin and operational revenue year by year.

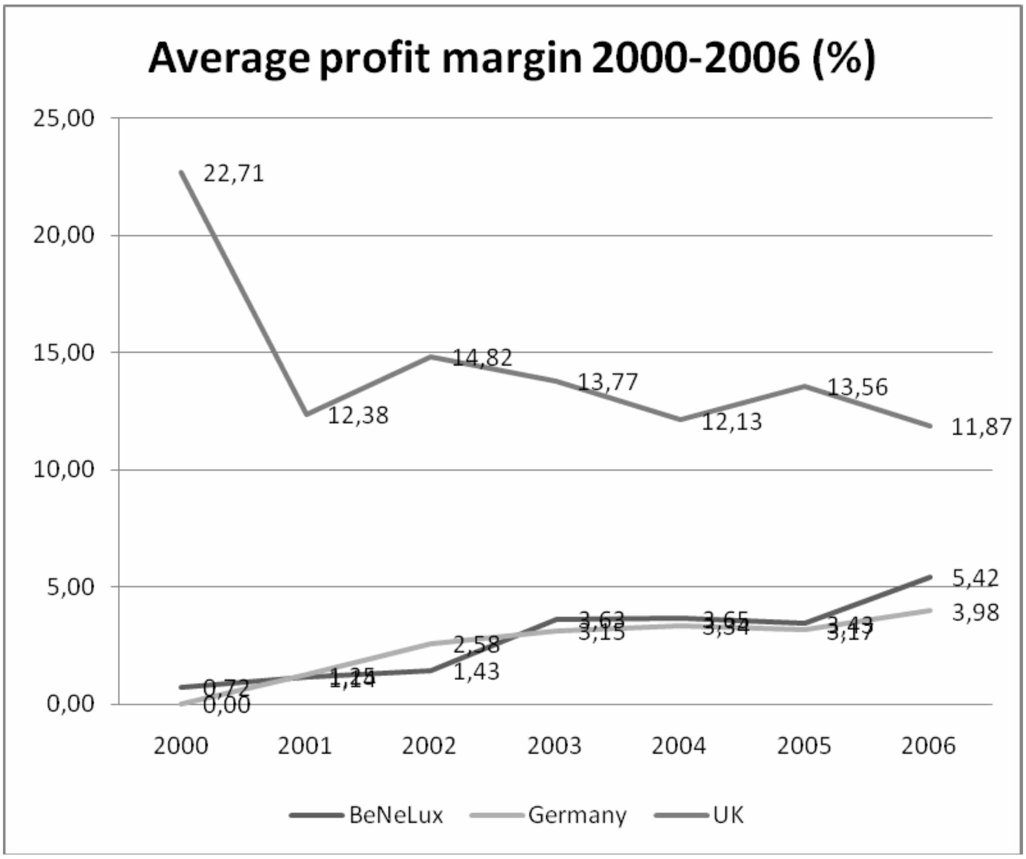
Figure 65: Average profit margins per company from 2000 to 2006 in the inland waterway transport sector



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

Comparable to Germany and the Balkan, the Benelux countries show a positive trend (average 2.77 %) with respect to profit margins, operational revenues and the number of employees per company (see *Figure 66*).

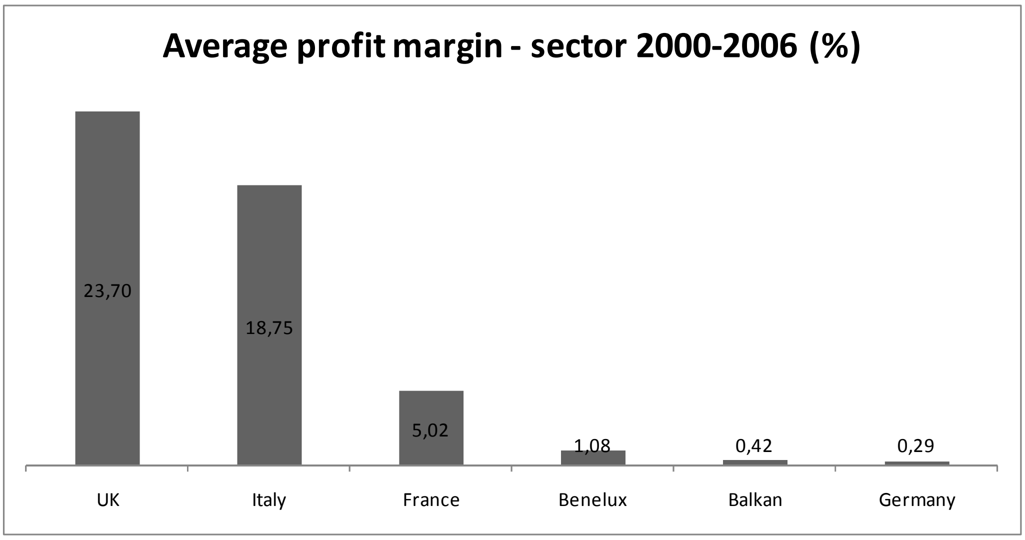
Figure 66: The development of profit margin per company in the inland waterway sector of selected countries from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

During the period from 2000 to 2006, the UK and Italy had the highest profits in the sector, with average margins of 23.53 % and 18.89 % respectively. Even though other countries such as the Balkan and Benelux countries and Germany did not generate losses, average profit margins were still quite low.

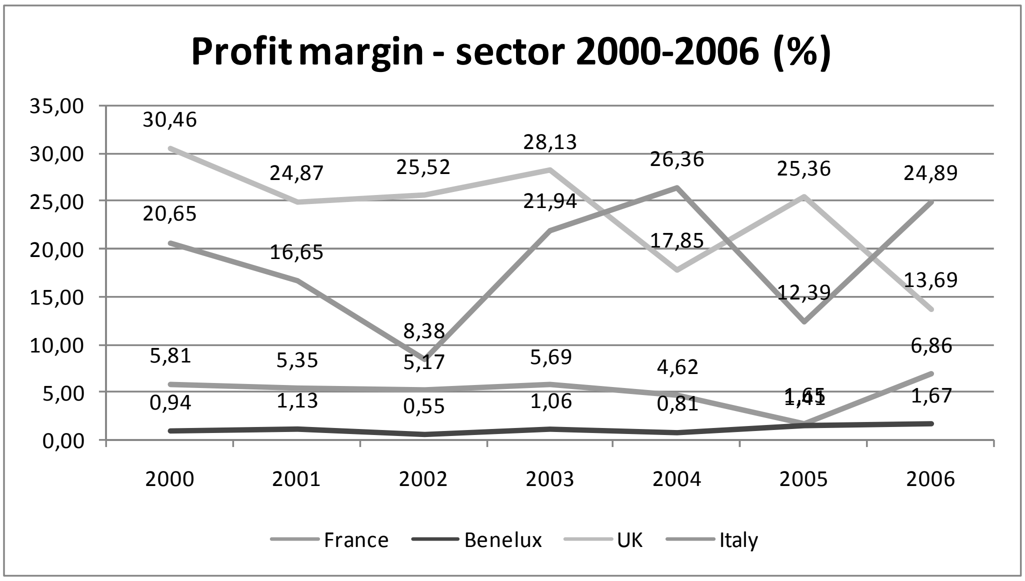
Figure 67: Average profit margin of the whole internal waterway sector from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

Except for the UK and Italy (where the share of this transport mode is quite low), the profit margins in these sectors stagnated between two and five percent since 2001. External drivers seem to have had a low impact on the performance of the sector.

Figure 68: The development of profit margins of the internal waterway sector in selected countries from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

4.5.5 Air

The average profit margin in air transport in the EU from 2000 to 2006 amounted to a small 0.5 %. The main losses happened in 2001 and 2002, after 9/11. After that, the profit margin grew slowly. The air traffic sector in some countries mostly has had negative profit margins in recent years (e.g. Italy, the Balkan countries, Spain and Portugal).

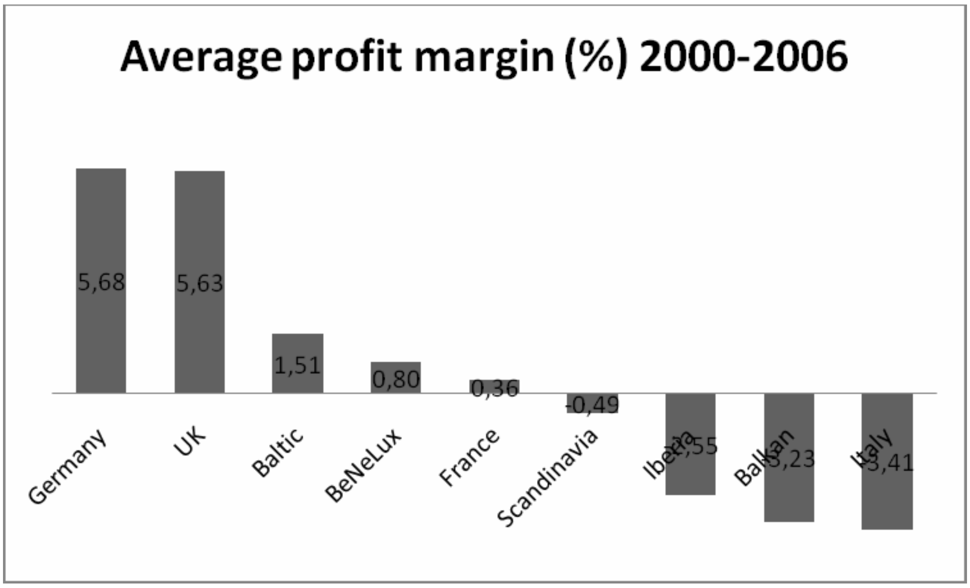
The highest average profit margins were generated in Great Britain (5.63 %), which rated permanently above five percent. In parallel, operational revenue and the number of employees per company grew on average by 5 % and 3 % p.a. respectively.

Companies in the Baltic States followed a clear growth path (with an average profit margin of 1.5 %). Their operational revenue grew by 30 % p.a. on average and the number of employees over 10 % p.a.

As shown in *Figure 69*, the lowest figures as far as profit margins were concerned were identified in Italy (-3.41 %) and the Balkan countries (-3.23 %). Over the period analysed, Italy had a negative average profit margin, although it grew from -5.8 % in 2002 to -0.9 % in 2006.

Starting in 2001 with an average loss margin of -9 %, the Balkan countries managed a turnaround and achieved positive margins in 2005. This was attended by the positive development of operational revenues and employees per company since 2003.

Figure 69: Average profit margins per company from 2000 to 2006 in the air transport sector[49]



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

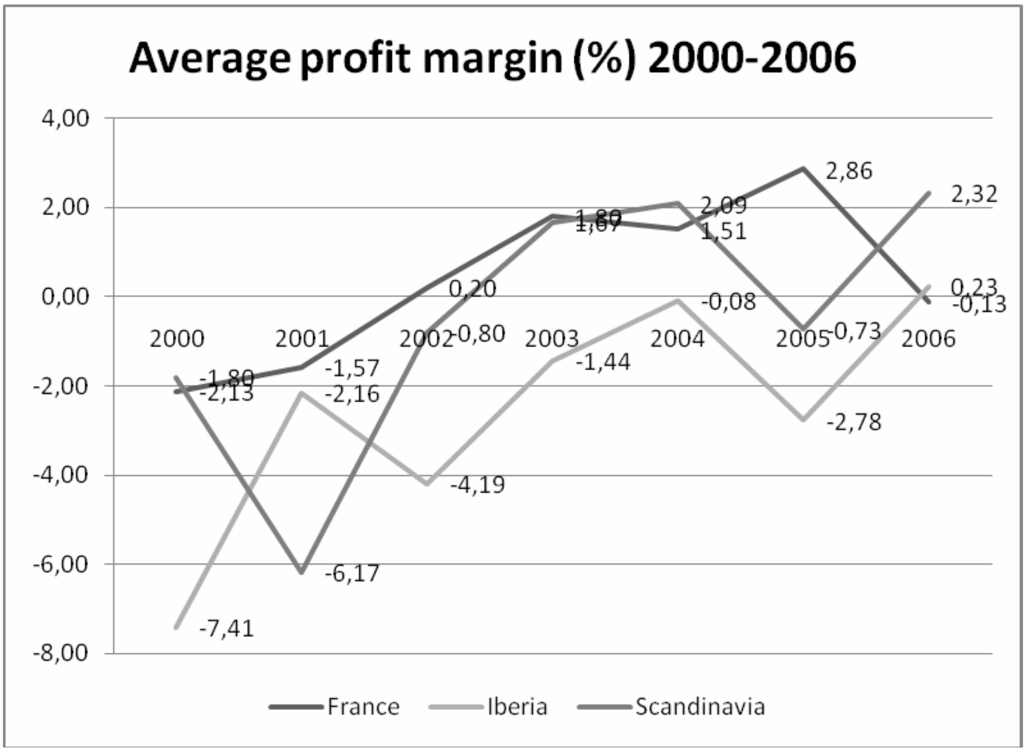
As with Italy, the air transport sector on the Iberian Peninsula reached positive profit margins in the last year of the analysis. Since 2003, the average operational revenue per company grew by nearly 10 % p.a., the employees per company by six percent.

In France, average profit margins increased before an extreme downturn in 2006.

Apart from blips in 2001 and 2005, the Scandinavian air sector registered positive average profit margins. The companies continuously enlarged the average operational revenue and reduced the number of employees.

[49] In some numbers, passenger traffic might be included, as some airlines don't have separate legal entities for cargo and passenger transportation.

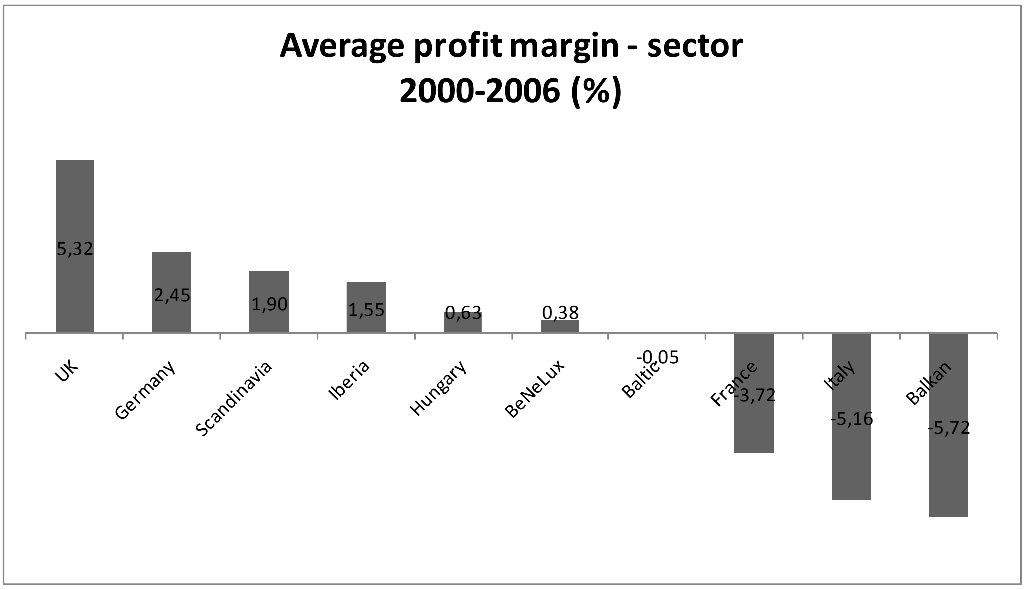
Figure 70: The development of profit margin per company in the air transportation sector of selected countries from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

Italy experienced the highest average losses in the sector compared to other countries, which might be attributed to Alitalia. The airline made heavy losses between 2000 and 2006. Although the Baltic States had a small average profit margin, their turnover growth rates increased continuously during those years. In the UK, the high average profit margins might be due to the fact that passenger transportation could not be totally excluded.

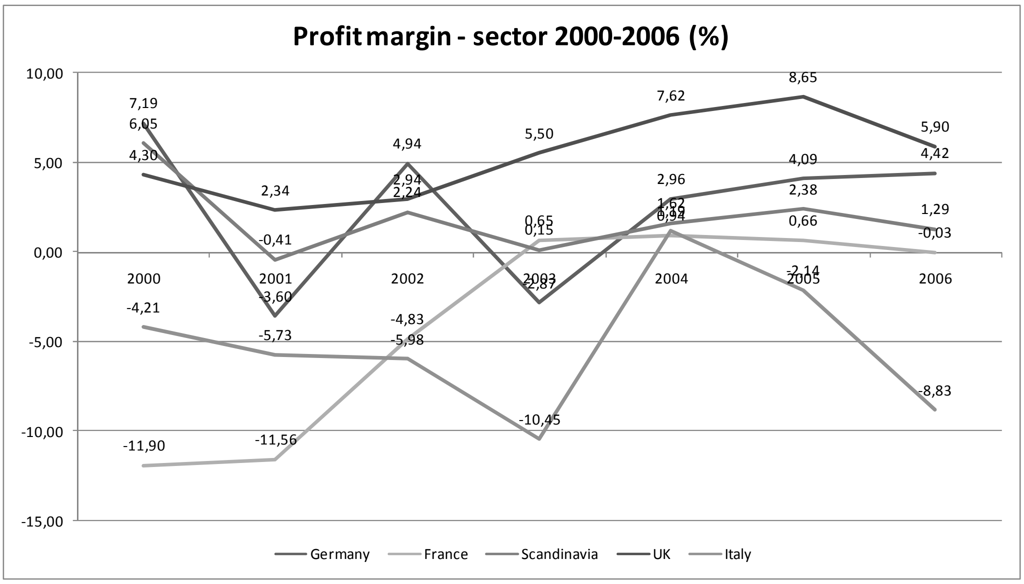
Figure 71: Average profit margin of the whole air sector from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

As shown in *Figure 72*, almost all countries suffered heavy losses in 2001 due to the market downturn in the wake of the terrorist attacks in the United States in September of that year. Despite unfavourable market conditions for carriers and rising fuel costs, most airlines enjoyed encouraging growth rates during 2004 and 2005. Only the UK's airline sector stayed "positive" over the whole period.

Figure 72: The development of profit margins of the air sector in selected countries from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

4.5.6 Cargo handling and storage (warehousing)

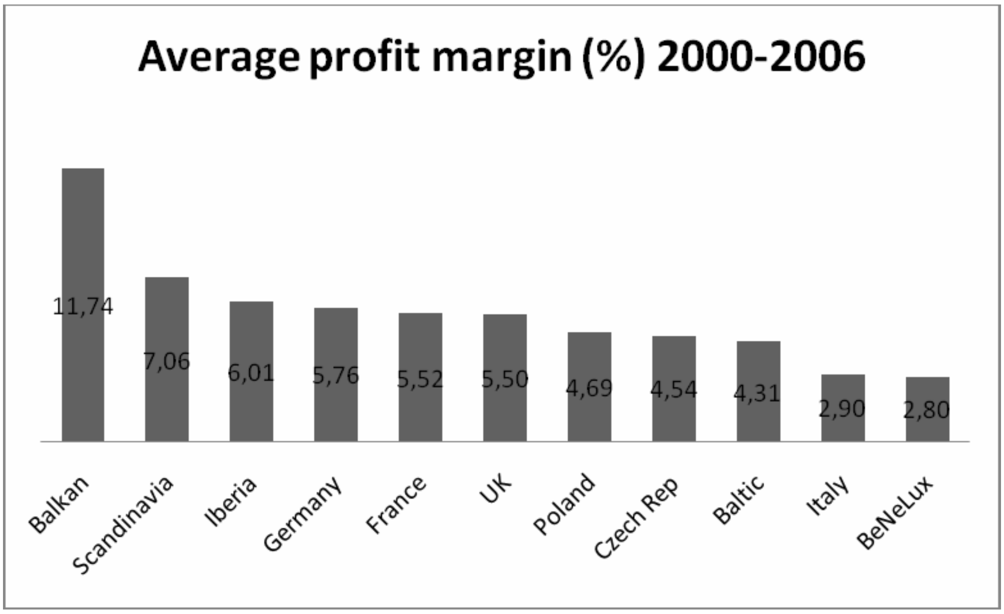
The average profit margin in cargo handling and storage from 2000 to 2006 in the EU was 5.53 %. The highest rates were identified in the Balkan countries and in Scandinavia (see *Figure 73*).

As far as average profit margins and average operational revenues per company are concerned, the warehousing companies in the Czech Republic grew continuously. In contrast, the number of employees per company on average remained static. Increases in efficiency seem to be clear.

A slightly different picture can be seen in the Balkan countries: as profit margins decreased from about 13 % in 2000 to 7.5 % in 2006, the operational revenues per company nearly doubled as the number of employees per company remained constant. The reasons for these developments are unclear.

The lowest profit margins per company were identified in Benelux (2.80 %) and Italy (3.25 %). In these countries, the margins remained at nearly the same level during the period under review (see *Figure 74*), whereas operational revenues and the number of employees per company increased continuously.

Figure 73: Average profit margins per company from 2000 to 2006 in the warehousing sector

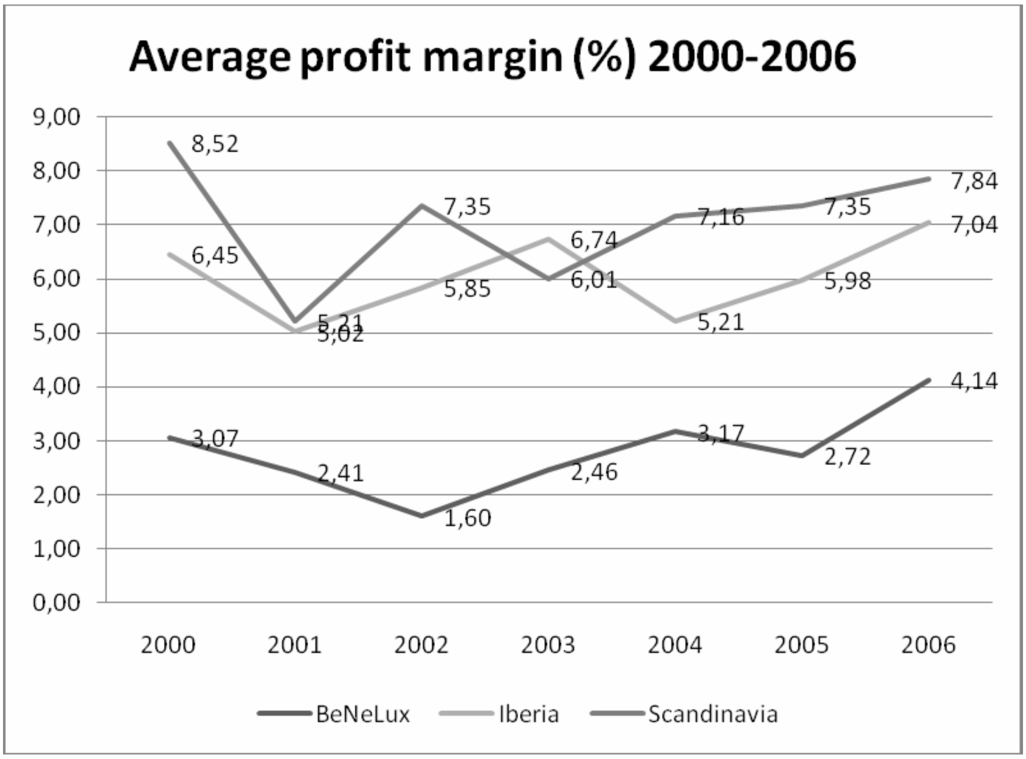


Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

The companies on the Iberian Peninsula generated a relatively stable profit margin during the period under review (from five to seven percent). In addition, the operational revenue per company grew on average by about nine percent, whilst the employment rate grew by over three percent a year.

For the Scandinavian companies, the analysis identified a more strongly fluctuating profit margin per company, ranging from five to 8.5 %. Meanwhile, operational revenues increased on average by four percent and the number of employees by about two percent a year.

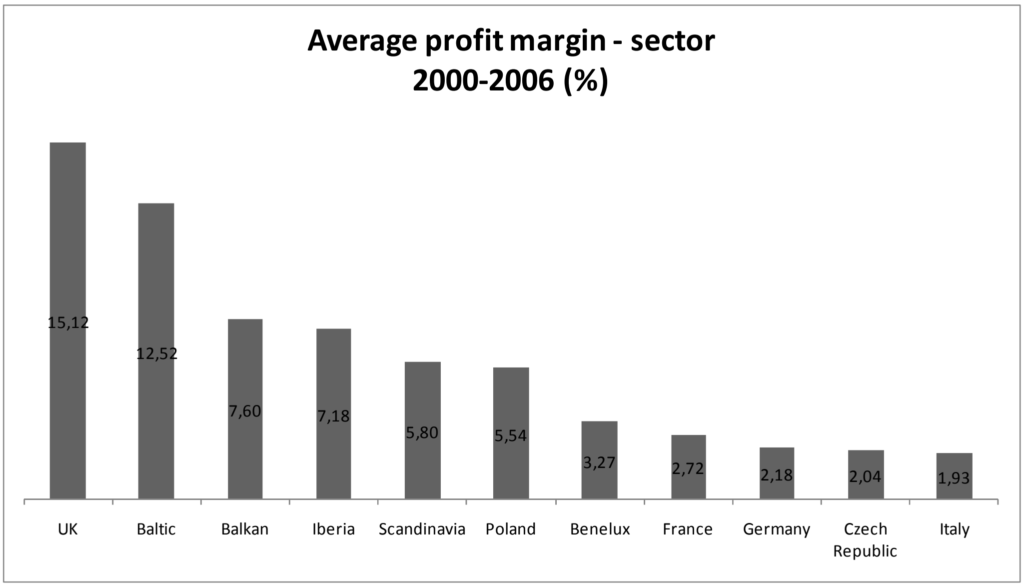
Figure 74: *The development of profit margin per company in the warehousing sector of selected countries from 2000 to 2006*



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

The big difference between results from the micro-view (the benchmarking approach) and the sector-view indicates that some companies have large revenues and profit margins different to smaller companies – e.g. in the UK, the port operators have large revenues and high profit margins.

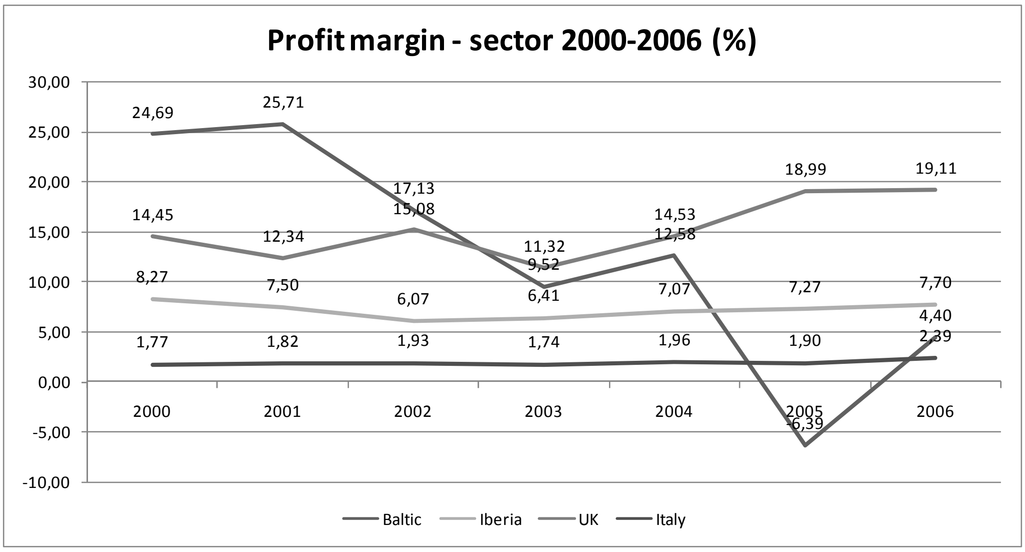
Figure 75: Average profit margin of the whole cargo handling and storage sector from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

The downturn in the Baltic States is enormous. Reasons for this development could be fluctuations in business with Russia. The UK has profited from globalization. Most of the other countries' sectors showed stagnation.

Figure 76: The development of profit margins of the cargo handling and storage sector in selected countries from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

4.5.7 Activities of other transport agencies (freight forwarders)

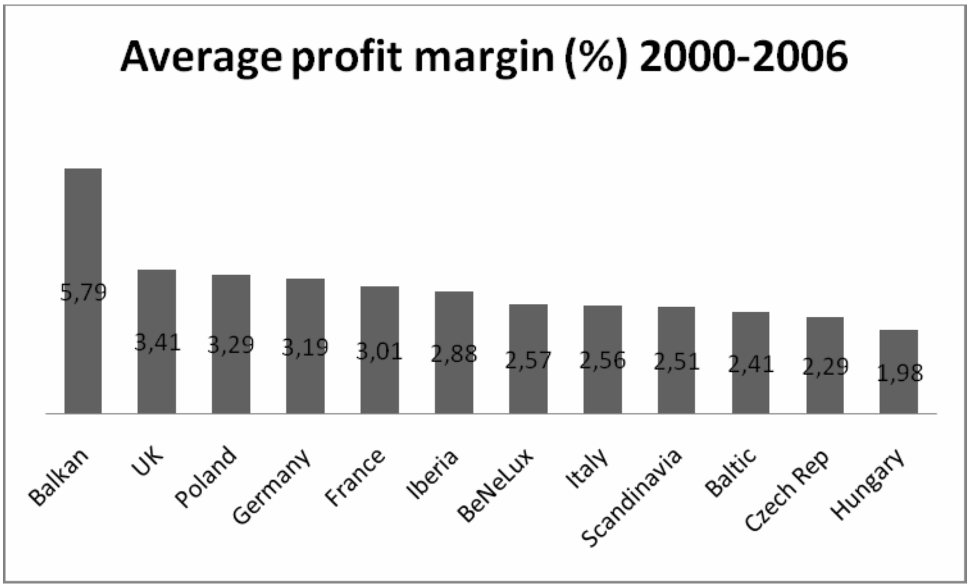
The average profit margin in activities of other transport agencies (mainly freight forwarders and brokers) from 2000 to 2006 in the EU was 2.99 %. The highest was identified in the Balkan countries (5.79 %) and in Great Britain (3.41 %), as illustrated in *Figure 77*. The high margins in the Balkan countries are interesting: they may result from the advantageous cost structure and the low number of companies serving the important Russian market. The average operational revenue and the number of employees per company grew constantly by nine percent and two percent respectively during the period under review.

The profit margins of Great Britain's companies grew constantly during the period under review. Furthermore, their average operational revenue (nearly 10 %) and the number of employees (over four percent) per company rose as well.

The lowest average profit margins in the EU were identified in Hungary (1.98 %) and the Czech Republic (2.29 %).

After a slight growth to four percent in 2004, the profit margin in the Czech Republic decreased in the following years. On the other hand, the average operational revenue and the number of employees per company grew at a high rate. A similar development took place in Hungary.

Figure 77: *Average profit margins per company from 2000 to 2006 in the freight forwarding sector*



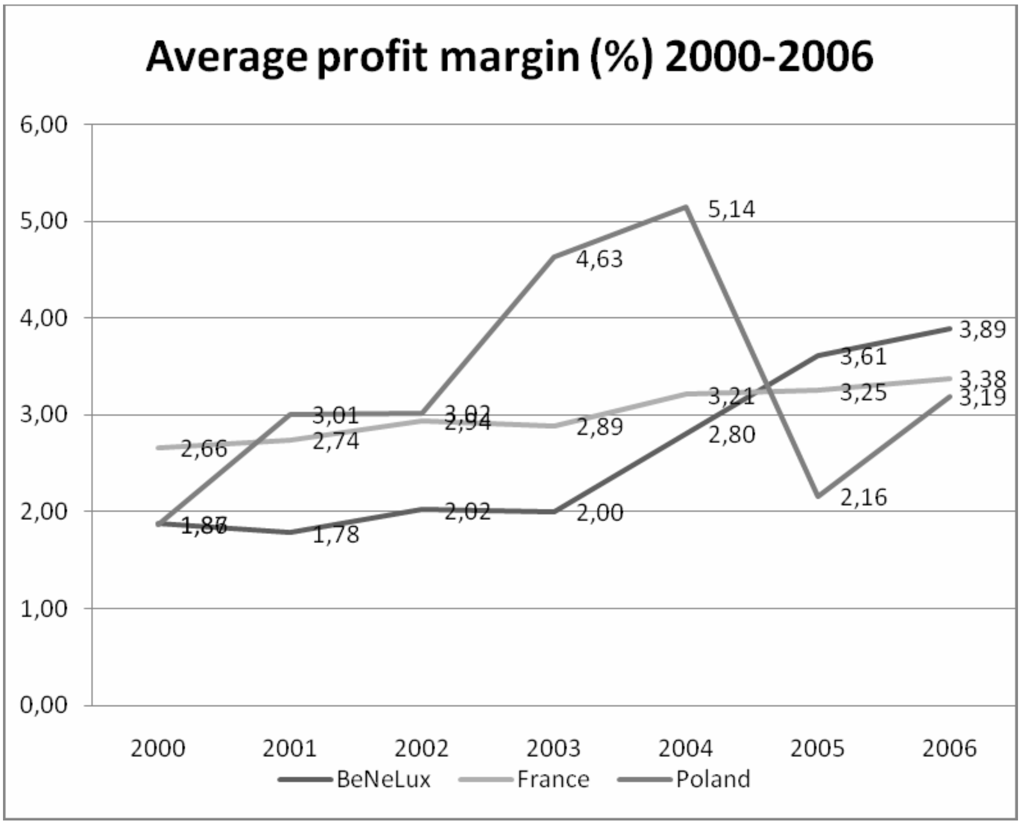
Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

A constant development could be identified in France. The average operational revenue grew by about 7 %. On the other hand, the employment rate remained at a constant level.

Overall, Poland has shown positive development since 2006 after a downturn in 2005. While the average operational revenue per company grew at nearly 10 % p.a., the number of employees per company increased only slightly (two percent).

Benelux could increase its low profit margins per company continuously at the beginning of the time under observation (the same applies to the indicators "employment" and "operational revenue"). This could show how the growth of import and export activities due to globalisation have resulted in the growth in turnover rates in the sea ports.

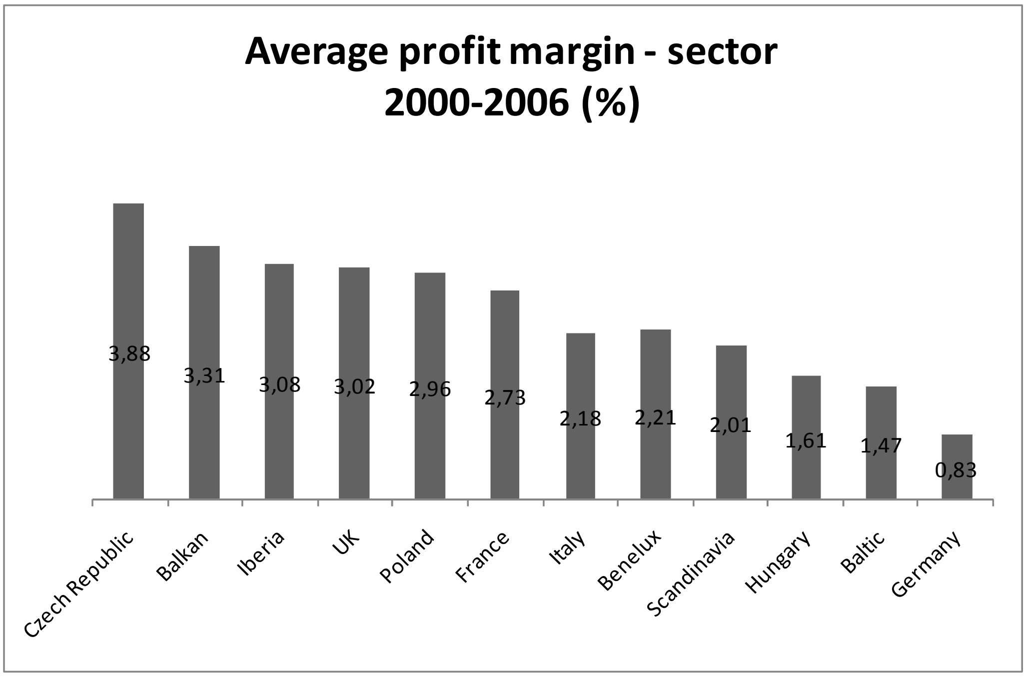
Figure 78: The development of profit margin per company in the freight forwarding sector of selected countries from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

The cargo handling sectors in the Czech Republic and the Balkan countries have the highest profit margins. Compared to the benchmarking data above, the differences are larger.

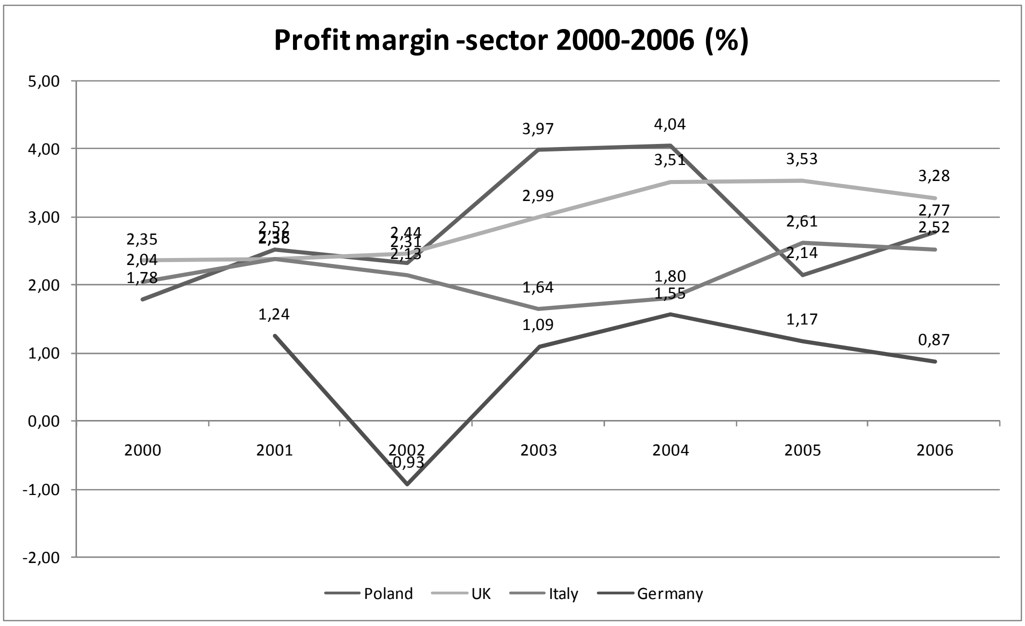
Figure 79: Average profit margin of the whole freight forwarding sector from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

The graphs in the following figure mostly show an upward trend. The growing importance of this sector might be one reason. The below-average development of Germany's sector might reflect rising costs and a continuous growth in competition.

Figure 80: The development of profit margins of the freight forwarding sector in selected countries from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

4.5.8 Postal and courier services

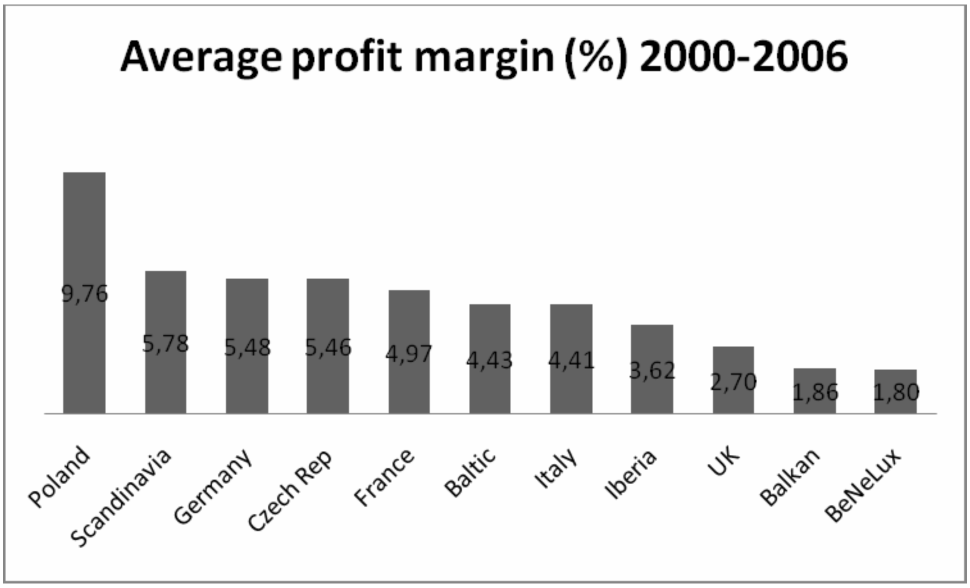
The average profit margin in post & courier activities in the EU from 2000 to 2006 was 4.57 %. The highest values were identified in Poland (9.76 %) and Scandinavia (5.78 %).

During the period under review, profit margins in Poland fell slightly but remained over nine percent. The growth in the average number of employees per company was significant and the operational revenue per company increased by about eight percent a year. The Scandinavian states give roughly the same picture (growing revenues per company and stagnating number of employees per company).

As shown in *Figure 81*, companies in the Benelux countries (1.80 %) and on the Balkan (1.86 %) had the lowest average profit margins in the EU.

In the Benelux companies, average profit margins grew constantly during the period under review - from under one percent in 2000 to over four percent in 2006 (see *Figure 82*). In addition, the average operational revenue per company grew by about four percent per annum, even though the number of employees decreased by about three percent each year. So, the reason for the growth in profit margins is obvious.

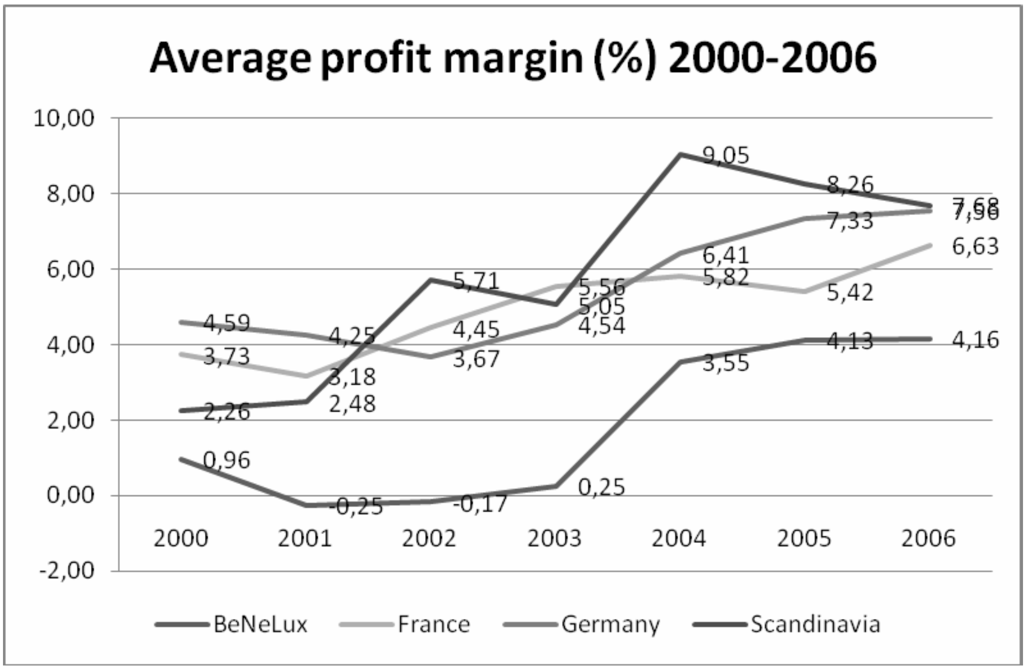
Figure 81: Average profit margins per company from 2000 to 2006 in the post and courier services sector



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

German companies in the postal sector show a consistently positive development. The average operational revenue per company grew by nearly 10 % p.a. and the number of employees per company by about five percent a year.

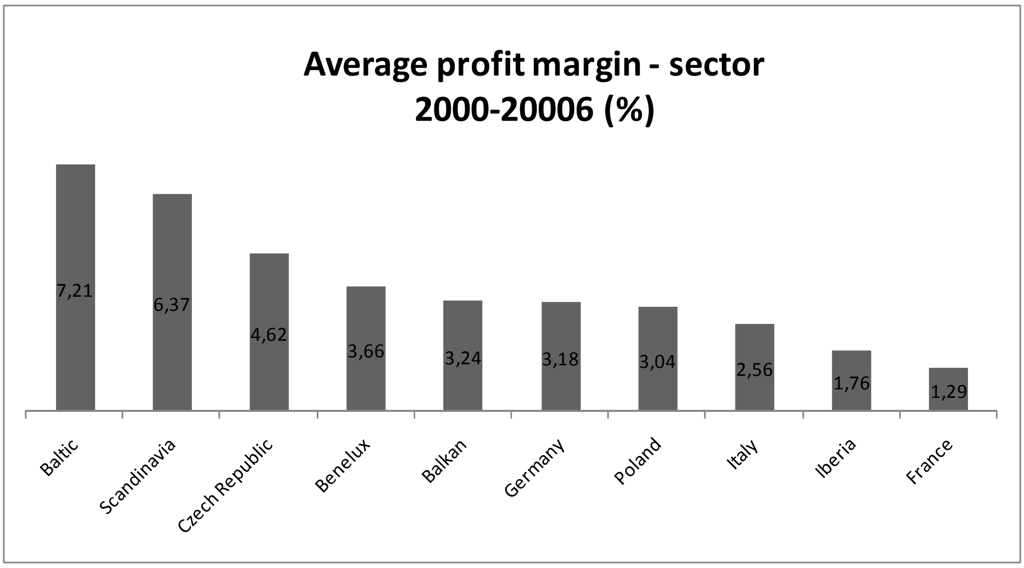
Figure 82: The development of profit margin per company in the post and courier services sector of selected countries from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

In most of the countries, this sector is characterized by the presence of one large company (the universal service provider or national postal corporation), a number of parcel services with comparable revenues, and many small and medium-sized companies in the express sector. This can be seen by comparing the very different figures of the average profit margins per company and in the whole sector.

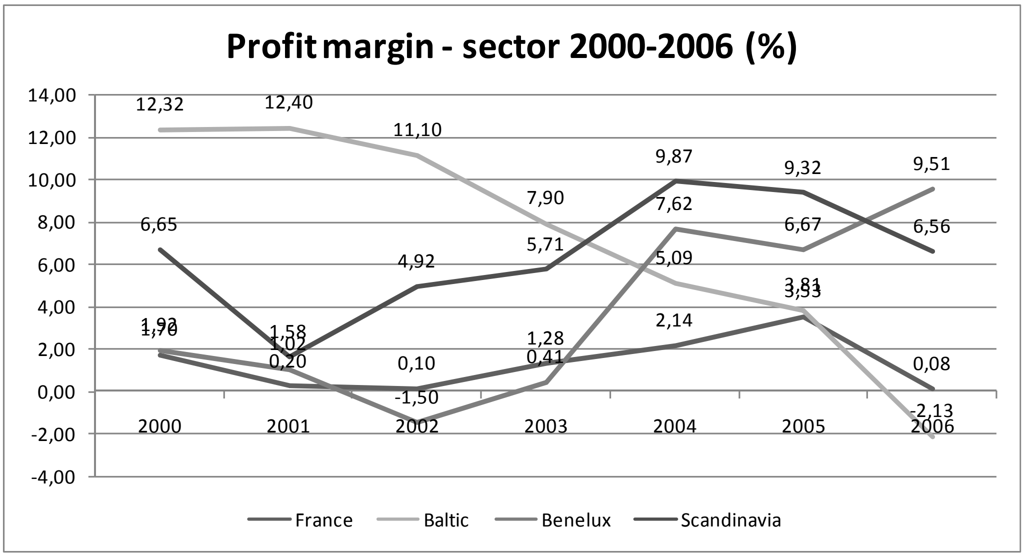
Figure 83: Average profit margin of the whole post and courier services sector from 2000 to 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

The development of the sector in the examined countries is characterized by restructuring and the identification of new markets to compensate for losses in the formerly reserved mail business sector and its substitution by electronic mail and telecommunications.

Figure 84: The development of profit margins of the post and courier services sector in selected countries from 2000 to 2006



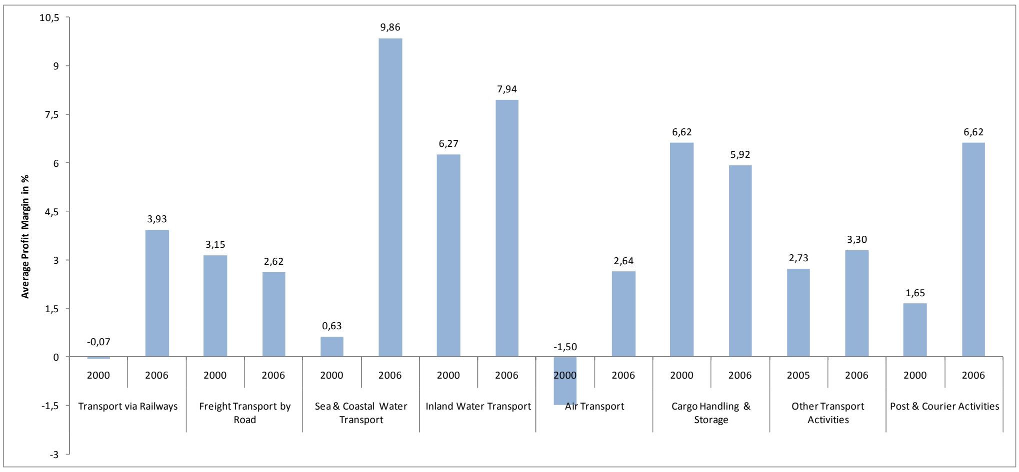
Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

4.5.9 A comparison of the average profits per transport mode in the EU

Figure 85 shows a comparison of average profit margins per company and transport mode in the EU.[50] Most of the average profit margins per company indicate positive developments (especially in rail, sea and air transport). The sea and air sector could take advantage of the rising global traffic in both directions – imports and exports. The rail sector (like the postal and courier sector) has implemented large efficiency programs to compete with road transport. Only road transport and cargo handling show a slight decrease in profit rates. Especially in the road sector, cross-border competition and rising costs put pressure on profits.

[50] It should be noted that the data of 2006 is much more representative than of 2000, as less companies have reported data in these early years.

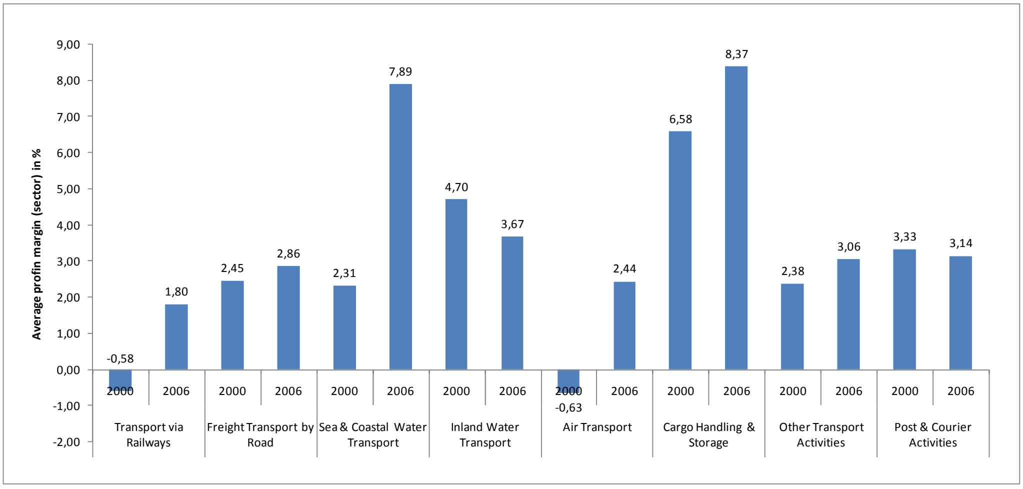
Figure 85: The comparison of average profit margins per company per transport mode in the EU in 2000 and 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

Comparable results can be derived from average sector profit margins for Europe as a whole (see *Figure 86*). Very concentrated markets such as rail and postal services give a very interesting picture: former monopolists still enjoying a dominant position in the markets have reduced profit margins in the sector compared to the average profit margin per company. One reason could be that the small and medium-sized companies performed better, at least in 2006 (in 2000, the national postal service providers increased the indicator). By comparing the degree of concentration and the differences between the profit margin per company and the sector profit margin, it is possible to ascertain the performance of small and medium-sized companies (where the degree of concentration is high and profit margins per company are higher than that of the sector as a whole, smaller companies perform better than the dominant player, and vice-versa). This is just a rough indicator as well as an initial picture of the market and a basis for a deeper analysis.

Figure 86: The comparison of profit margins of the transport modes in the EU in 2000 and 2006



Source: Fraunhofer ATL, based on the database of Bureau van Dijk (see footnote No. 44)

4.6 Modal Choice

Over the past decades, transportation in the European Union has increased dramatically. Growth rates vary significantly between predominant transportation modes. The most common choice is road transportation (see the macroeconomic analysis). But other transport modes such as environmental-friendly inland waterways suitable for large cargo shipments and rail transport, which offers an economical solution for longer distances, or air transport, which is suited to high-speed shipments, also grew in importance.

By road, rail or water – freight can arrive at its destination in many ways. The choice of the mode of transport depends on many factors and is a complex issue for manufacturing and trading companies as well as for logistics companies organizing supply chains. These days there are many options and methods to determine an appropriate mode of transport. Considerable attention is often paid to factors such as costs, time in transit and the reliability of transit time. However, they mostly rely too heavily on economic cost factors and too little on behavioural factors. Different approaches will be described below.

Figure 87 shows modal choices based on cost and service requirements and the relation between the size of order/load (volume of freight) and the distance to be travelled.[51] The combination of these variables consequently determines the choice of transport mode. For example small parcels, which are carried short distances, will be distributed via road transport or post. In contrast, a 100-tonne-plus load that has to go thousands of kilometres will most probably go via sea freight.

Figure 87: Reasons for modal choice according Rushton 2006

Size of order/ load	short	medium	long	very long
100T	road	road/rail	rail/sea	sea
20T	road	road	road/rail	rail/sea
pallet	road	road	road/rail	air/sea
parcel	post/road	post/road/air	post/road/air	post/air

Delivery distance

Source: Rushton et al. 2006

Here it is clear that the modal choice depends on the size of the load and the distance. So, low-value short-range goods (e.g. stones and other mineral products from the building industry) are always transported by road, but goods with a high value such as cars are transported by rail - for example, from Spain to Germany.

Another source presents the results of weighting different criteria of modal choice.[52] In this cited study[53], purchasing managers were asked which the most important factors in choosing modes for distributing their goods were. Here, time and cost are the highest weighted criteria, followed by reliability. Again, it seems clear that the value of goods has no direct impact on the modal choice.

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[51] Rushton, Alan, Croucher, Phil, Baker, Peter: The Handbook of Logistics and Distribution Management, p. 359-380, 2006.

[52] Murphy, Paul R., Daley, James M.: A Framework for Applying Logistical Segmentation, published in: International Journal of Physical Distribution & Logistics Management, Vol. 24 No. 10, 1994, pp. 13-19.

[53] The original source is Gentry, J.J., Purchasing's Involvement in Transportation Decision Making, Center for Advanced Purchasing Studies/National Association of Purchasing Management, Tempe, AZ, 1991.

Figure 88: Criteria for modal choice of purchasing managers

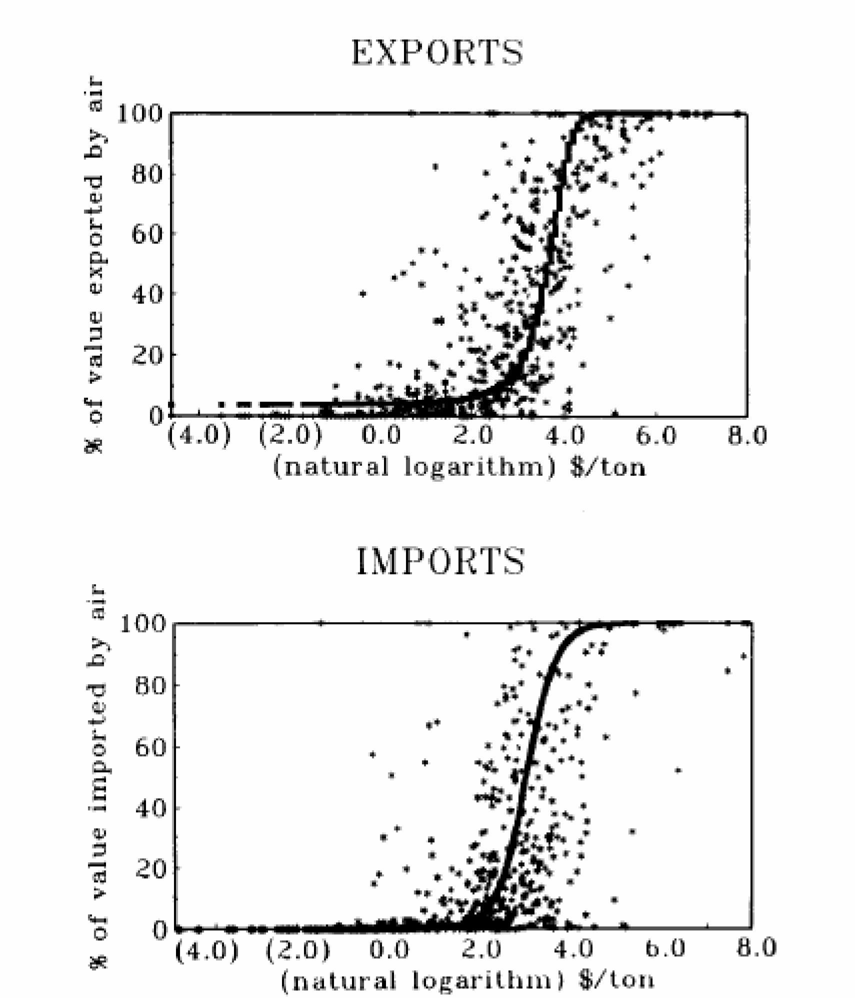
Factor	Percentage ranking First	Second	Third	Total
Required delivery date	41	8	20	69
Cost of transport	24	10	35	69
Reliability of service quality	16	24	10	50
Shipment size	14	14	10	38
Time in transit	2	25	6	33
Item type shipped	2	16	6	24
Possibility of damage	2	2	6	10
Available services	0	2	8	10

Source: Gentry 1991

One approach to determining the correlation between the value of goods and the choice of transport mode was through an empirical survey.[54] Here imports and exports to and from the U.S. in 1987 and their chosen mode (air or sea transportation) were examined. The results showed that low-value goods were most likely to be transported by water. On the other hand, high-value freight is often moved by air. However, the value-per-tonne range was wide: below 7,400 US$ per tonne, the shipments were always transported by sea; above 148,000 US$, by air. In between, no correlation could be identified (see *Figure 89*). This once more demonstrates the difficulty of determining the correlation between modal choice and the value of goods. Many other factors also have an impact on the modal choice (and they are mostly dependent on each other, see *Figure 87*).

[54] Warf, Barney: Air and water cargo transport mode substitutions among US customs districts, Maritime Policy & Management, 16:3,247-256, 1989.

Figure 89: Results of an empirical approach to show the correlation between value of goods and transport mode in external trade



Source: Warf 1989

In the following sections, a different method of identifying the possible reasons for modal choice was selected. In the first step, the "benefits" of or "services offered" by the different modes are presented. Here, the modes are rated according to ten criteria. In the next step, the requirements of different industries are compared to the different services offered by the transport modes. The following sections will therefore provide a picture of the qualitative criteria of choice and the different performance profiles, beginning with the characterization of each criterion[55].

[55] In chapter 6, a more detailed picture on the reliability and costs is given. Here, only qualitative issues are discussed.

4.6.1 Criteria of the performance profiles

In general, ten criteria are taken into account when choosing the “right” transportation mode[56]. These should include all the possible requirements forwarders might have:

1. **Speed**: The duration of transportation differs clearly between the transport modes (from about 10 km/h on inland waterways to several 100 km/h by plane). Also, as is discussed later, the requirements for this criterion for the transported goods vary.
2. **Mass transportation**: Here, mainly the ability of transport modes to carry large volumes or heavy goods.
3. **Network**: The density of the network is an important criterion, especially for the distribution of consumer goods. It ranges from a few static point-to-point networks such as sea- or airports to high-density road networks.
4. **Reliability**: Supply chain planning - especially to production plants - must make it possible to predict when goods will arrive at their destination in order to allow production to proceed without any break.
5. **Frequency of transportation**: This is defined as the frequency with which it is possible to request transportation services.
6. **Security**: Mainly, the security of the whole chain or the transported goods is included in this criterion.
7. **Flexibility**: The more flexible a transportation mode is, the more spontaneously a transport decision can be made.
8. **Costs**: The main reason for choosing a transport mode is the price.
9. **Ecological aspects**: Today, the managers and planners of supply chains think more about ecological aspects than in the past.
10. **Transparency**: The transparency of a transportation chain is very important because it allows a rapid reaction to any delay.

The profiles given above are likely to have a significant impact on modal choice in freight transport and might need to be taken into account. In the following sections, the different transportation modes are evaluated and their major attributes described in detail.

[56] See Fritz Voigt: Verkehr, die Theorie der Verkehrswirtschaft, 1973, Duncker&Humblot, Berlin.

4.6.2 Rail

In the rail sector, the main positive factors are the ability to transport large or bulky shipments; the reliability, security of the whole transportation chain; and environmental considerations. On the other hand, it also implies a network with less speed, density and flexibility.

Table 21: Rail transportation

Criteria	Characteristics				
Speed	++	+	0	-	--
Mass transportation	++	+	0	-	--
Network	++	+	0	-	--
Reliability	++	+	0	-	--
Frequency	++	+	0	-	--
Security	++	+	0	-	--
Flexibility	++	+	0	-	--
Costs	++	+	0	-	--
Ecological aspects	++	+	0	-	--
Transparency	++	+	0	-	--

Source: Fraunhofer ATL

4.6.3 Road

The main advantages of the road sector are the high density of the network, and high frequency and flexibility in the ordering of transportation services (see *Table 22*). As this mode of transport is largely the first choice (see macro-economic analysis), it seems that these characteristics meet most of the requirements.

Table 22: Road transportation

Criteria	Characteristics				
Speed	++	+	0	-	--
Mass transportation	++	+	0	-	--
Network	++	+	0	-	--
Reliability	++	+	0	-	--
Frequency	++	+	0	-	--
Security	++	+	0	-	--
Flexibility	++	+	0	-	--
Costs	++	+	0	-	--
Ecological aspects	++	+	0	-	--
Transparency	++	+	0	-	--

Source: Fraunhofer ATL

4.6.4 Inland waterway

Inland waterway transportation has advantages in mass transportation, security, costs and ecological aspects. However, compared to other transport modes, there are also many disadvantages (see *Table 23*).

Table 23: Inland waterway transportation

Criteria	Characteristics				
Speed	++	+	0	-	--
Mass transportation	++	+	0	-	--
Network	++	+	0	-	--
Reliability	++	+	0	-	--
Frequency	++	+	0	-	--
Security	++	+	0	-	--
Flexibility	++	+	0	-	--
Costs	++	+	0	-	--
Ecological aspects	++	+	0	-	--
Transparency	++	+	0	-	--

Source: Fraunhofer ATL

4.6.5 Sea

Transportation by sea is mostly chosen for longer routes or for feeder routes from smaller ports to the main ports such as Hamburg or Rotterdam. Therefore, its main advantage is its ability to move large volumes. Security concerns vary with the length of the routes but could be seen as a disadvantage.

Table 24: Sea transportation

Criteria	Characteristics				
Speed	++	+	0	-	--
Mass transportation	++	+	0	-	--
Network	++	+	0	-	--
Reliability	++	+	0	-	--
Frequency	++	+	0	-	--
Security	++	+	0	-	--
Flexibility	++	+	0	-	--
Costs	++	+	0	-	--
Ecological aspects	++	+	0	-	--
Transparency	++	+	0	-	--

Source: Fraunhofer ATL

4.6.6 Air

The most expensive transportation mode is air freight. Normally only time-critical or high-value goods are shipped by air (see next chapter). This illustrates the main advantages of air freight: speed, security and transparency.

Table 25: Air transportation

Criteria	Characteristics				
Speed	++	+	0	-	--
Mass transportation	++	+	0	-	--
Network	++	+	0	-	--
Reliability	++	+	0	-	--
Frequency	++	+	0	-	--
Security	++	+	0	-	--
Flexibility	++	+	0	-	--
Costs	++	+	0	-	--
Ecological aspects	++	+	0	-	--
Transparency	++	+	0	-	--

Source: Fraunhofer ATL

4.6.7 Matching the requirements of the industries and the transport modes

Using the results of the previous chapters, it is possible to match the requirements of the industries and the transport modes. This analysis was conducted in a former study[57]. The main results are illustrated in the following tables[58]. There the match of the goods and the transportation modes were analysed qualitatively and the results adjusted to fit with this study. The main focus here is on intra-European traffic, so incoming goods from abroad are not taken into account.

In the food and beverages industries, road transportation is generally the best choice. The reasons are speed, high-density networks and relatively low costs. Over long distances, transportation by rail within Europe, or by sea and air for intercontinental freight (which only applied to a few food products) are

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[57] Kille, Christian/Schmidt, Norbert: Wirtschaftliche Rahmenbedingungen des Güterverkehrs – Studie zum Vergleich der Verkehrsträger im Rahmen des Logistikprozesses in Deutschland, 2008, Fraunhofer IRB Verlag.

[58] The focused industries are highlighted.

both possible options. Recently, both Kraft Foods and REWE Austria decided to switch from road to rail to transport goods from Bludenz to Vienna[59].

The chemical sector is hard to rank because it ships both high-value and time-critical products as well as bulky goods. However, by dividing this market into basic materials and consumer products, a tendency can be identified. As with the food and beverages industry, chemical consumer goods are transported by road – except for high-volume products with a long storage life such as washing powder, where rail transportation might be the better option over long distances for cost and environmental reasons. In contrast, basic materials are mainly transported by rail because it can carry bulky goods and large volumes more cost-efficiently. In addition, these goods are non-perishable so there are no time requirements.

In the basic metal industry, inland waterway and rail transportation are the most interesting modes, as they can carry high volumes and heavy loads, and road transportation is usually chosen only for short routes. Companies in this industry are usually located near a port or railway station.

In the electronics industries, most of the goods are transported by road or – in intercontinental supply chains – by sea. Only the hinterland traffic of the sea-ports is sometimes handled by rail.

The automotive industry relies mainly on rail and road traffic. The OEMs (Original Equipment Manufacturers) mostly transport their vehicles and move their semi-finished goods between their manufacturing sites by rail, whereas the suppliers use road transportation because of its flexibility, reliability and speed.

To sum up, the combination of industries and transport modes are ranked according to three categories: the “↑” indicates the best match for at least a large group of goods in the industries; the “→” stands for a good match for some goods in the industry or in some circumstances; and the “↓” shows a poor match between the mode and the requirements of the industry.

[59] See e.g. http://www.verkehrsrundschau.de/suesse-transportloesung-789837.html.

Table 26: Matching of goods and transportation mode

	Road	Rail	Air	Inland ww	Sea
NACE	Qualitative ranking	Qualitative ranking	Qualitative ranking	Qualitative ranking	Qualitative ranking
01	↑	→	→	→	→
02	→	↑	↓	↑	→
05	↑	→	→	↓	→
10	↑	↑	↓	↑	→
15	↑	→	→	↓	→
16	↑	→	↓	→	→
17	↑	↑	↓	↓	→
18	↑	↑	↓	↓	→
19	↑	↑	↓	↓	→
20	→	↑	↓	↑	↑
21	↑	↑	↓	→	↑
22	↑	↓	→	↓	↓
23	→	↑	↓	↑	→
24	↑	↑	→	→	→
25	↑	→	↓	→	→
26	↑	↓	↓	↓	↓
27	→	↑	↓	↑	→
28	↑	↑	↓	↓	→
29	↑	→	→	↓	→
30	↑	→	→	↓	→
31	↑	→	↓	↓	→
32	↑	→	↓	↓	→
33	↑	→	→	↓	→
34	↑	↑	↓	↓	→
36	↑	→	↓	↓	→

Source: Kille/Schmidt 2008, partly adjusted

5 Terminal perspective

5.1 Introduction

Task 4 “the terminal perspective” aims to give a (qualitative and quantitative) description of the most important terminals and distribution centres across Europe in terms of tonnes throughput. Further, the Terms of Reference says the terminal perspective shall provide information on the terminals’ location, their main product areas, their main goods flows (including forecasts) and their use of various transport modes. It also involves getting some relevant information on the terminals’ performance and quality (handling capacity, transhipment costs, average waiting times).

In section 5.2, we first describe the approach concerning the selection of different types of terminals and distribution centres, the list of indicators, the data sources and collection of data. Next, sections 5.3 – 5.7 show the analysis and results with respect to airport terminals, seaport terminals, inland waterway terminals, road-rail terminals and logistics distribution centres. The data presented in these paragraphs are selected from the terminal database which is more comprehensive. Conclusions of the terminal perspective are drawn in section 5.8.

5.2 Approach

5.2.1 Selection of ‘terminals’

The selection of terminals is based on the throughput in tonnes and/or containers and the geographical balance across Europe. This resulted in a balanced set of terminals with respect to size of the terminal, type of inland waterway and location within Europe.

Statistical data regarding the largest distribution centres of logistics service is very scarce. Based on a top-100 list[60] a first selection of the largest logistics service providers in each member state was presented. This list however did not include distribution centres of large trading companies and manufacturers. Therefore the list was adapted by including some large trading companies and manufacturers, taking into account a well-balanced geographical spread across the EU.

[60] Top 100 in European Transport and Logistics Services, Klaus/Kille, 2007.

The preliminary list of distribution centres was continuously updated as new sources of information on distribution centres became available. The final list of terminals and distribution centres is presented in Annex 6.

5.2.2 Draft list of indicators

The second task has provided a list of indicators with regard to the terminals' performance (see table below). For each indicator information has been gathered both through existing data sources (statistics, reports and studies) and primary data collection (questionnaire and direct contacts with terminal operators).

A set of questionnaires has been developed (for each type of terminal) and sent to representatives of the ports (sea, air), terminal operators (inland shipping and road-rail) and distribution centres. Data collected (through statistics, reports, studies, websites) and received (through the questionnaire and direct contacts with operators) have been put in a database.

The next section presents the draft results of the data collection for airports, seaports, inland shipping terminals, road-rail terminals and distribution centres.

Table 27: List of indicators regarding terminal performance

	Airports	Seaports	Inland shipping terminals	Road-rail terminals	Distribution centres
Turnover and employment	X	X	X	X	X
Transport volume (tonnes +TEU)	X	X	X	X	X
Main good flows (OD)	X	X	X	X	X
Capacity	X	X	X	X	X
Surface area	X	X	X	X	X
Services offered	X	X	X	X	X
Transhipment costs	X	X	X	X	
Average waiting times	X	X	X	X	
Forecasts (volumes)	X	X	X	X	
Delivery reliability					X
Order fulfilment cycle time					X
Load factors					X

During the data collection process we learnt that some indicators, which were originally not on the above list, were very relevant for certain types of 'terminals'. In that case we have added these data in the report. Sometimes respondents were not willing to provide information on certain indicators (transhipment costs, average waiting times), i.e. for reasons of confidentiality. Or the value of indicators was simply varying and respondents were able to provide 'rough estimates' only. In that case we have tried to find further evidence from existing reports or by contacting experts.

In the sections 5.3 – 5.7 we provide quantitative information on the various indicators for airports, seaports, inland shipping terminals, road-rail terminals and distribution centres.

5.3 Airports

5.3.1 Introduction

In the terms of reference statistical data were requested for seaports, road-rail terminals, inland shipping terminals and distribution centres. Airports have been added to the 'terminal perspective', because freight transport by air is an important transport as well. Based on total throughput the airports of Frankfurt (DE), Paris-Charles de Gaulle (FR), Amsterdam Schiphol (NL) and London Heathrow (UK) were selected. Luxembourg has been added as this airport is mainly focussed on freight, whereas the other airports are big in terms of passengers as well. Next the airports of Copenhagen Kastrup (DK) and Madrid Barajas (ES) have been added to get a more geographical spread.

Figure 90: Selected Airports

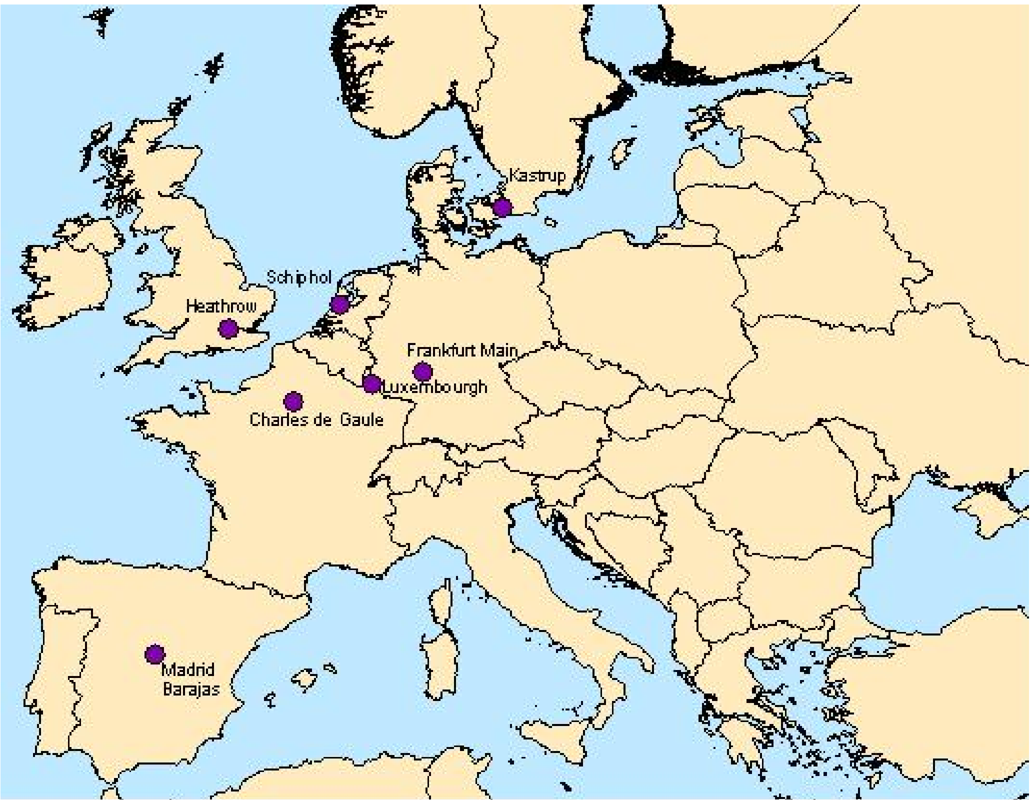


Table 28: Available indicators on air cargo terminals

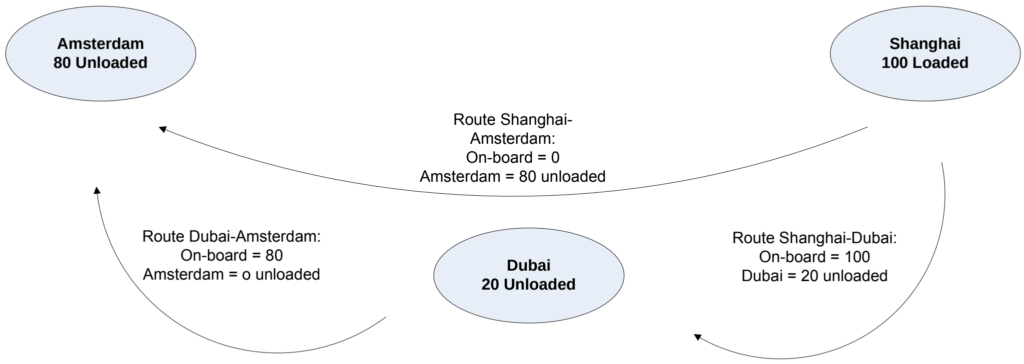
Indicator	Quality and Availability	Source
Turnover and employment	Available on air cargo operator level, hardly terminal specific	Annual reports airline operators
Throughput, tonnes and Workload unit (WLU)	Available, good quality	Eurostat, airport statistics
Percentage of WLU cargo and mail	Available, good quality	Eurostat, airport statistics
Share of cargo and passengers	Available, good quality	Eurostat, airport statistics
Main OD flows	Available from airport-to-airport, airport-to-country, within EU, outside EU, good	Eurostat
Total commercial (freight and mail) flight movements	Available, good quality	Eurostat
% of cargo by combi/belly freight	Partly available, good quality	Eurostat, airport statistics
Capacity	Available, bad quality (unreliable)	Airport statistics
Surface area	Available, bad quality (unreliable)	Airport statistics
Load factor	Sometimes available for cargo airlines	Airline operators

WLU: Workload Unit (see below)

5.3.2 Data and performance indicators

Throughput statistics are calculated based on Eurostat statistics on loaded and unloaded tonnes. Eurostat collects both statistics on tonnes that are 'on-board' and statistics of loaded and unloaded freight on an airport. This is further elaborated in *Figure 91* with an example of a flight from Shanghai via Dubai to Amsterdam. In this example, the tonnes unloaded for the flight Shanghai – Amsterdam is higher than the tonnes that are on board the aircraft. This can be explained by transit stops in long haul flights. In the example, 100 tonnes are loaded in a flight departing from Shanghai. The flight makes a transit stop in Dubai where 20 tonnes are unloaded, and continues towards Amsterdam, where the remaining 80 tonnes are unloaded. In the below figure an overview is given how this flight will be reported in airports statistics.

Figure 91: Elaboration of 'On-board' and 'throughput' statistics (ECORYS/ Eurostat)



Source: ECORYS / Eurostat

The most complete and recent figures on air cargo terminals are for the year 2006. *Table 29* below shows the throughput (both freight and mail) in 2006 for the selected airports based on different sources: Eurostat, Air cargo World and Atlas of cargo airports in Europe. There are significant differences between Eurostat and the two other sources with respect to the reported figures for Paris Charles de Gaulle. The issue of the freight air transport reported by the two airports in Paris (Charles de Gaulle and Orly) has been repeatedly raised by Eurostat to the French authorities[61], and more particularly to the data provider, the Direction General de l'Aviation Civil (DGAC). The Eurostat data for freight transport in the Paris airports are systematically underestimated, depending on the year, up to a 40 %. A new data collection system that will provide right cargo data for these two airports will be launched from 2009 onwards.

Based on the two other sources (Air cargo world and Atlas of cargo airports) Frankfurt and Paris Charles de Gaulle are the largest cargo terminals with both 2.1 million tonnes throughput of freight.

Table 29: Total throughput of selected terminal in 2006 and 2007

Terminal	Country	Total throughput in 2006* (1000 Tonnes)	Total throughput in 2007* (1000 Tonnes)	Total throughput in 2007** (1000 Tonnes)	Total throughput in 2006*** (1000 Tonnes)
Paris-Charles de Gaulle	FR	1,340	1,435	2,298	2,130
Frankfurt/ Main airport	DE	2,178	2,211	2,169	2,154
Schiphol Airport	NL	1,567	1,499	1,651	1,567
London Heathrow airport	UK	1,343	1,393	1,396	1,343
Luxembourg-Findel Airport	LU	633	703	857	752
Copenhagen Kastrup	DK	N/A	N/A	396	380
Madrid Barajas	ES	336	342	N/A	351

* Eurostat
** AirCargoWorld feature focus: Top 50 airports
*** Atlas of cargo airports in Europe, Netherlands Institue for spatial planning

A term which is often used in air transport is **'Workload Unit'** (WLU). This represents passenger traffic plus cargo traffic; one WLU represents 1,000 passengers or 100 tonnes of cargo. *Table 30* shows the percentage freight and mail cargo within the total WLU for 2000, 2005 and 2006. This indicates whether an airport can be characterised predominantly as a cargo or passenger airport. Luxembourg has a cargo share of 82 % and can therefore be characterised as a cargo airport. On the other hand, Madrid Barajas only has a share of 7 % of cargo and is therefore predominately a passenger airport.

[61] Email from Eurostat by Mr. De La Fuente Layos, dated 5 December 2008.

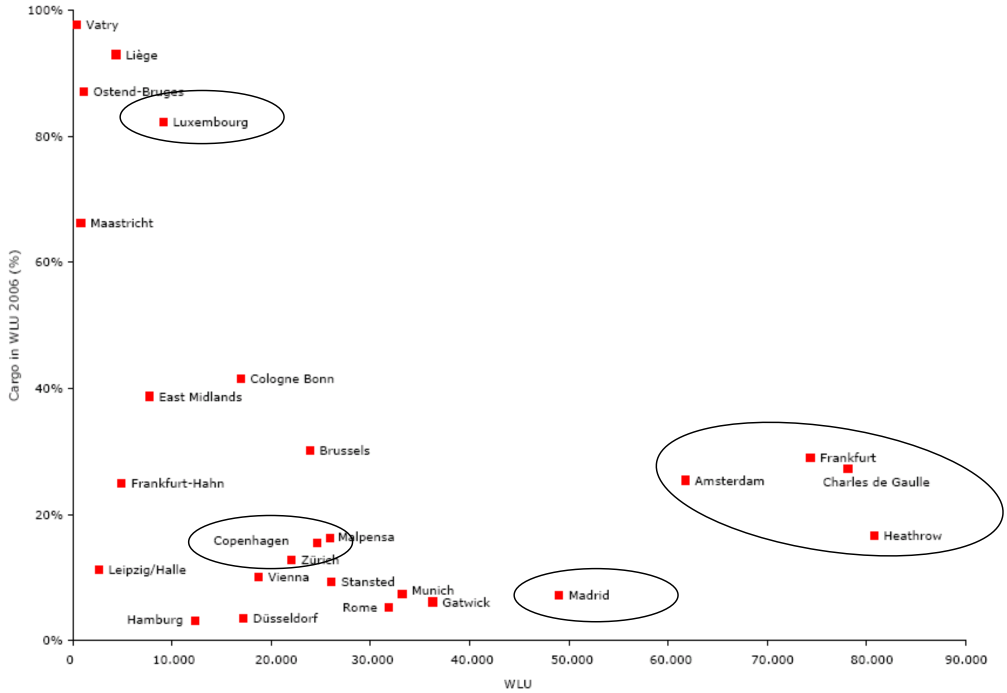
Table 30: WLU and cargo and mail as the share of total WLU in 2000, 2006

	2000	2006	2000	2006
	Workload unit (WLU)	Workload unit (WLU)	% of WLU cargo and mail	% of WLU cargo and mail
Frankfurt/ Main airport	66,665	74,351	26%	29%
Schiphol Airport	51,944	61,734	24%	25%
London Heathrow airport	78,296	80,765	18%	17%
Paris-Charles de Gaule	64,351	78,157	25%	27%
Luxembourg-Findel Airport	6,669	9,137	75%	82%
Copenhagen Kastrup	22,314	24,678	19%	15%
Madrid Barajas	36,270	49,038	9%	7%

Source: Atlas of cargo airports in Europe, NISR 2007

Figure 92 below characterises a broad range of European airports according to the share of freight and mail relative to the total WLU. On the right side of this figure, the group including Amsterdam, Frankfurt, Heathrow and Charles de Gaulle, are all large European airports with more or less the same share of cargo in terms of total WLU. Note that the share of cargo at Heathrow is somewhat lower than at the other three airports. The figure also confirms that Luxembourg is a relatively small European airport with a large share of cargo compared to the total WLU.

Figure 92: WLU versus percentage cargo of WLU in 2006 (NISR, 2007)



Source: Atlas of cargo airports in Europe, Netherlands Institute for Spatial Research (NISR) (2007)

The main **origin-destination** pairs (OD-flows) from airport-to-airport have been selected based on tonnes loaded plus unloaded (see *Table 31*). The most dense OD-pairs are between the larger European airports; Frankfurt, Amsterdam, Charles de Gaulle, Heathrow and large airports in the US and East Asia; New York JFK, Chicago O'Hare, Shanghai, Hong Kong, Gimpo Korea, Narita Japan, Singapore Changi. In addition, Dubai seems to be a big air freight hub for the Middle East. The Luxembourg airport which was characterized as a cargo airport shows some different main OD-pairs like Azerbaijan, Abu Dhabi, Huntsville USA, Beijing or Lagos Nigeria. The airport of Madrid Barajas which is a relatively small cargo airport mainly operates to/from the Spanish Canary islands and Spanish speaking countries like Argentina and Mexico. There was no information available on the main OD-pairs of Copenhagen Kastrup.

Table 32 shows the OD-pairs from airport-to-country and confirms that the largest volumes are between the largest economies and the rapidly developing economies: USA, Japan, China, Korea, India, United Arab Emirates.

Table 33 summarises the information on various indicators (total throughput, capacity and surface area) and combinations of indicators to estimate the airports' performance (capacity utilisation, terminal productivity).

Table 31: Main goods flows (airport-to-airport) Origin-Destination flows (Tonnes, 2007)

OD Pair	OD1 Name	OD1 Volume	OD2 Name	OD2 Volume	OD3 Name	OD3 Volume	OD4 Name	OD4 Volume	OD5 Name	OD5 Volume
Frankfurt/ Main airport	Gimpo Korea	149,786	Shanghai China	145,844	Hong Kong	139,205	Narita Japan	115,935	Chicago O'Hare USA	101,886
Schiphol Airport	Hong Kong	161,772	Shanghai China	99,590	Singapore Changi	78,586	Dubai	67,794	Narobi / Jomo Kenyatta	67,363
London Heathrow airport	New York JFK	114,786	Chicago O'Hara	81,037	Dubai	73,962	Los Angeles	61,257	Narita Japan	53,585
Paris-Charles de Gaule	Dubai	72,461	New York JFK	70,592	Shanghai	67,516	Chicago O'Hare USA	64,103	Hong Kong	63,942
Luxembourg-Findel Airport	Baku Azerbajan	145,586	Abu Dhabi	51,842	Huntsville USA	33,957	Beijing China	29,885	Lagos Nigeria	28,629
Madrid Barajas	Las Palmas Gran Canaria	20,512	Tenerife Norte	18,979	Ezeiza Ministro Argentina	17,818	New York JFK	15,312	Mexico City	14,574

Source: Eurostat

Table 32: Main goods flows (airport-to-country) Origin-Destination flows (Tonnes x1000, 2007)

OD Pair	OD1 Name	OD1 Volume	OD2 Name	OD2 Volume	OD3 Name	OD3 Volume	OD4 Name	OD4 Volume	OD5 Name	OD5 Volume
Frankfurt/ Main airport	United States	421	South Korea	150	China	146	Hong Kong	139	Japan	133
Schiphol Airport	United States	299	China	162	Hong Kong	100	United Arab Emirates	99	Japan	99
London Heathrow	United States	466	United Arab Emirates	91	India	84	Canada	62	South Africa	61
Paris-Charles de Gaule	United States	315	United Arab Emirates	84	China	68	Hong Kong	64	Japan	58
Luxembourg-Findel Airport	Azerbaijan	146	United States	114	United Arab Emirates	80	Nigeria	34	China	30
Madrid Barajas	United States	57	Germany	27	Belgium	18	Argentina	18	Brazil	16

Source: Eurostat

Table 33: Other terminal (performance) indicators

	Total throughput in 2006 (x1000 tonnes)	Capacity (x1000 tonnes)	Capacity utilisation (%)	Surface area (hec) Gross Floor Area (GFA)	Terminal productivity (x1000 tonnes/ha)	Total commercial (freight and mail) flights in 2006	% of cargo by combi/belly freight	Tonnes per full-freighter flight
Frankfurt/ Main	2,178	4,500	48%	35,4	62	25,905	41%	50
Schiphol	1,567	1,500	104%	37,5	42	16,854	42%	54
London Heathrow	1,343	800	168%	N/A	N/A	2,834	95%	24
Paris-Charles de Gaule	1,340	2,000	67%	50	27	48,536	N/A	N/A
Luxembourg-Findel	633	750	84%	36,8	17	11,519	N/A	N/A
Copenhagen Kastrup	N/A	N/A	N/A	4,6	N/A	7,890	N/A	N/A
Madrid Barajas	336	N/A	N/A	28,7	12	11,711	N/A	N/A

Source: Eurostat

The capacity utilisation is calculated as follows:

$$\text{Capacity utilisation} = \frac{Throughput}{Capacity}$$

The table shows that for Amsterdam Schiphol and London Heathrow, the capacity utilisation exceeds 100 %. Since the capacity utilisation cannot be higher than 100 %, this indicates that the reported capacity of these airports is probably dated.

The terminal productivity is calculated as follows:

$$\text{Terminal productivity} = \frac{Throughput}{Gross\ surface\ area}$$

The reliability of this statistic depends on the quality of reporting of the surface area. It is not known if airports report their gross floor area of the cargo terminals consistently. Based on the calculations the terminal productivity of the selected airports varies between 12,000 tonnes per hectare (Madrid Barajas) up to 62,000 tonnes per hectare (Frankfurt – Main). Although Luxembourg airport can be characterised as a freight airport, surprisingly this airport has a relatively low terminal productivity.

Finally, some performance indicators which are believed to be relevant for the sector as they are frequently reported have been collected as well. These are total commercial flights, % of cargo by combi/belly freight and tonnes per full-freighter flight. Remarkably London Heathrow the third largest freight airport reports a relatively low number of commercial freight flights. With 95 % of all freight throughputs, belly freight seems to be dominant at London Heathrow. Furthermore, the tonnes per full-freighter flight can be calculated:

$$\text{Tonnes per full-freighter flight} = \frac{Throughput * (1 - \%\,belly\ freight)}{Number\ of\ freighter\ flights}$$

Frankfurt/Main and Amsterdam Schiphol are quite close to each other in that respect (50 tonnes/full freighter and 54 tonnes/full freighter respectively). London Heathrow handles on average 24 tonnes/full freighters. Based on two cargo operators, an indication of the cargo load factor of air cargo carriers in Europe is approximately 70 % in 2007[62].

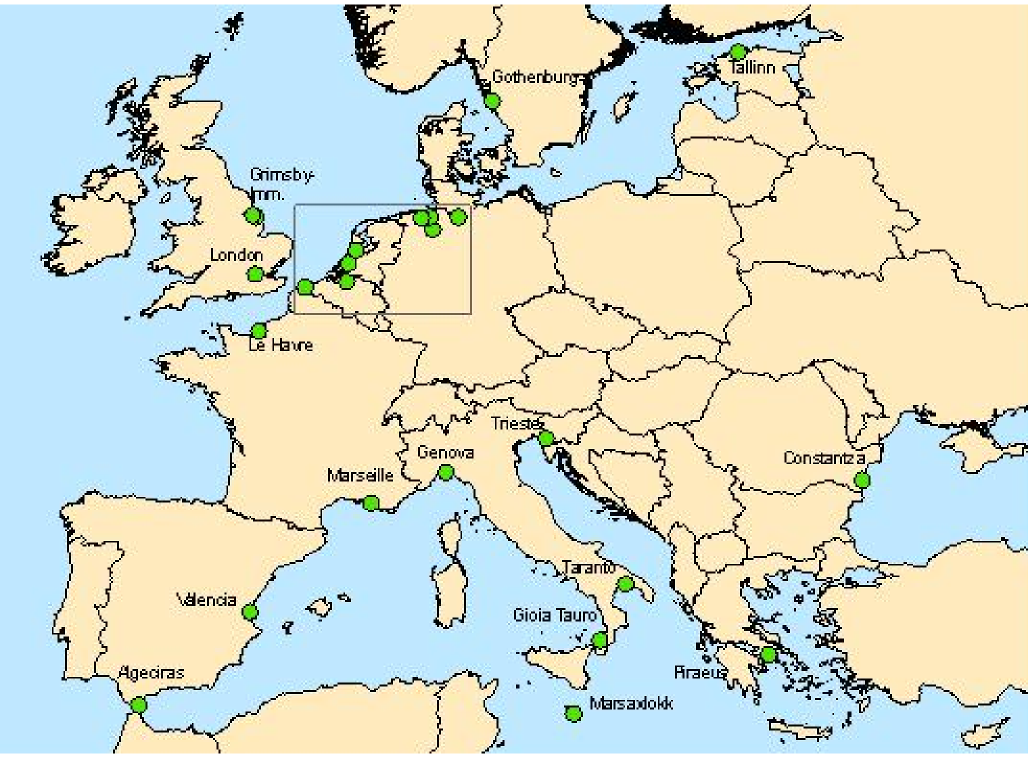
[62] Source: Lufthansa, Cargolux.

5.4 Seaports

5.4.1 Introduction

Based on the throughput of the EU ports a first draft selection was made, which resulted in a list of seaports which are located in Western Europe mainly. A better geographical coverage was therefore preferred. A Baltic port (Tallinn), a Greek port (Piraeus) and a Scandinavian port (Gothenburg) have been added to the list. Further it is preferred to include some important tran-shipment ports as well (besides Algeciras which was already included). Therefore, Gioia Tauro and Marsaxlokk have been added to the list.

Figure 93: Selected Seaports



The collection of statistical data has been executed by using various sources:

- ISL (2007), Shipping statistics yearbook 2007
- Berenberg Bank & HWWI (2006), Strategie 2030 – Maritime Wirtschaft und Transportlogistik
- OSC (2006), The European & Mediterranean container port markets.
- Annual Container market review and forecast 2007/ 2008
- Cargo Systems (2008), issue September 2008
- Questionnaires

Figure 94: Selected ARA ports

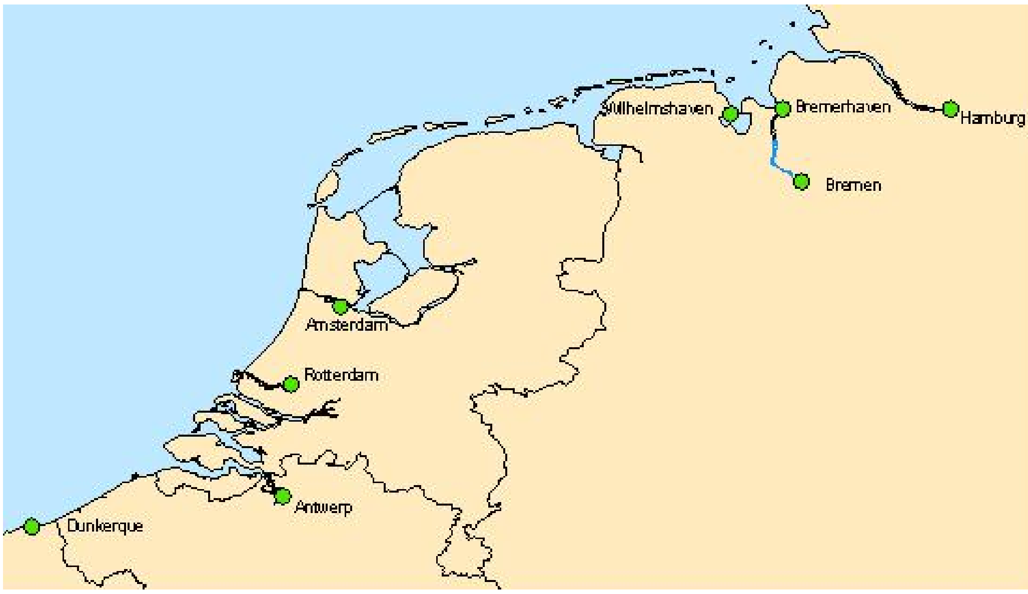


Table 34: Available indicators on seaport terminals

Indicator	Quality and Availability	Source
Turnover and employment	Available on port level, but inconsistent. No figures available on terminal level.	Port authorities, annual reports, questionnaires
Throughput, tonnes and TEU	Good availability, good quality	ISL statistical yearbook, Containerisation international, Questionnaires
Forecast of throughput	Multiple available, forecast period and geographical scope varies	Multiple a.o. Netherlands Bureau for Economic Policy Analysis, Ocean shipping consultants
Capacity	Available for 2004, good quality	Ocean shipping consultants
Main OD flows	Mostly available for larger geographical areas	ISL
Breakdown in commodities	Available for main goods	ISL
Modal split	Available for hinterland transport in Hamburg - Le Havre range	Schiffahrt Hafen Bahn und Technik
Transshipment containers	Available for larger container ports	Drewry
Berth productivity	Available for 2007 for a limited number of terminals, will become available for the top 100 terminals in the future	Cargo Systems
Terminal productivity	Available for 2007 for a limited number of terminals, will become available for the top 100 terminals in the future	Cargo Systems
Transshipment costs	Poor availability	Questionnaires
Average waiting times	Poor availability	Questionnaires

5.4.2 Data and performance indicators

Throughput and **capacity** of the selected seaports is presented in the following table. *Table 35* shows that there is a large difference in both size and characteristics of the ports. There is a great difference in the percentage of containerised cargo. Some ports, like Bremen, Valencia and Gioia Tauro have a relatively high percentage of containerisation. Looking at the **forecasted growth of throughput**, there is a large difference between ports that have a high percentage of containerised cargo and ports that mainly accommodate general cargo. Estimated growth of container ports is higher than that of other ports.

Table 35: Realised and forecasted throughput and capacity of selected terminals[63]

		Throughput 2006		Forecasted Throughput 2030		Capacity in mln. TEU	
		Tonnes (mln)	TEU (x 1000)	Forecast tonnes 2030	Alt. forecast	2004	2015
Rotterdam	NL	378	9,690	805	826	8.4	20.0
Antwerp	BE	167	7,019	486	486	6.6	16.0
Hamburg	DE	135	8,882	486	528	7.3	14.0
Marseille	FR	100	950	151	133	1.5	3.0
Amsterdam	NL	84	306	77	75	1.2	1.2
Le Havre	FR	74	2,138	191	169	2.9	7.3
Algeciras	ES	66	3,257	217	218	3.1	9.1
Bremen/ Bremenhaven	DE	65	4,444	219	205	3.8	7.1
Grimsby & Immingham	UK	64	137	70	68		
Constantza	RO	57	1,037			0.6²	1.5²
Dunkerque	FR	57	205	74	70	0.6	1.0
Genova	IT	55	1,657	122	118	1.8	3.6
London	UK	52	1,699	114	104	-	2.1
Taranto	IT	49	892	80	86	1.2	2.0
Trieste	IT	48	220			0.4	0.6
Valencia	ES	47	2,612	153	155	2.5	6.2
Wilhelmshaven	DE	43	0			-	2.7
Tallinn	EE	41	152			0.2²	0.5²
Gothenburg	SE	41	820	66			
Gioia Tauro	IT	29	2,938	210	180	3.5	8.2
Piraeus	GR	21	1,403				
Marsaxlokk	MT	21¹	1,485			1.8²	3.1²

Source for Throughput 2006: ISL (2007), Shipping statistics yearbook 2007.
Source for Forecasted Throughput 2030: Berenberg Bank & HWWI (2006), Strategie 2030 – Maritime Wirtschaft und Transportlogistik
Source for Capacity 2004/2015: OSC (2006), The European & Mediterranean container port markets

The ports have also been contacted through a questionnaire to provide information on the throughput over the last three years. However, the next table

[63] ¹Estimate based on TEU throughput (source Containerisation International Yearbook 2008) and throughput other goods (Source: ECORYS (2007), Feasibility and Environmental Impact Studies for Maritime Transport Infrastructural Projects – Malta)
²Total capacity of the country.

provides the data on throughput of containers (TEU) for a selection of ports based on Eurostat. All ports show a (considerable) increase in container throughput between 2003 and 2006, except Gioia Tauro (IT) and Piraeus (GR). Constanta and Antwerp show the largest relatively growth between 2003 and 2006.

Table 36: Throughput (1,000 TEU) 2005-2007

Port	2003	2004*	2005	2006	2007	Growth 2006-2007	Growth 2003-2007
Rotterdam	7,118	8,242	9,195	9,575	10,773	13%	51%
Hamburg	6,126	7,004	8,084	8,878	9,914	12%	62%
Antwerp	4,012	5,055	6,221	6,718	7,879	17%	96%
Bremen/B'haven	3,191	3,501	3,741	4,504	4,884	8%	53%
Algeciras	2,024	970	3,184	3,262	3,420	5%	69%
Gioia Tauro**	3,094	3,170	3,123	2,835	N.A.	N.A.	-8%
Valencia	2,012	2,156	2,415	2,615	3,049	17%	52%
Le Havre**	2,015	2,158	2,144	2,119	N.A.	N.A.	5%
Piraeus	1,606	1,551	1,401	1,413	1,384	-2%	-14%
Constanta	N.A.	391	867	1,170	1,445	24%	270%
Marseille	835	920	911	950	1,058	11%	27%
Goteborg**	634	722	722	812	N.A.	N.A.	28%

Eurostat
* 2004 underestimated figures
** Growth of 2003-2006 period

The **forecasted growth of throughput** in the above *Table 36* is based on a study of HWWI. The Netherlands Bureau for Economic Policy Analysis remarks in a comparative study that the container forecast of HWWI is at the high end of what is expected by different institutes. The Bureau concludes that the annual growth of container throughput will grow within a range of 4 % to 6 %.

Table 37: Comparison of different container throughput forecasts

Institute	Geographical range	Scenario	Forecast period	Annual growth of container throughput
Netherlands Bureau for Economic Policy Analysis	Dutch seaports	Low scenario	2002-2020	3.5%
		High scenario	2002-2020	6.9%
Ocean Shipping Consultants	Range Hamburg - Le Havre	Base scenario	2003-2020	4.7%
		High scenario	2003-2020	5.8%
		Low scenario	2003-2020	4.5%
UNESCAP	Worldwide exclusing Asia		2002-2015	5.8%
HWWI	Range Hamburg - Le Havre		2004-2030	7.9%
Global Insight	Worldwide		2004-2014	6.1%
			2015-2024	5.0%

Source: CPB Netherlands Bureau for Economic Policy Analysis (2006), Adaptation long term scenario's for container transport. CPB Memorandum 172. (in Dutch)

There are large inconsistencies in the data for **annual turnover** and **employment** in the existing reports. For some ports the annual figure of the port authority is presented. Other ports publish statistics on turnover and employment of all port related companies. A third reporting method that is used by ports is the turnover and employment of both direct and indirect port related activities. Therefore some primary data collection has been done through a questionnaire. The respondents were asked to specify the annual turnover and persons employed directly related to their port for the last three years (2005-2007). The next tables provide the data on annual turnover and number of employees for the ports who responded to the questionnaire.

Table 38: Annual turnover (million €) 2005-2007

	2005	2006	2007	Growth 2005-2006	Growth 2006-2007
Marseilles	175	181	184	3.4%	1.7%
Constanta	21	29	39	38.1%	34.5%
Dunkerque	74	75	78	1.4%	4.0%
Tallinn	72	75	74	4.2%	-1.3%
Gothenburg	143	163	170	14.0%	4.3%

Source: questionnaire, ECORYS 2008.

For all of the above listed ports annual turnover is increasing in the reporting period, with a small decrease for the port of Tallinn in the period 2006-2007. Annual turnover in the port of Constanta is growing at a considerable rate.

The number of employees is showing a small decline in the same period for Dunkerque and Tallinn, whereas the port of Constanta and Gothenburg show an increase in number of employees.

Table 39: Number of employees 2005-2007

	2005	2006	2007	Growth 2005-2006	Growth 2006-2007
Marseilles	1,496	1,525	1,511	1.9%	-0.9%
Constanta	408	443	562	8.6%	26.9%
Dunkerque	510	500	476	-2.0%	-4.8%
Tallinn	609	566	553	-7.1%	-2.3%
Gothenburg	1,128	1,173	1,216	4.0%	3.7%

Source: questionnaire, ECORYS 2008.

In *Table 40* a regional division is presented of the loading and unloading regions of cargo in selected ports. On average, 43 % of total throughput in the selected ports has an **origin** or **destination** in Europe. The relatively low percentage of Europe as an origin or destination shows that a large percentage of throughput in European ports consists of intercontinental trade (for example from Asia towards Europe and vice versa). Cargo traffic to or from other continents (with the exception of Oceania) is roughly equally divided. There are however large regional differences. Southern ports (Marseille, Algeciras, Genova) are for example more oriented on Africa than Northern ports. Ports that have a high percentage of containerised cargo have a relatively large share in Asia.

Table 40: Cargo traffic of selected ports by loading and unloading regions for 2006 (in % total cargo)

		Africa	America	Asia	Europe	Oceania	unknown
Rotterdam	NL	15%	20%	18%	45%	3%	0%
Antwerp	BE	13%	27%	26%	32%	2%	0%
Hamburg	DE	5%	17%	37%	40%	1%	
Marseille	FR	36%	11%	6%	45%	3%	
Amsterdam	NL	10%	28%	14%	45%	1%	2%
Le Havre	FR	24%	11%	18%	46%	1%	
Algeciras	ES	36%	12%	23%	21%	0%	9%
Bremen/B'haven	DE	4%	26%	19%	51%	1%	
Dunkerque	FR	11%	24%	4%	52%	10%	
Genova	IT	26%	9%	19%	42%	0%	3%
Valencia	ES	15%	18%	33%	33%	1%	2%
Wilhelmshaven	DE	16%	9%	0%	52%		24%
Tallinn	EE	3%	9%	6%	81%	0%	1%
Piraeus	GR	4%	2%	35%	54%	0%	5%
Average (weighted)		**16%**	**18%**	**19%**	**43%**	**2%**	**2%**

Source: ISL *(2007), Shipping statistics yearbook 2007*

Note: Because of rounding off, percentages may not sum up to 100 %.

The selected ports differ greatly in **commodities** that are being transferred. On average, liquid bulk (raw oil, oil products) has the largest share in total throughput. Relatively large liquid bulk ports are Rotterdam, Marseille, Le Havre and Trieste. The second largest type of commodity is containerised general cargo. The largest container ports are Rotterdam, Antwerp, Hamburg, Algeciras and Bremen. Large dry bulk ports are Rotterdam, Amsterdam, Constanta and Dunkerque.

Table 41: Breakdown of total throughput in main goods for 2006 (in % total cargo)[64]

		Dry bulk	Liquid Bulk	General cargo	
				Containers	Other
Rotterdam	NL	23%	47%	25%	5%
Antwerp	BE	16%	23%	48%	14%
Hamburg	DE	21%	11%	66%	2%
Marseille	FR	16%	67%	0%	16%
Amsterdam	NL	57%	30%	4%	9%
Le Havre	FR	5%	64%	28%	2%
Algeciras	ES	4%	31%	59%	7%
Bremen/B'haven	DE	13%	4%	69%	14%
Grimsby & Immingham	UK	38%	38%	2%	23%
Constantza	RO	49%	26%	7%	18%
Dunkerque	FR	49%	25%	0%	26%
Genova	IT	12%	39%	28%	20%
London	UK	32%	37%	28%	3%
Taranto	IT	49%	15%	14%	22%
Trieste	IT	4%	78%	6%	11%
Valencia	ES	15%	9%	59%	17%
Wilhelmshaven	DE	5%	95%	0%	0%
Tallinn	EE	28%	59%	3%	11%
Gothenburg	SE	0%	51%	0%	49%
Gioia Tauro	IT	0%	0%	100%	0%
Piraeus	GR	2%	0%	64%	33%
Marsaxlokk¹	MT	0%	20%	80%	0%
Average (weighted)		**22%**	**37%**	**30%**	**11%**

Source: ISL (2007), Shipping statistics yearbook 2007

Due to geographical differences in the ports, there is a large difference in the modal split of hinterland transport. Some important corridors can be distinguished. A first corridor is the Rhine–corridor (Rotterdam, Antwerp and Amsterdam). The Rhine gives access to a large urban market (Ruhr area in Germany). Because of the large draught of the Rhine, transport is possible with large vessels (see also waterway classification next page, Rhine is in the largest category). Therefore transport by inland shipping is relatively cheap. The large share of inland shipping for Rotterdam and Antwerp is partly overestimated, because part of the inland shipping consists of shipments between the two ports (about 617.000 TEU in 2006). A second important geographical distinction is the large share of rail transport in the German ports. In Northern Germany, rail transport is well developed. Furthermore, there are limited options for inland waterway transport.

[64] ¹Estimate based on TEU throughput (Source Containerisation International Yearbook 2008) and throughput other goods (Source: ECORYS (2007), Feasibility and Environmental Impact Studies for Maritime Transport Infrastructural Projects – Malta)

Classification of European inland waterways

CLASSIFICATION OF EUROPEAN INLAND WATERWAYS

Type of inland waterways	Classes of navigable waterways	Motor vessels and barges – Type of vessel: General characteristics – Designation	Maximum length	Maximum beam	Draught 7/	Tonnage	Pushed convoys – Type of convoy: General characteristics	Length	Beam	Draught 7/	Tonnage	Minimum height under bridges 2/	Graphical symbols on maps
			L(m)	B(m)	d(m)	T(t)		L(m)	B(m)	d(m)	T(t)	H(m)	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
OF REGIONAL IMPORTANCE – To West of Elbe	I	Barge	38.5	5.05	1.80-2.20	250-400						4.0	
	II	Kampine-Barge	50-55	6.6	2.50	400-650						4.0-5.0	
	III	Gustav Koenigs	67-80	8.2	2.50	650-1,000						4.0-5.0	
OF REGIONAL IMPORTANCE – To East of Elbe	I	Gross Finow	41	4.7	1.40	180						3.0	
	II	BM-500	57	7.5-9.0	1.60	500-630						3.0	
	III	6/	67-70	8.2-9.0	1.60-2.00	470-700		118-132	8.2-9.0	1.60-2.00	1,000-1,200	4.0	
OF INTERNATIONAL IMPORTANCE	IV	Johann Welker	80-85	9.5	2.50	1,000-1,500		85	9.5 5/	2.50-2.80	1,250-1,450	5.25 or 7.00 4/	
	Va	Large Rhine vessels	95-110	11.4	2.50-2.80	1,500-3,000		95-110 1/	11.4	2.50-4.50	1,600-3,000	5.25 or 7.00 or 9.10 4/	
	Vb							172-185 1/	11.4	2.50-4.50	3,200-6,000		
	VIa							95-110 1/	22.8	2.50-4.50	3,200-6,000	7.00 or 9.10 4/	
	VIb	3/	140	15.0	3.90			185-195 1/	22.8	2.50-4.50	6,400-12,000	7.00 or 9.10 4/	
	VIc							270-280 1/ 195-200 1/	22.8 33.0-34.2 1/	2.50-4.50 2.50-4.50	9,600-18,000 9,600-18,000	9.10 4/	
	VII						8/	285	33.0-34.2 1/	2.50-4.50	14,500-27,000	9.10 4/	

Source: ECMT Resolution 92/2 on New Classification of Inland Waterways

Hinterland transport is documented for some ports in the Hamburg – Le Havre range. Outside of this region, there is almost no documentation for hinterland transport of containers. Partly this can be explained by the large share of transhipment in Mediterranean ports.

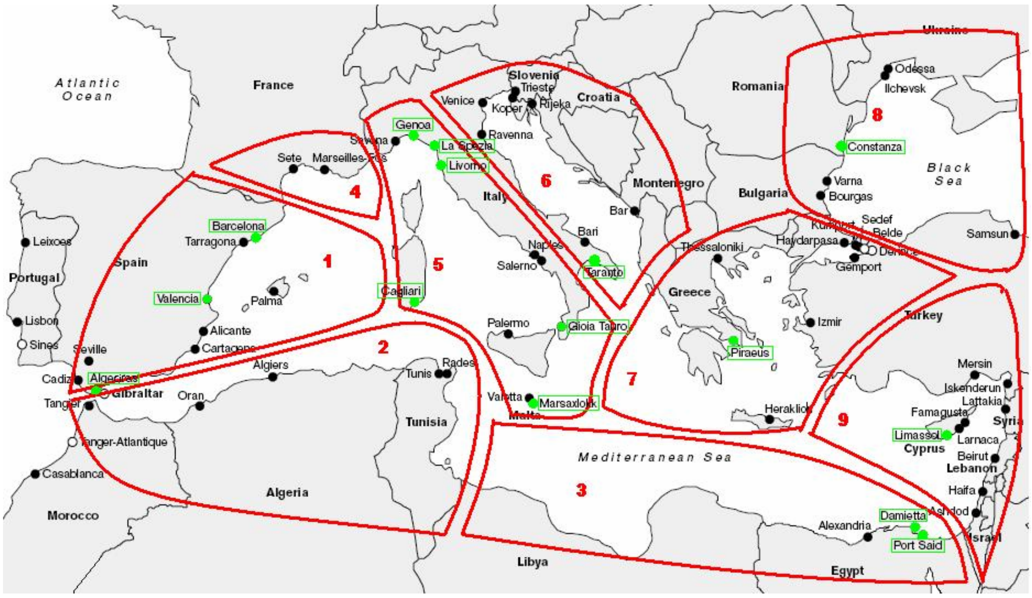
Table 42: Modal split of hinterland transport of container throughput in 2006[65]

		Road	Rail	Inland shipping
Rotterdam	NL	60.0%	9.0%	31.0%
Antwerp	BE	59.9%	8.0%	32.1%
Hamburg	DE	66.8%	31.4%	1.8%
Marseille	FR	82.0%	12.0%	6.0%
Amsterdam	NL	54.0%	3.0%	43.0%
Le Havre	FR	86.8%	5.1%	8.1%
Bremen/ B'haven	DE	39.6%	56.3%	4.1%
Constantza	RO	47.6%	47.3%	5.1%
Dunkerque	FR	88.0%	8.0%	4.0%

Besides hinterland transport, an important logistics feature for seaports is the amount of **container transshipment**. Transshipment of containers between shipping lines can be distinguished in transshipment for hub-spoke systems (between mainline and feeder line) and transshipment of containers between mainline services, referred to as relay transshipment. The transshipment for hub-spoke systems applies to feeder areas such as the Nordic area or parts of the Mediterranean. In the below map an example of feeder areas is presented for the Mediterranean. In most ports hub-spoke transshipment dominates, while a few ports have also considerable volumes of relay transshipment. Relay transshipment often concerns ports on locations where north – south and east – west lines cross. In practice it is often applied within one company (i.e. Maersk in Algeciras).

[65] ¹Estimate based on TEU throughput (Source Containerisation International Yearbook 2008) and throughput other goods (Source: ECORYS (2007), Feasibility and Environmental Impact Studies for Maritime Transport Infrastructural Projects – Malta).

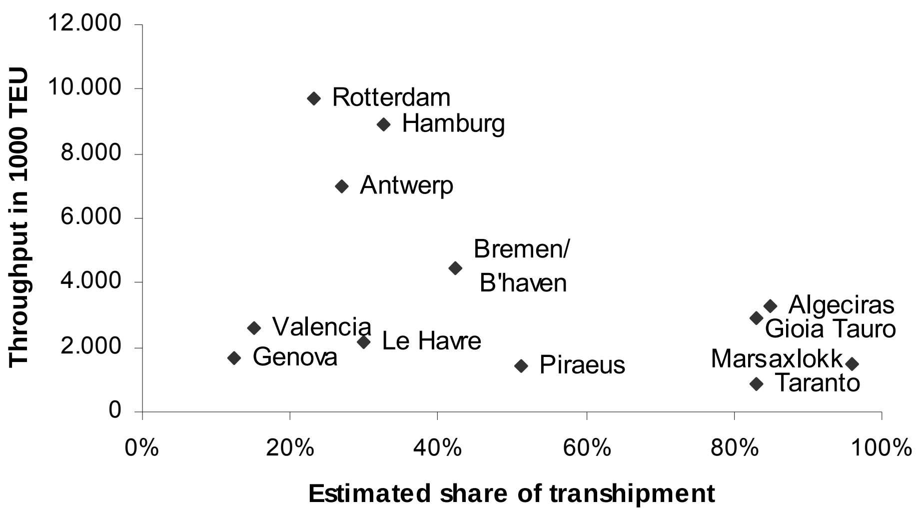
Figure 95: Map of feeder areas and hub-ports in the Mediterranean



Source: ECORYS adapted from Drewry international

The following figure categorises main container ports by the estimated share of transhipment (x-axis) and TEU throughput (Y-axis). The share of transhipment is relatively small in large container ports such as Rotterdam and Hamburg. These ports mainly function as a hub towards Great Britain and Scandinavia. In the Mediterranean Marsaxlokk, Taranto, Algeciras, Gioia Tauro and Port Saïd (Egypt) are the main container hubs. Other Mediterranean ports have a much lower share of containerisation. These ports mainly serve the hinterland, and mainly have some level of transhipment because of the large container throughput in the port.

Figure 96: Share of transhipment versus size of container throughput in 2006



Source: ECORYS adapted from Drewry (2007), Annual Container market review and forecast 2007/ 2008

In a recent study by Cargo Systems[66] methods of comparing **productivity** of maritime terminals were analysed. A traditional way to compare berth productivity of terminals is to assess the TEU per meter berth per year. This is a relatively simple exercise, but has as a shortcoming that it doesn't measure the capital intensity of the terminal. If for instance a terminal invests in an additional quay crane, productivity of the terminal will increase. It is however uncertain whether this terminal is more productive than terminals that have less capital investment, but for instance operate more efficiently. Cargo Systems therefore proposes to include a cost element in the productivity measure: the "TEU per US$1,000 per annum". This measurement tool can be calculated by the following means:

$$Berth\ productivity = \frac{365 * R * N * U}{C}$$

Where:

C = Cost per berth (both capital and direct[67])

R = Ship-To-Shore crane unit working rate (TEU per day)

N = Ship-To-Shore cranes per berth (#)

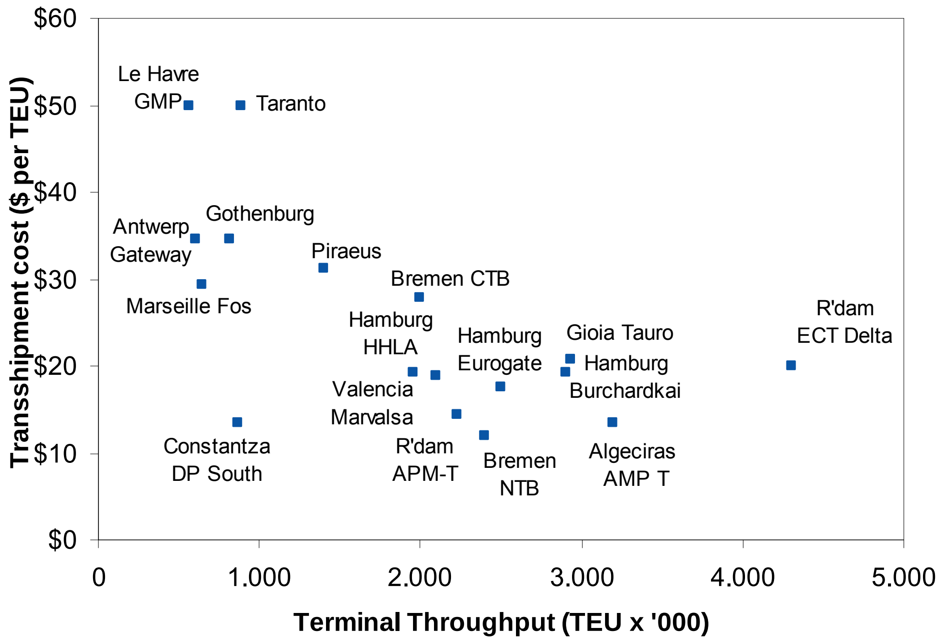
U = Berth utilization (%)

The results of the cargo systems methodology is depicted below and shows that the transshipment cost per TEU (based on productivity in TEU per $1,000) decreases as the terminal throughput increases (economies of scale).

[66] Cargo Systems, issue September 2008, p. 44-48.

[67] Cargo Systems 2008: The capital costs cover berth construction back to the extent of the STS crane overhang at the rear of the berth, the provision of crane rails and electrical power, and the cost of STS cranes and spreaders. These capital costs have then been separately annualized at appropriate depreciation rates. The direct costs included cover labour and maintenance but not power consumption.

Figure 97: Relationship between transhipment cost and terminal throughput in 2006



In the following *Table 43* an overview is given of both the berth productivity measured in throughput per meter berth as well as the productivity per meter berth in TEU per $1,000 cost (capital and direct cost included) per year (in short TEU per $1,000 annum). The table shows that there is a relatively weak correlation between the two mentioned factors.

Table 43: Berth productivity for selected container terminals in 2006[68]

Name Port	Name Terminal	Throughput per metre berth per annum	Productivity (TEU per $1,000)	Productivity ($ per TEU)
Rotterdam	APMT	1394	70	14
	ECT Delta	1194	50	20
Antwerp	BE	364	29	35
Hamburg	HHLA			
	Altenwerder	1500	53	19
	Burchardkai	1018	52	19
	Eurogate	1220	57	18
Marseille	Fos	550	34	29
Amsterdam				
Le Havre	GMP	316	20	50
Algeciras	APMT	1732	74	14
Bremen/B'haven	NTB	2182	83	12
	CTB	690	36	28
Grimsby & Immingham				
Constantza	DP South	1036	74	14
Dunkerque				
Genova				
London				
Taranto		595	20	50
Trieste				
Valencia	Marvalsa	1099	52	19
Wilhelmshaven				
Tallinn				
Gothenburg		364	29	35
Gioia Tauro		865	48	21
Piraeus		506	32	31
Marsaxlokk				
Average		**978**	**48**	**25**

Source: Cargo Systems (2008) issue September 2008

Other performance indicators include **transshipment costs**[69] and **average waiting time**[70]. The response rate for these indicators in the questionnaire was around 35 %. Mentioned transshipment costs varied between €80 and €125 per move[71]. Average waiting time of ships at terminals is estimated by the respondents between 10 and 15 hours. The questionnaire response was

[68] The productivity in the last column is recalculated based on the previous column with the productivity in TEU per $1,000 cost (capital and direct cost included) per year.

[69] Transhipment costs are defined as the average cost for one move of a loading unit (i.e. container). A move can be from the incoming modality to the stack, from the stack to the outgoing modality, or directly from the incoming modality to the outgoing modality.

[70] The average waiting time is defined as the average number of hours or days a loading unit or vehicle (i.e. container, vessel, truck, train/wagon) stays at the terminal (measured from the moment the loading unit or vehicle enters the terminal area until it leaves the terminal area.

[71] One move can be from the incoming modality to the stack, from the stack to the outgoing modality, or directly from the incoming modality to the outgoing modality.

too low in order to illustrate any regional differences regarding transshipment costs and average waiting times.

Almost all services that were mentioned in the questionnaire (storage / empty depot / value added / services like repacking, tagging / customs / administration / dangerous goods / reefer power) are offered at the seaports. In two cases respondents said no empty depots are offered and in one case no packing and tagging is offered at the terminal.

5.5 Inland shipping terminals

5.5.1 Introduction

Based on the throughput of the inland shipping terminals a first draft selection was made. In order to have a better geographical coverage it was preferred to include terminals in some of the Danube ports. For that reason Vienna and Budapest have been added to the list. As Seville mainly concerns sea-going vessels it was skipped from the list.

Figure 98: Selected inland shipping terminals (ports)

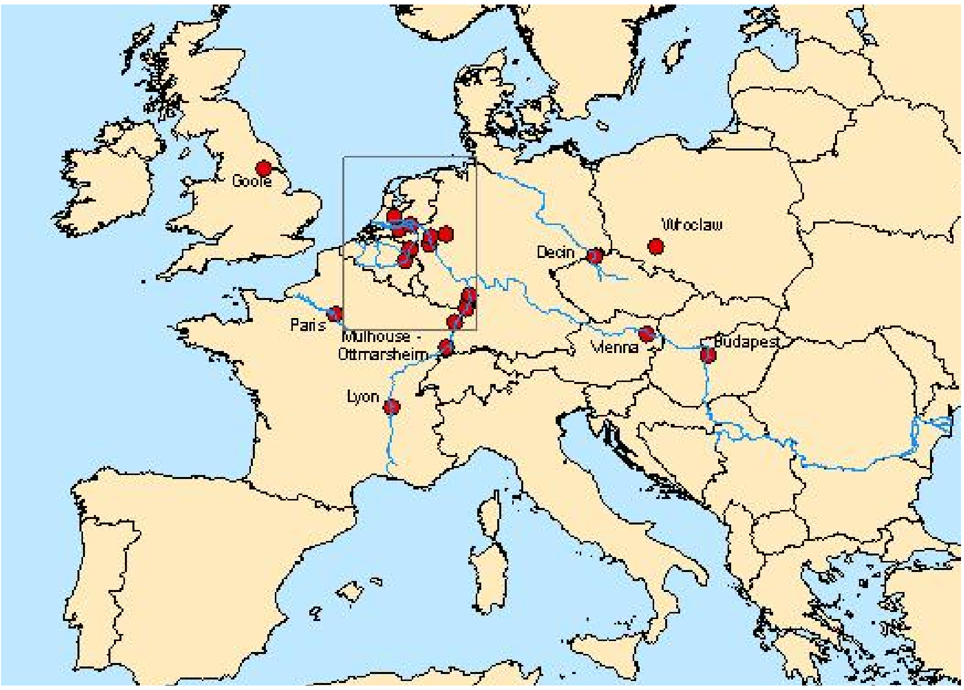
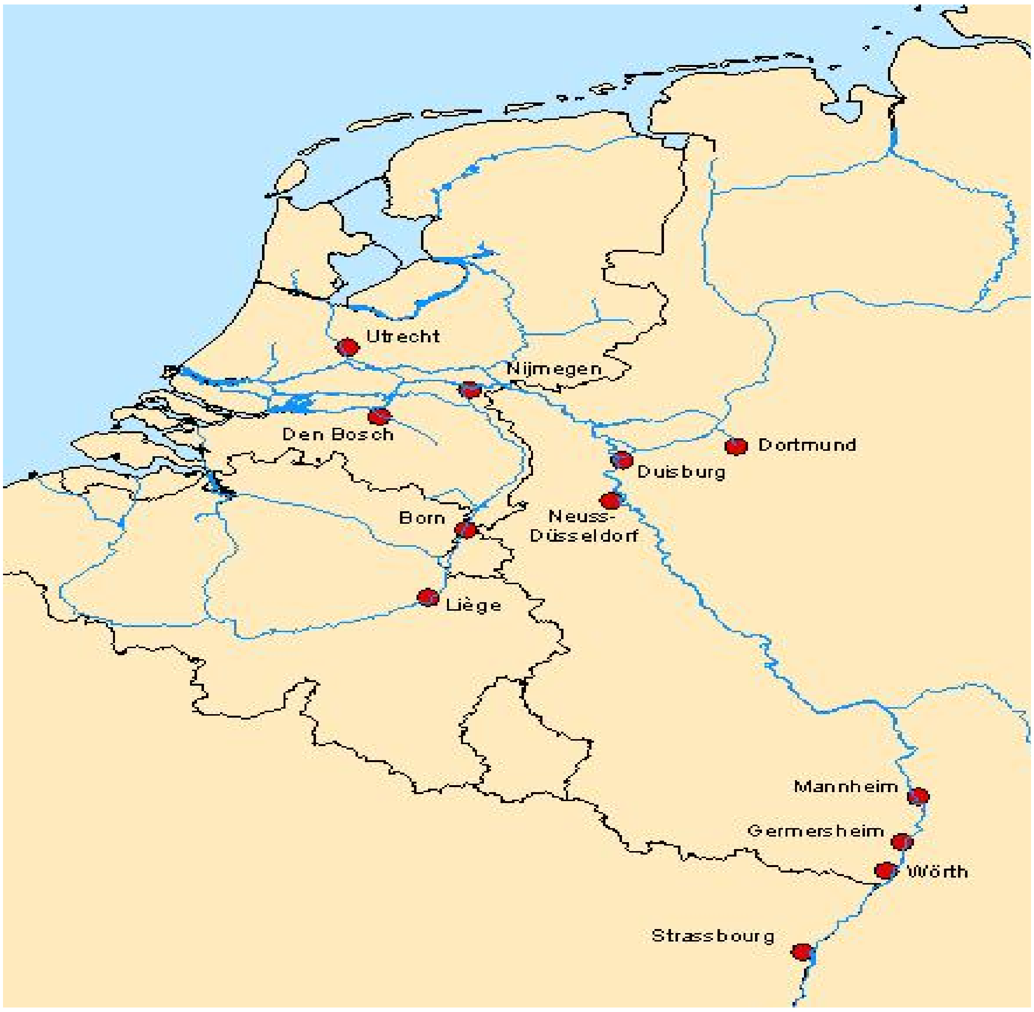


Figure 99: Selected inland shipping terminals (ports) in the Rhine area



The collection of statistical data has been executed by using various sources:

- Dutch Inland Shipping Agency (2007), Power of Inland Navigation
- Schifffahrt Hafen Bahn und Technik (2008), Issue march 2008
- UK Department for Transport (2008), Provisional Port Statistics 2007
- Destatis (2008), Güterverkehrsstatistik der Binnenschifffahrt
- CBS (2007), Inland shipping throughput
- Websites and Annual reports individual terminals
- Questionnaires

Table 44: Available indicators on inland waterway terminals

Indicator	Quality and Availability	Source
Turnover and employment	Available on port level, but inconsistent. No figures available on terminal level.	Inland port authorities, Quesionnaires
Throughput, tonnes and TEU	Available for most ports, good quality	Multiple, Questionnaires
Forecast of throughput	Multiple available	Multiple, Questionnaires
Main OD flows	Poor availability	Questionnaires
Storage capacity	Available	Multiple
Modal split	Poor availability	Dutch inland shipping agency, Schiffahrt Hafen Bahn und Technik
Surface area	Poor availability	Multiple
Transshipment costs	Poor availability	Questionnaires
Average waiting times	Poor availability	Questionnaires

5.5.2 Data and performance indicators

In the next *Table 45* an overview is given of total **throughput** of the inland shipping ports. Unlike throughput in large seaports, there are no sources that give a coherent overview of throughput of inland shipping terminals. Therefore it is difficult to compare the terminals in terms of throughput. For Rhine-ports, TEU throughput and water bound total throughput is well documented by national statistics and private companies. In Germany, the UK and the Netherlands some statistics are collected on a national basis. For other countries this information is not collected.

The throughput in inland shipping terminals and the degree of containerisation of this throughput greatly differs. By far the largest inland shipping port is Duisburg, both as a container port and as a dry bulk port. Most inland shipping ports (63 %) have a total container throughput between 100,000 and 250,000 TEU. The share of water bound throughput however greatly differs. For some inland ports like Nijmegen (NL), Den Bosch (NL) and Born (NL) waterbound transport is 100 %, which means that inland shipping is the mode used for the main trip and road is only used for pre or end haulage, while for Duisburg (DE) only 21 % of the throughput is water bound. The modal split for the inland shipping terminals Nijmegen and Den Bosch has been estimated. Containers are either transported by barge or truck. Incoming containers from Rotterdam, Amsterdam and Antwerp by barge are loaded on trucks and transported further to the client and vice versa. Therefore the modal split is estimated at 50 % truck and 50 % inland navigation.

Table 45: Total throughput for selected terminals in 2006[72]

	Terminal	Country	Throughput waterbound (TEU)	Throughput total (TEU)	Throughput waterbound (tonnes)	Throughput total (tonnes)
DE	Duisburg	DE	357,000	787,000	50,300,000	101,000,000
DE	Neuss-Düsseldorf	DE	153,132	684,593	9,102,500	
AT	Vienna	AT		277,320	1,318,000	4,746,000
DE	Wörth	DE	171,206	233,253		
FR	Strassbourg	FR	78,331	224,946		8,502,628
FR	Paris (Gennevilliers)	FR	64,800	222,404		20,000,000[4]
DE	Germersheim	DE		220,000		
FR	Lyon	FR	55,440	203,282		1,479,634[3]
DE	Dortmund	DE		149,000	2,499,000	
FR	Mulhouse -	FR	61,520	134,457	5,740,061	8,444,886
HU	Budapest	HU		132,000		
DE	Mannheim	DE	119,690	119,690	1,098,045	7,945,983
NL	Den Bosch	NL	105,000	105,000	2,820,000	
NL	Born	NL	86,000	86,000		2,000,000[2]
NL	Nijmegen	NL	81,000	81,000	2,793,000	
BE	Liège	BE		18,478	14,413,738	20,059,925
CZ	Decin	CZ	2,487			
NL	Utrecht	NL			4,089,000	
PL	Wroclaw (municipal port)	PL				
UK	Goole	UK	82,000		2,800,000	

Sources: Dutch Inland Shipping Agency (2007), Power of Inland Navigation
Schiffahrt Hafen Bahn und Technik (2008), Issue March 2008,
Department for Transport (2008), Provisional Port Statistics 2007
Destatis (2008), Güterverkehrsstatistik der Binnenschifffahrt
CBS (2007), Inland shipping throughput (in Dutch)
CCNR (2008), Market observation for inland navigation in Europe 2007-1
Websites and annual reports of individual terminals

The inland shipping terminals have also been contacted through a questionnaire to provide information on the throughput over the last three years. The next tables provide the data on throughput of containers (TEU) for the inland shipping terminals who responded to the questionnaire. Mannheim and Mulhouse show a (considerable) decrease in container throughput over the last three years. Container throughput via the other inland shipping terminals is growing rapidly with growth rates of 14 % or more for Vienna, Duisburg (by far the largest) and Den Bosch.

[72] [1] 2005 figure, [2] 2002 figure, [3] 2007 figure, [4] global figure

Table 46: Throughput (1000 TEU) 2005-2007

	2005	2006	2007	Growth 2005-2006	Growth 2006-2007
Duisburg	712	787	901	10.5%	14.5%
Vienna	225	277	323	23.1%	16.6%
Mulhouse	181	134	120	-26.0%	-10.4%
Den Bosch	100	105	120	5.0%	14.3%
Mannheim	134	120	108	-10.4%	-10.0%
Nijmegen	78	81	88	3.8%	8.6%

Source: questionnaire, ECORYS 2008

There are large differences in the **modal split** of the ports. Some ports, such as Wörth in Germany and Den Bosch and Nijmegen in the Netherlands, have a large share of transport by inland shipping[73]. For most ports rail throughput is relatively small, and almost never exceeds 30 %. The weighted average gives the modal spilt based on actual throughput volumes where larger ports are having a larger impact on the modal split. Unfortunately the modal split can not be divided by inbound and outbound flows (modal shares).

Table 47: Modal split of container throughput

Terminal	Country	Year	Road	Rail	Inland waterway
Duisburg	DE	2007	50%	30%	21%
Neuss-Düsseldorf	DE	2007	51%	25%	25%
Wörth	DE	2006	22%	1%	77%
Den Bosch	NL	2007	50%	0%	50%
Mulhouse - Ottmarsheim	FR	2007	42%	13%	45%
Nijmegen	NL	2007	50%	0%	50%
Strassbourg	FR	2007	59%	10%	31%
Paris (Gennevilliers)	FR	2007	67%	1%	31%
Lyon	FR	2007	47%	13%	40%
Budapest	HU	2004	54%	41%	5%
Average (weighted)			50%	19%	32%

Sources: Dutch Inland Shipping Agency (2007), Power of Inland Navigation
Schiffahrt Hafen Bahn und Technik (2008), Issue March 2008

Just as with seaports, figures on **annual turnover** and **employment** differ to a large extent between terminals. For some terminals figures are presented for an entire port group that represents multiple terminals or for all companies which are related to the inland port. Because of the large inconsistencies in the found figures some primary data collection was done through the questionnaires. The respondents were asked to specify the annual turnover and

[73] Modal split for inland shipping terminals Nijmegen and Den Bosch are estimated. Containers to/from these two terminals are either transported by barge or truck. Incoming containers from Rotterdam, Amsterdam and Antwerp by barge are loaded on trucks and transported further to the client and vice versa. Therefore the modal split is estimated at 50% truck and 50% inland navigation. However, road transport is only used for pre or end haulage, the main trip between the seaports and terminals is done by barge.

persons employed directly related to their port for the last three years (2005-2007). The next tables provide the data on annual turnover and number of employees for the inland shipping terminals who responded to the questionnaire.

All inland shipping terminals show an increase in their annual turnover (rounded figures). The number of employees increases at a slower pace (with Vienna remaining stable), which means that productivity in terms of annual turnover per employee also increases.

Table 48: Annual turnover (million €) 2005-2007

	2005	2006	2007	Growth 2005-2006	Growth 2006-2007
Vienna	40	42	45	5.0%	7.1%
Duisburg	60	64	-	6.7%	-
Mulhouse	-	-	8	-	-
Den Bosch	7	8	8	14.3%	0.0%
Nijmegen	6	7	8	16.7%	14.3%

Source: questionnaire, ECORYS 2008

Table 49: Number of employees 2005-2007

	2005	2006	2007	Growth 2005-2006	Growth 2006-2007
Vienna	168	167	172	-0.6%	3.0%
Duisburg	202	213	-	5.4%	-
Mulhouse	-	-	80	-	-
Den Bosch	22	23	25	4.5%	8.7%
Nijmegen	17	18	20	5.9%	11.1%

Source: questionnaire, ECORYS 2008

In the analysis of **forecast throughput** there is a considerable difference between the forecast of containers and that of other goods. The growth of container throughput is forecast between 2 % and 6 % per annum for the short term. The total throughput of inland shipping, however, is forecast to only grow by between 0 % and 2 %.

Table 50: Forecast of total throughput and container throughput

Source	Forecast range	Forecast period	Scenario	Total throughput	Container throughput
Netherlands Bureau for Economic Policy Analysis	Netherlands	2002-2020	high	2.0%	5.7%
			low	-0.3%	2.4%
		2020-2040	high	1.6%	4.1%
			low	-0.4%	0.6%
European Commission	EU-25	2000-2020		1.2%	
PLANCO	Germany	2000-2015		2.0%	
Average of returned Questionaires					5%

Sources: CPB Netherlands Bureau for Economic Policy Analysis (2006), Adaptation of long term scenarios for container transport. CPB Memorandum 172 (in Dutch: Aanpassing WLO scenario's voor het containervervoer)
European Commission (2006), Keep Europe moving - Sustainable mobility for our continent. Mid-term review of the European Commission's 2001 Transport White Paper
PLANCO (2003), Potentials and Future of German Inland Waterways Shipping

In the following *Table 51*, the **storage capacity** and **surface area** of the terminals is presented. There are large differences in terminal storage capacity. When looking at the storage capacity utilisation (throughput divided by capacity) there is a large variety ranging between 25 and 95. Because no direct and capital costs are known, no conclusions can be made on the productivity of the inland terminals.

Table 51: TEU throughput, storage capacity and surface area of terminals

Terminal	Country	Year	TEU Throughput	TEU storage capacity	Throughput / Storage capacity	Surface area (in ha)
Duisburg	DE	2007	1,794,000	31,000	58	55,0
Germersheim	DE	2006	220,000	6,300	35	11,0
Neuss-Düsseldorf	DE	2007	739,000	7,800	95	5,1
Wörth	DE	2006	174,358	7,000	25	9,0
Mannheim	DE	2007	152,313	2,400	63	1,13
Dortmund	DE	2007	200,700	5,000	40	
Den Bosch	NL	2007	120,000	4,500	27	4,5
Mulhouse – Ottmarsheim	FR	2007	119,518	5,000	24	7,5
Born	NL	2007	110,000	4,000	28	4,5
Nijmegen	NL	2007	88,000	2,500	35	3,5
Utrecht	NL					
Strassbourg	FR	2007	259,059	5,500	47	12,0
Paris (Gennevilliers)	FR	2007	295,000			
Goole	UK	2006	82,000			
Liège	BE	2007	17,138			
Decin	CZ					
Lyon	FR	2007	144,645			20,0
Wroclaw (municipal port)	PL					
Budapest	HU	2005	132,000	2,200	60	
Vienna	AT	2007	323,424	4,000	81	6,0

Around 50 % of the respondents give information on the **transhipment costs** and **average waiting time**[74] for their terminal. The transhipment costs for inland terminals vary between 18 and 25 EUR per move. This is much lower than transhipment costs in seaports. Only a few respondents are able to provide information on the waiting time at terminals. Some terminals report maximum waiting time of 48 hours for containers at terminals. The average waiting time is believed to be around a few hours. None of the terminals is able to provide more precise figures on waiting times.

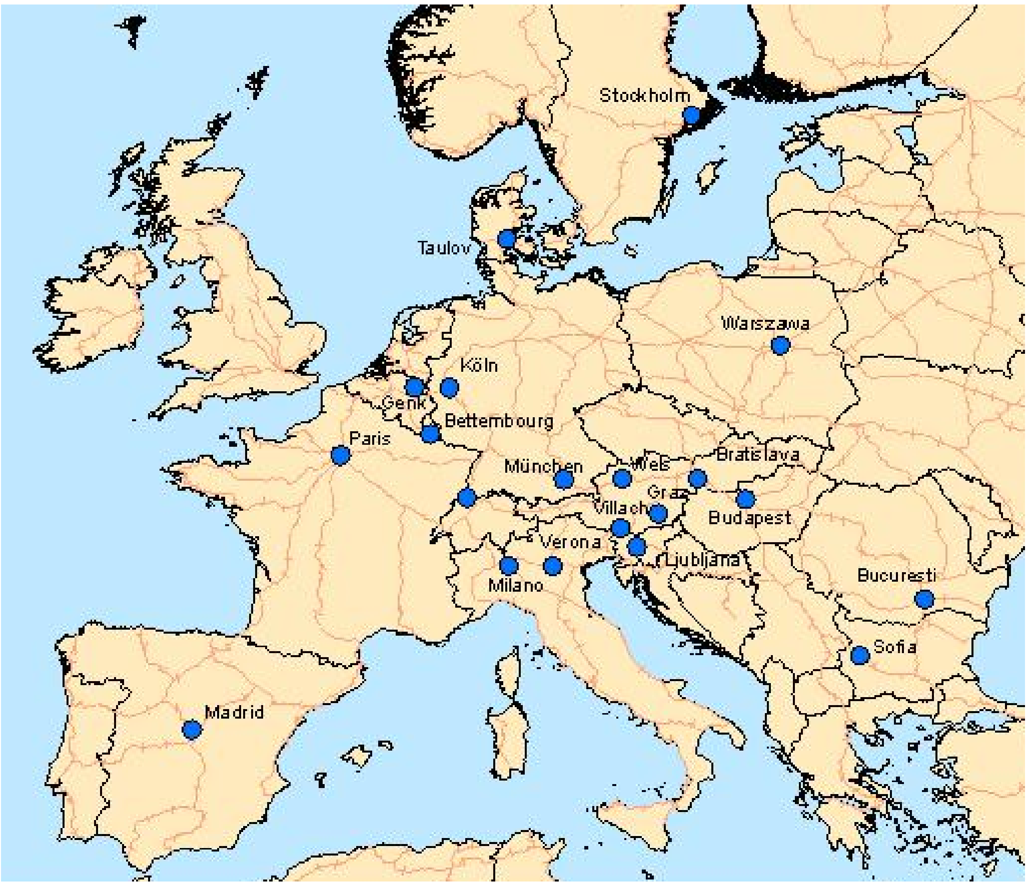
Storage, empty depot, customs and handling of dangerous goods are the services mentioned frequently by the respondents.

5.6 Road-rail terminals

5.6.1 Introduction

Based on the throughput of the road-rail terminals a first draft selection was made. In order to have a better geographical coverage it was preferred to include Scandinavia. For that reason Stockholm has been included in the final list.

Figure 100: Selected road-rail terminals



The collection of statistical data has been executed by using various sources:

- Study on infrastructure capacity reserves for combined transport by 2015 (UIC-GTC, 2004)
- Websites of road-rail terminals
- Annual reports of road-rail terminals
- Validation by independent expert
- Questionnaires

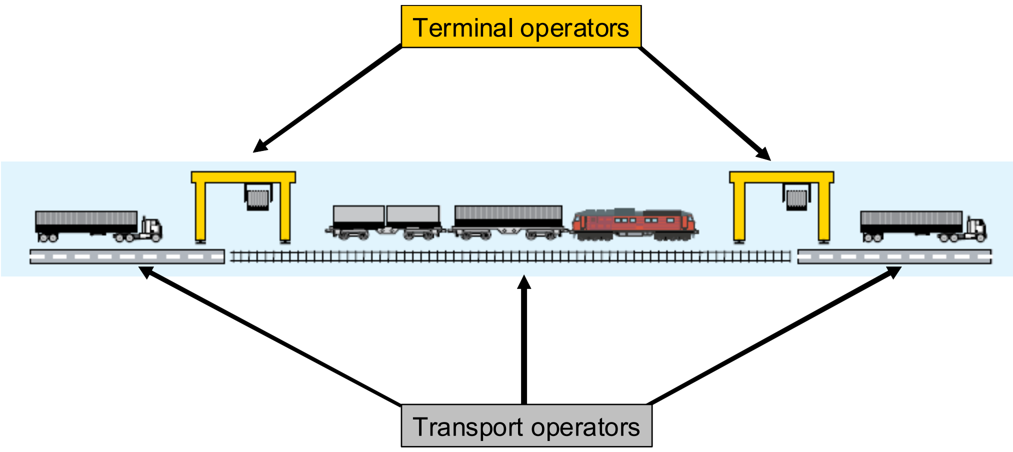
Table 52: Available indicators on road-rail terminals

Indicator	Quality and Availability	Source
Turnover and employment	Hardly available on terminal level, available on operator level	UIRR, UIC, Rail cargo operators, Questionnaires
Throughput, tonnes and TEU	For most terminals hardly available	UIC studies, Questionnaires
Throughput share National/International	For most terminals hardly available	UIC studies
Handling Capacity	Hardly available	Questionnaires, UIC studies
Main OD flows	Available for some corridors measured in numbers of trains per week	Questionnaires, UIC studies
Forecast 2015	Available for some terminals	UIC studies
Surface area	Hardly available	Questionnaires
Transshipment costs	Hardly available	Questionnaires
Average waiting times	Hardly available	Questionnaires

5.6.2 Data and performance indicators

In general data on road-rail terminals is scarce. There is a lot of information on the transport operators (through UIRR statistics), but not of the terminal operators themselves. In addition, some road-rail terminals are very insignificant and do not have a website, annual report or any reporting at all.

Figure 101 Road-rail terminal scheme



At this moment, the most recent figures in reports on throughput and capacity utilisation of road-rail terminals (in TEU) are representing the year 2002. For some areas the figures are aggregates for several terminals in that area, like for instance Paris (6 terminals) or Milano (9 terminals).

The next *Table 53* shows the performance of various terminals across Europe. The largest single road-rail terminal is in Cologne (Köln-Eifeltor) with 266,000 loading units in 2002, while Milano including 9 terminals even has a throughput of 488,002 loading units. The Cologne terminal has an international orientation: 73 % of the throughput has an origin or destination outside Germany. The terminal in Munich on the other hand has a domestic function, as more than 70 % of the total throughput has an origin or destination within Germany.

The capacity utilisation of the terminals varies a lot as well. Cologne, Taulov and Genk report very high utilisation percentages. For Cologne the utilisation rate was estimated to be more than 100 %[75] in the UIC-study, which indicates congestion. Because the nominal maximum capacity of terminals is 100 %, the capacity utilisation for Cologne is set at 100 %. Paris and Graz report very low utilisation percentages.

The UIC study (2004) assumed a theoretical capacity in 2002 of 144 movements (passenger and freight) per day and direction on a double tracked electrified line. The forecast horizon for 2015 is based on a 20 % higher maximum capacity of 173 train movements. This value reflects progress in productivity and the signalling systems. This estimate was also verified in a number of investigations, in particular in Germany and France.

75 Since not all terminals in the UIC-study provided actual values for handling capacity, a standardised calculation for capacity was made for these terminals. At the time of the UIC-study an extension of the handling capacity to 300,000 loading unites (LU) per year for the Cologne Terminal was planned. The current handling capacity is 330,000 LU/year (www.duss-terminal.de).

Table 53: Total throughput, handling capacity and utilisation of selected terminals

Terminal	Number of terminals	Total throughput in 2002 (LU)	Throughput National (%) in 2002	Throughput International (%) in 2002	handling capacity (LU)	Capacity utilisation
Milano (IT)	9	488,002	17%	83%	801,000	61%
Köln – Eifeltor (DE)	1	265,745	27%	73%	237,000	*100%*
Verona (IT)	2	223,796	0%	100%	329,000	68%
München – Riem (DE)	1	200,000	72%	28%	320,000	63%
Paris (FR)	6	176,282	63%	37%	658,000	27%
Prague (CZ)	2	148,600	6%	94%	250,000	59%
Budapest – BILK Combiterminal (HU)	2	140,000	0%	100%	210,000	67%
Wels Vbf – Container terminal (AT)	1	102,815	33%	67%	132,000	78%
Madrid (ES)	1	100,000	80%	20%	192,000	52%
Taulov (DK)	1	75,000	33%	67%	80,000	94%
Ljubljana (SI)	1	58,300	19%	81%	100,000	58%
Genk (BE)	2	57,842	5%	95%	69,000	84%
Villach (AT)	1	51,289	13%	87%	70,000	73%
Graz Süd CCT (AT)	1	50,000	18%	82%	130,000	38%
Warszawa (PL)	1	40,000	0%	100%	60,000	67%
Basel Wolf Hupac A.G. (CH)	2	155,274	43%	57%	195,00	80%

Source: UIC (2004), Study on infrastructure capacity reserves for combined transport by 2015

In the study on infrastructure capacity reserves (UIC, 2004), **forecasts** of the volumes and capacity are provided for 2015. Based on those figure the capacity gap in 2015 is calculated. Note that the nominal maximum capacity of terminals is at 100 % utilisation but in practice this is around 80 % (or else waiting times increase dramatically) and therefore the capacity gap is even larger than presented in the *Table 54* below. The yearly growth rates of the volume and capacity are calculated in order to see if these growth rates correspond with each other or to see that for instance the current gap is getting larger. The average growth rate of the throughput is 5.1 % while the average growth rate of the capacity is only 2.2 %.

Table 54: Volume and capacity forecast and yearly growth rates of selected terminals

Terminal	Number of terminals	Volume forecast 2015 (LU)	Capacity forecast 2015 (LU)	Capacity Gap 2015 (at 100% utilisation) (LU)	Yearly growth rate volume	Yearly growth rate capacity
Milano (IT)	9	1,130,000	1,057,925	72,000	6.7%	2.2%
Köln – Eifeltor (DE)	1	517,000	330,000	217,000	5.3%	1.8%
Verona (IT)	2	551,000	780,000	0	7.2%	6.9%
München – Riem (DE)	1	283,000	320,000	0	2.7%	0.0%
Paris – 6 terminals (FR)	6	270,000	658,000	0	3.3%	0.0%
Prague – 2 terminals (CZ)	1	288,000	200,000	88,000	5.2%	1.4%
Budapest – BILK Combiterminal (HU)	2	263,000	300,000	0	5.0%	2.8%
Wels Vbf – Container terminal (AT)	1	181,000	132,000	49,000	4.4%	0.0%
Madrid (ES)	1	140,000	192,000	0	2.6%	0.0%
Taulov (DK)	1	130,000	120,000	10,000	4.3%	3.2%
Ljubljana (SI)	1	87,000	150,000	0	3.1%	3.2%
Genk (BE)	2	150,000	122,000	28,000	7.6%	4.5%
Villach (AT)	1	121,000	110,000	11,000	6.8%	3.5%
Graz Süd CCT (AT)	1	137,000	130,000	7,000	8.1%	0.0%
Warszawa (PL)	1	79,000	60,000	19,000	5.4%	0.0%
Basel Wolf Hupac A.G. (CH)	2	238,000	390,000	0	3.3%	5.5%

Source: UIC (2004), Study on infrastructure capacity reserves for combined transport by 2015

Primary data collection has been done through a questionnaire. There are only three respondents which have provided detailed information on the **annual turnover** and **number of employees**, the **transport volumes handled** (commodities and OD), **capacity**, **surface area** and **services offered** at their terminals. We will describe the main findings in separate anonymous cases hereafter.

Table 55: Turnover and employment

	Terminal operator	Total 2005	Total 2006	Total 2007
Annual Turnover (€ million)	Nr. 1	140	160	190
	Nr. 2	11.1	9.3	9.1
	Nr. 3	0.11	0.13	0.15
Number of employees	Nr. 1	350	450	600
	Nr. 2	18	18	19
	Nr. 3	3	3	3

Source: Questionnaire, ECORYS 2008

Obviously, these terminals have different sizes. Looking at the turnover per employee the first two terminals are in the range of 0.3-0.5 million turnover per employee. The third terminal is a small Romanian terminal in the start-up phase and is therefore less comparable.

Table 56: Transport volume (accompanied + unaccompanied combined transport)

	Terminal operator	2005	2006	2007
Throughput inbound (TEU)	Nr. 1	124,234	176,353	250,567
	Nr. 2			45.9%
	Nr. 3	879	3,181	3,779
Throughput outbound (TEU)	Nr. 1	113,456	165,723	234,567
	Nr. 2			54.1%
	Nr. 3	1,106	3,087	3,822
Throughput Total (TEU)	Nr. 1	237,690	344,076	485,134
	Nr. 2	361,193	361,202	542,439
	Nr. 3	1,985	6,268	7,601
	Terminal operator	**2005**	**2006**	**2007**
Throughput inbound (Tonnes)	Nr. 1	1,490,808	2,080,965	2,881,520
	Nr. 2			45.9%
	Nr. 3	5,670	54,780	63,340
Throughput outbound (Tonnes)	Nr. 1	1,361,472	1,955,531	2,627,150
	Nr. 2			54.1%
	Nr. 3	6,760	53,280	62,025
Throughput Total (Tonnes)	Nr. 1	2,852,280	4,036,496	5,508,670
	Nr. 2	6,015,270	6,377,540	6,286,992
	Nr. 3	12,430	108,060	125,365

Source: Questionnaire, ECORYS 2008

All three terminals are growing steadily in terms of throughput. The inbound and outbound flows, either by road or by rail, are almost balanced.

The main goods flows (next table) are reported in various ways. Some stated the type of goods and the volumes in TEU, while others reported the number of weekly train pairs to/from specific countries/cities.

Table 57: Main goods flows by origin and destination[76]

Terminal operator	Main Good Flows	Country / region	Throughput (TEU)	Throughput (WTP¹)
Nr. 1	Parts of electronic	CZ	25,000 TEU Incoming	-
	Tyres	CZ	10,000 TEU Outgoing	-
	Automotive CKD	CZ	15,000 TEU Outgoing	-
	Cargo for Supermarkets	SK	10,000 TEU Incoming	-
	Autom otiv	HU	15,000 TEU Incoming	-
	Prague	CZ	40,000 TEU incoming	-
	Budapest	HU	45,000 TEU incoming	-
	Plzen	CZ	15,000 TEU incoming	-
	Otrokovice	CZ	20,000 TEU outgoing	-
	Szekesfehervar	HU	15,000 TEU incoming	-
Nr. 2		Münich, Bremen/Bremerhaven, Köln, Hamburg, Leipzig, Mannheim, Düsseldorf, Rostock (D)	-	107 WTP
		Kolding (DK)	-	8 WTP
		Gliwice (PL)	-	7 WTP
		Rotterdam (NL)	-	5,5 WTP
		Bratislava (SK)	-	4 WTP
		Oradea (RO)	-	3 WTP
		Vienna (AT)	-	3 WTP
		Ljubljana (SI)	-	2 WTP
		Prague (CZ)	-	1 WTP
		Bologna, La Spezia, Genoa (IT)	-	20 WTP
Nr. 3	Origin 1	Romania	-	-
	Origin 2	Italy	-	-
	Destination 1	Romania	-	-

Source: Questionnaire, ECORYS 2008

The main origins and destinations are located in the neighbouring countries of the country where the terminal is located. Some terminals only report the number of weekly train pairs between origins and destinations.

[76] ¹ Weekly Train Pairs.

Table 58: Capacity

Terminal operator	Capacity terminal:	Most recent year:
Nr. 1	TEU Tonnes	2,000,000 20,000,000
Nr. 2	TEU Tonnes	- Expansion planned for 2010 - Expansion planned for 2010
Nr. 3	TEU Tonnes	12,500 160,000

Source: Questionnaire, ECORYS 2008

Table 59: Surface area[77]

Terminal operator	Surface area 1	M²	TEU
Nr. 1	Total terminal area (Gross¹)	340,000	15,000
	Storage area	250,000	
	Surface area 2	**M²**	**TEU**
	Total terminal area (Gross²)	70,000	3,500
	Storage area	70,000	
	Surface area 3	**M²**	**TEU**
	Total terminal area (Gross³)	30,000	2,500
	Storage area	25,000	
	Surface area 4	**M²**	**TEU**
	Total terminal area (Gross⁴)	5,000	1,500
	Storage area	5,000	
	Surface area 5	**M²**	**TEU**
	Total terminal area (Gross⁵)	300,000	150,000
	Storage area	250,000	
	Surface area 6	**M²**	**TEU**
	Total terminal area (Gross⁶)	7,000	3,000
	Storage area	7,000	
Nr. 2	Terminal area (Net)	190,500	-
	Total terminal area (Gross⁷)	340,500	-
	Storage area:		
	- open air	600,000	-
	- warehouse	312,000	-
Nr. 3	Terminal area (Net⁸)	10,000	-
	Total terminal area (Gross⁹)	20,000	-
	Storage area	10,000	198

Source: Questionnaire, ECORYS 2008

[77] [1-9] Excluding roads, green surface etc.

Table 60: Services offered

Service offered:	Terminal 1 Yes/No	Terminal 2 Yes/No	Terminal 3 Yes/No
Storage	Yes	Yes	Yes
Empty depot	Yes	Yes	Yes
Value added services (repacking, labelling)	No	Yes	No
Customs	Yes	Yes	No
Administration	Yes	Yes	Yes
Dangerous goods	Yes	Restricted	Yes
Reefer	Yes	Yes	No
Power	Yes	Yes	Yes
Other: Trucking, Customs, Repairs etc.	Yes	Yes	-
Other: Safety and security	-	Yes	-

Source: Questionnaire, ECORYS 2008

The services listed in the *Table 60* above show that the road-rail terminals offer more or less the same services. Some terminals indicate to offer additional trucking, repairs or safety and security services.

The **transhipment costs** are reported in the range of EUR 20-25 per move[78]. **Average waiting times** for trains, measured as the time between entering and leaving the terminal, is reported in the range of 2-6 hours on average, with a maximum of 30 hours. The transhipment cost and average waiting times have been validated by an external intermodal transport expert who characterised these figures as reasonable.

[78] One move can be from the incoming modality to the stack, from the stack to the outgoing modality, or directly from the incoming modality to the outgoing modality.

5.7 Distribution centres

5.7.1 Selection of performance indicators

The characteristics of European distribution centres and how they operate depends largely on the industry sector, the geographic markets that those industries serve, the product type and the location of manufacturing facilities. This results in a broad range of different types of distribution centres characterised by for instance the number of stock keeping units (SKU's), the level of warehouse automation, heavy inbound or heavy outbound logistics, the order reliability, the order fulfilment cycle time, safety stocks etc.

It is this very variety of different types of distribution centres that hampers a consistent comparison between a randomly selected sample of distribution centres across Europe.

This paragraph first elaborates on the characteristics of distribution centres in the EU. After that, two detailed case studies are described based on interviews at these distribution centres. Through alternative sources, several smaller case studies are included in order to give an indication of the types of performance indicators relevant to different types of distribution centres. Finally, some conclusions are drawn to show which main performance indicators are in general important for distribution centres and to what level different distribution centres can be compared.

Table 61: Available indicators on distribution centres

Indicator	Quality and Availability	Source
Turnover and employment	Sometimes available on DC level, otherwise on company level	Websites, case studies, interviews
Throughput, tonnes or units	Hardly available	Case studies, interviews
Main OD flows; sourcing areas, client destinations	Hardly available	Interviews
Number of suppliers	Sometimes available on websites	Websites, interviews
Modal split	Hardly available	Interviews
Stock Keeping Units (SKU)	Sometimes available	Websites, interviews, case studies
Pallet positions	Hardly available	Interviews
Inventory (days of inventory)	Hardly available	Interviews
Surface area	Sometimes available	Websites, interviews, case studies
Delivery reliability	Hardly available	Interviews
Average lead times	Hardly available	Interviews

5.7.2 Characterisation of the EU distribution centres

Most distribution structures around the world follow similar patterns and normally fall into one or more of the following four distribution centre functions:

- Global distribution centre: often located close to the worldwide manufacturing site and serves to distribute goods to the different worldwide geographic regions.
- European distribution centre (EDC): serving as a central storage of goods for the European, Middle-East and Africa (EMEA) regions and takes care of replenishment of the different regional distribution centres.
- Regional distribution centre, serving as a main distribution centre for a specific region within EMEA, for example the UK/Ireland region or the Nordic region.
- Country / local distribution centre, serving final distribution to customers.

In terms of the location of European distribution centres, there are various factors that will affect the location decision of a retailer or manufacturer. Important factors include existing transport infrastructure, wages and benefits, proximity to ports, multilingualism, airports, rail hubs, customers and suppliers, labour availability and flexibility and real estate costs. Government incentives are also important.

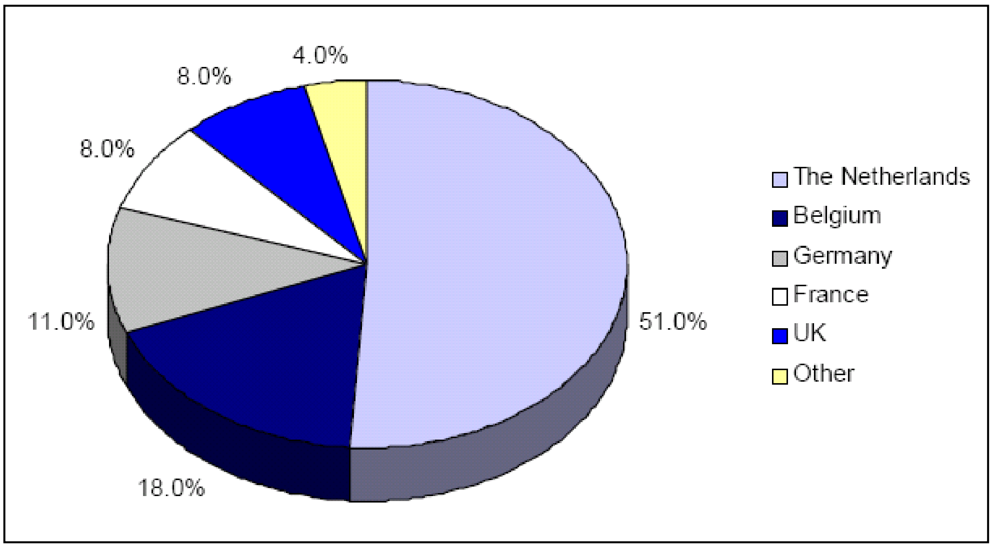
Three countries that mostly enjoy benefits from these location decision factors are Belgium, Germany and The Netherlands *(Transport Intelligence / HIDC, 2006):*

- Belgium benefits from its proximity to seaports (such as Antwerp) and airports (Brussels), its transport infrastructure and the incentives it offers to investing companies.
- Germany benefits from being the largest economy in Europe, its proximity to rail hubs and its infrastructure.
- The Netherlands benefits from its proximity to seaports (Rotterdam) and airports (Amsterdam Schiphol), its transport infrastructure, the incentives offered to investing companies, the multilingualism of its nationals and the positive business environment (including flexible customs regime).

In general these three countries are considered an attractive location for a European distribution centre and make up 80 % of the European distribution centres by location[79].

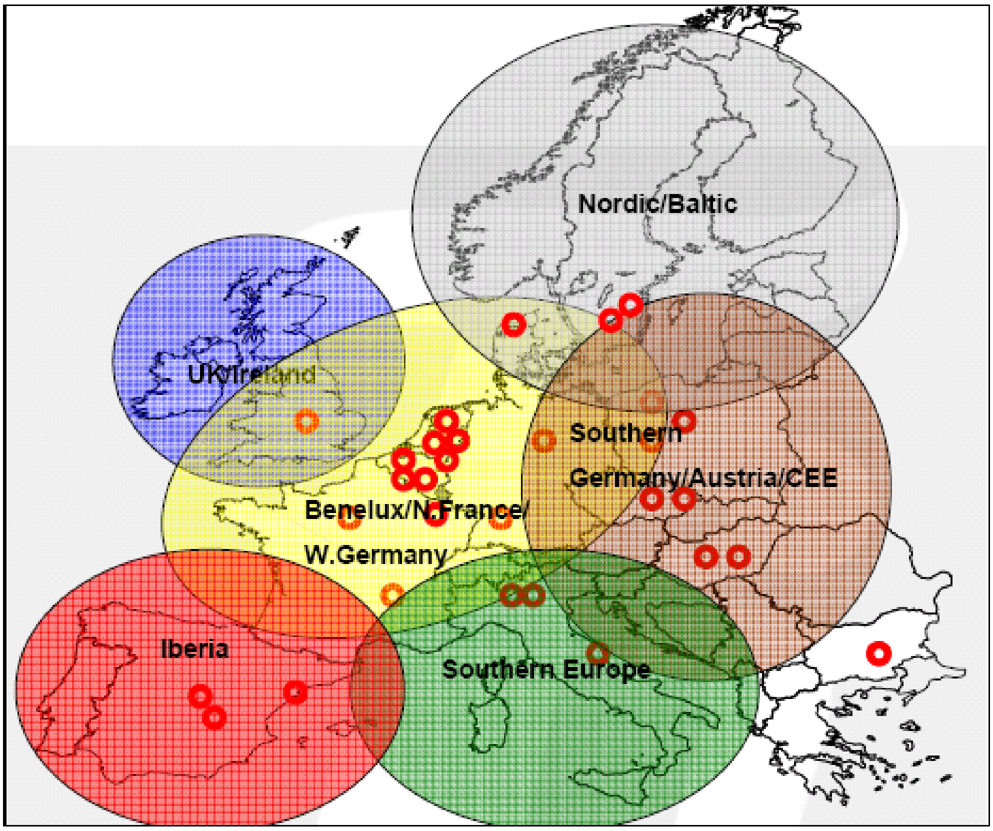
[79] Transport Intelligence, European Distribution Warehousing 2006, An overview of the dynamic European warehousing and distribution property market, Report code: TIEDW0511.

Figure 102: European distribution centres by location in Europe



Source: Transport Intelligence / HIDC (2006)

Figure 103: Preferred/future European distribution centre locations in Europe



Source: Transport Intelligence / HIDC (2006)

Following, some important trends are mentioned regarding the European distribution warehousing sector.

For the logistics sector, the expansion of the European Union and opening of new markets in Eastern Europe has required a new European distribution strategy. With the accession of new EU members in central and Eastern Europe, the geographical centre of gravity of the new European Union has started to move eastwards, in order to serve the additional population. As a consequence administrative as well as physical barriers between countries within the EU are decreasing. This has driven a trend towards more European distribution centres instead of national distribution centres as part of the supply chain structure.

In Europe it is estimated that owner-occupiers possess 68 % of the total value of commercial property while in the US this drops to 24 %. In Europe, leasing activity has increased principally from logistics providers, who prefer to lease facilities with lease terms that match contract lengths.

The growth in outsourcing has been a driving force behind the development of the contract logistics sector and is a key reason why leading logistics companies have grown rapidly from national medium-sized warehousing and distribution providers into global multi-service professional companies. Two main outsourcing options are distinguished:

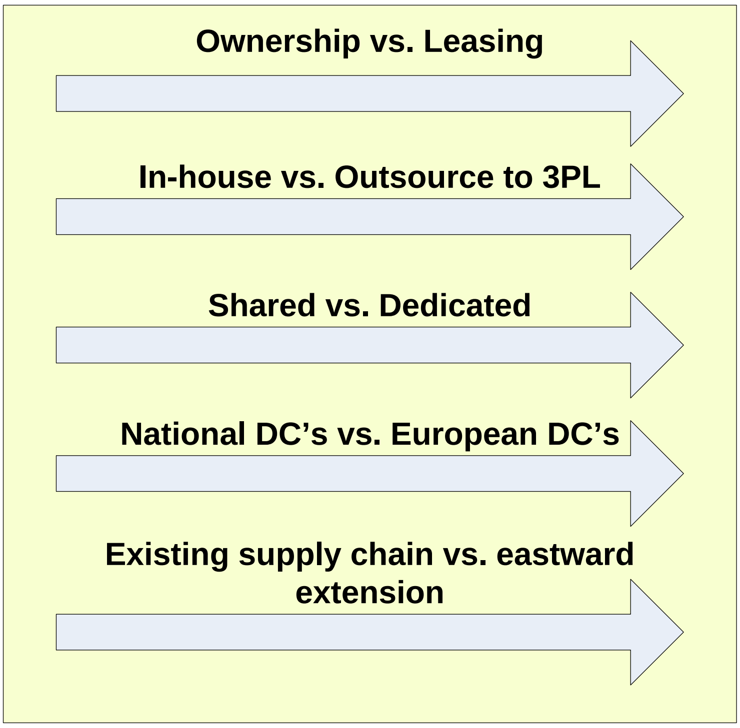
- By distribution centre: many retailers/manufacturers throughout Europe contract out the management of the distribution function related to **one** specific distribution centre in a country.
- By geography: this involves the management of **multiple** distribution centres in a geographic region, and will probably involve higher levels of value adding management of goods flows across a network.

Within the third-party logistics industry, warehousing and distribution contracts typically are either shared-user or dedicated. If the contract or service provided by the third-party logistics company is shared-user, this means that the facility is owned/leased by the logistics company, and customers' products are stored with other customers' products in a single warehouse. In the case of dedicated contracts, the warehouse is more often than not owned/leased by the customer and the logistics company manages the warehouse operation, along with the associated distribution services.

For any retailer, warehousing and distribution account for the majority of logistics costs. Within grocery retail, warehousing accounts for 45 % of the total cost of distribution, followed by transport which accounts for 32 % (Transport Intelligence, 2006). Retailers compete strongly for the ideal location of their warehouses, with the increasing pressure of storing an ever increasing range of products and product types.

The figure below summarises the trends in the European distribution warehousing sector. The trends are towards the right-hand side of the figure.

Figure 104: Trends in European distribution warehousing



Source: ECORYS

5.7.3 Case study: Flora Holland distribution centre

General information

Flora Holland flower auction is international market leader in floriculture sales. The company is situated in six different locations in the vicinity of the most important flower production areas in the Netherlands. Flora Holland is a key player in an intricate and high-quality network of companies, ranging from breeders and growers to sales experts and export firms. It fulfils the role of matchmaker, intermediary and knowledge centre. In the following *Table 62* some key figures of the company are shown.

Table 62: Key figures on Flora Holland distribution centre

	2006	2007
Turnover in millions of Euro	3,892	4,063
Turnover in millions of units:		
- cut flowers	11,007	11,005
- indoor plants	814	832
- outdoor plants	400	391
Number of suppliers	9,900	9,633
Employees (in fte)	3,612	3,612

Inbound sourcing

Over 85 % of all revenue's are sourced in the Netherlands. The floriculture industry in the Netherlands is concentrated in five different areas, in four of which Flora Holland has an auction hall. Transport towards the auction is primarily performed by road transport. Main sourcing countries outside of the Netherlands are shown in the *Table 63* below. Imports inside of Europe are primarily performed by road transport. Sourcing outside of Europe use air freight and shipping. Transport between the main port and the auction site is performed through road transport.

Table 63 Sourcing countries of Flora Holland distribution centre

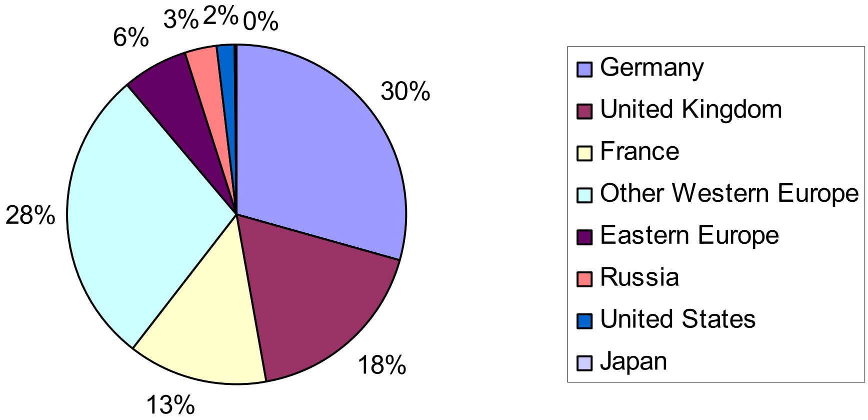
Origin of revenues	Total revenu in millions of Euro	Share in revenu
Netherlands	3,441	85%
Kenya	224	6%
Israel	102	3%
Ethiopia	57	1%
Ecuador	41	1%
Germany	37	1%
Belgium	36	1%
Zimbabwe	21	1%
Spain	14	0%

In total over 30.000 truck shipments arrive at the different auction sites each day.

Outbound delivery

The main destination markets of Flora Holland are the large economies in Europe: Germany, United Kingdom and France. Besides Western European Countries, the company exports flowers towards Eastern Europe, the United States and Japan. Although the share of Eastern Europe and Russia is relatively small, the total turnover in these countries is growing rapidly.

Figure 105: Destination of Flora Holland distribution centre sales



Just like with inbound sourcing, outward delivery of products is mostly done through road transport. The transport is performed by customers, that mostly outsource the transport of products towards 3PL companies.

Flora Holland is currently at the beginning stage of multimodal transport initiatives. The company is primarily focusing on setting up rail transport initiatives for different corridors.

Terminal perspective and performance indicators

Flora Holland brings suppliers and buyers together through two different processes. The main business of the company involves physical sale of products in one of the six different auction halls. Secondly, the company acts as an intermediary agent in direct sales between growers and large buyers.

In the auction hall, a total of 30,000 truck shipments arrive at the sites each working day. The products are stocked in cooling cells, and usually are auctioned the same day. During the auctioning, the supplies of one grower can be bought by different buyers. A standard quantity in the selling of floriculture products are Danish trolleys. After the selling a distribution process takes place in which the goods are redistributed into packages for each client.

A service level agreement for this process is that the time of delivery between the auction and the client's dock is less than 2.5 hours.

The total capacity of the six auction sites is presented in the *Table 64* below. For Flora Holland there is virtually no storage capacity restrain, because in most cases, handling and distribution of the products in done within 24 hours.

Table 64: Facilities of Flora Holland distribution centre

Facilities	Aalsmeer	Naaldwijk	Rijnsburg	Venlo	Bleiswijk	Eelde
Buildings surface area	1,013,000	713,000	400,000	103,000	123,000	45,875
Own building trade surface area	148,000	185,400	52,766	60,000	90,957	100
Number of customers with accommodation on auction site	600	500	220	40	90	0
Surface area cold store	42,000	43,000	36,000	15,715	3,800	3,440
Number of processed stacking carts and Danish containers	4,050,000	2,413,288	1.039.058	299,804	254,669	107,000
Number of docks	523	483	296	102	114	20

Future trends

Momentarily, Flora Holland is relatively uncertain regarding how the auction will develop in the future. Presently, clients still feel the need to physically see the products before buying the products. However, technological innovations could lead to a more internet-based market, which could mean a diminishing role for Flora Holland. The company therefore wishes to develop into the role of supply chain facilitator. The company is suitable for this role because it is independent and has lots of know how and contact within the supply chain.

Contrary to this development, Flora Holland is planning to open a new location in Germany. The location will mostly function as a distribution centre for local clients.

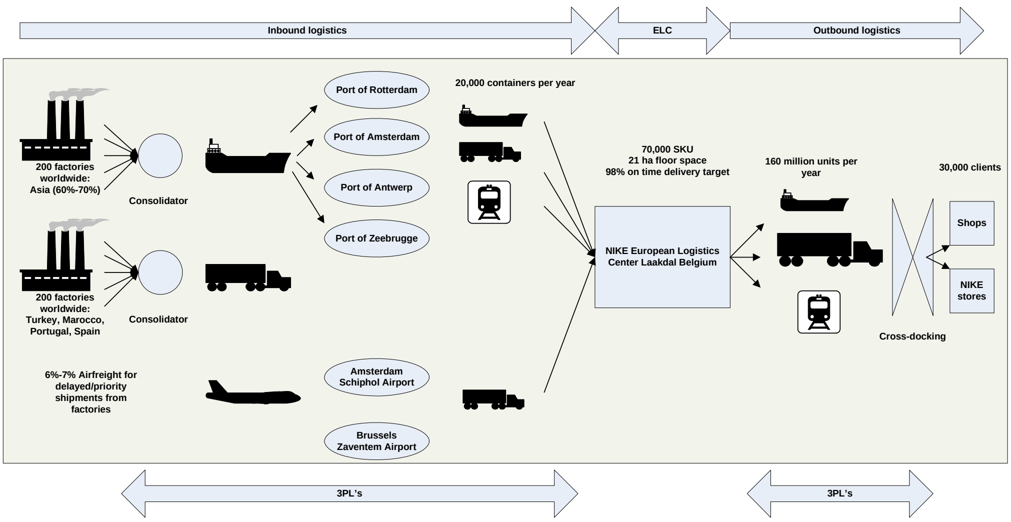
As mentioned before, Flora Holland also is in the starting process to consider multimodal transport initiatives. Especially rail transport is considered to be a good alternative for long haul transport. There are however some important factors that are required for multimodal transport in order to become profitable. Firstly, Flora Holland can only load a few wagons on its own. The company therefore needs additional partners in order to set up a regular shipping line. Secondly, specialized temperature controlled containers are required to keep the flowers fresh. Fluctuations in the container temperature will have a negative impact on the value of the products. Lastly, a distribution network needs to be set up at the end of the railroad line.

5.7.4 Case study: NIKE EMEA European Logistics Center (ELC)

Since 1994, NIKE EMEA (Europe, Middle East, Africa) Logistics Center is the logistic operations centre of NIKE EMEA. Before 1994, NIKE organised its distribution in Europe through multiple national distribution centres. With the enlargement of the EU and too high levels of inventory at the national distribution centres, NIKE decided to centralise its inventory and distribution activities at the ELC in Belgium. All logistic activities between 200 factories and 30,000 clients are coordinated from NIKE's European Logistic Center. NIKE ELC manages the warehouses, the transport facilities, the information and communication systems and offers logistic solutions for its clients.

NIKE ELC supplies three types of product categories to its customers namely sports wear (garments), sports equipment and sport shoes (footwear). In total the ELC manages 70,000 SKU (stock keeping units). Typical for these kinds of retail products, the ELC is very much affected by the seasons. Therefore, the NIKE ELC distinguishes 4 seasons of 3 months each. There are 1,400 FTE continuously employed at the ELC, but at seasonal peaks which are especially in January/February and August/September, an additional 1,000 FTE[80] are temporarily employed. The ELC is owned and operated by NIKE.

Figure 106: Supply chain of NIKE ELC, Belgium



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[80] Full-time equivalent.

Inbound sourcing

The three different product segments have a different source base. The sportswear are for approximately 66 % sourced in Asia and 33 % in Europe (Portugal, Spain) or Europe's neighbouring countries (Turkey, Morocco). Footwear is sourced in South-East Asian countries like, China, Vietnam, Thailand and Indonesia. The source base for the equipment category very much depends on the specific product category. Focussing on products sourced from factories in Asia, basically three parts make up the inbound lead time.

First, products from different factories have to be consolidated before they can be shipped to Europe. This phase includes customs procedures and administration. Depending on the administrative burden, this phase takes approximately between 3 and 10 days. Next, the products are shipped by ocean shipping to 4 different ports in the Hamburg – Le Havre range. These ports are Rotterdam, Amsterdam, Antwerp and Zeebrugge and shipping takes approximately between 16 and 26 days. The third part of the inbound lead time is the transport of containers from the 4 ports to the ELC in Laakdal, Belgium. Trucks, barges and trains are used for this third phase of inland transport. 98 % of the NIKE containers that arrive at Antwerp are transported on barges by inland waterways to the ELC. There is a barge container terminal located next to the ELC which handles 20,000 inbound containers per year for the ELC. The last phase takes approximately 3 days. In addition, 6-7 % of the inbound products are carried by freight aircraft. This mode is only used for delayed shipments caused by the manufacturer or other priority shipments. Apart from air transport, the total inbound lead time (from a factory in Asia to the ELC in Belgium) is between 22 and 39 days.

Reasons to use primarily barges and trains to ship the products from the ports to the ELC are as follows. The ELC is very good accessible by inland waterways and railways. Barges are less expensive than trucks, especially the cost of the truck driver is important. There is sufficient capacity at barges and inland waterways which makes them also reliable. In addition, NIKE is more and more focussing on sustainable means of transport and therefore barges and trains are preferred as they are less polluting than trucks.

Outbound delivery

The major outbound destinations are the larger European countries with relatively high purchasing power being the UK, Germany, France, Spain and Italy. The two most important growth markets are Russia and Turkey. In percentages the growth in Russia and Turkey is much higher than in the West European countries. In absolute numbers the growth is more or less equal. Traditionally the truck is primarily used for outbound shipments across Europe. Currently there is much more focus on multimodal transport and bundling of cargo flows with other companies. According to NIKE this is not primarily done as a cost reducing measure but more as a strategic consideration that they will be affected in the long term by the societal and environmental impact of trucking by roads.

An example of a multimodal transport route is for instance shipping by barge to Antwerp, then by short-sea shipping to Finland and further by truck or rail into Russia. Nevertheless, at this moment several issues hamper a more widespread use of multimodal transport. The volumes of cargo of the ELC are not high enough to load a full train at fixed times. The volumes at the ELC fluctuate not only by season but even on a day to day basis. Multimodal transport is currently not flexible enough to cope with these fluctuations. Another issue is the security at certain multimodal/road-rail terminals. Products of NIKE are an attractive target for thieves, especially when a container is waiting at an intermodal terminal where the level of security is limited. A third issue is the cost of pre and end haulage of multimodal transport. Furthermore, inland waterway shipping is considered to result in too high lead times.

While the ELC is owned and operated by NIKE itself, it has various arrangements and contracts with 3rd party logistics providers (3PL), both inbound and outbound. Typical contract length is about 2-3 years with 1-2 3PL providers per country. Some 3PL providers operate in several countries but nevertheless it is necessary to have also 3PL providers from each specific country.

Terminal and performance perspective

NIKE has two types of ordering systems. One is called ‘Futures’ and the other is based on replenishments. Futures are ordered by shops 6 months in advance of the new season and make up 85 % of all products. Replenishments make up the other 15 % of the products and can quickly respond to specific needs of the clients. With 70,000 stock keeping units (SKU) there is a broad range of different products and characteristics in terms of performance. On average products are 2-3 months at the ELC stored, but of course the cycle time of some products is much higher or lower than the other.

In the ELC there are separate areas to handle the three types of products; sportswear, footwear and equipment. The largest part of the ELC is automated with bar-coding tags, sorting machines and small belt conveyers. Only limited value adding activities are taking place at the ELC. Approximately 25 % of the products are subject to value adding activities being pricing or labelling etc. The most important performance indicator for NIKE is the delivery reliability. NIKE has agreements with its client to achieve a ‘hit rate’ of 98 % on time delivery with respect to the agreed time slots for delivery at the shops. Other performance indicators are the level of inventory, the capacity, order picking process and load factors. Inventory is measured and monitored in different ways; days of sales inventory, inventory cost per unit, lead time.

The capacity is measured in terms of inbound capacity, handling capacity and outbound capacity. The inbound capacity depends on the number of unloading docks and the number of SKU's to be handled. The handling itself depends on the SKU's, picking bays and storage area. The total floor space is 21 ha and the maximum outbound capacity is 800,000 – 900,000 units per day. One unit in this context is for instance one sportswear shirt of a specific size. In total the ELC transports 160 million units outbound per year. The load factor of the load device being used either inbound or outbound is on average 86 %-87 %.

Reverse logistics make up 1-2 % of the products which are allowed to be send back by the shops. These products are primarily being sold by factory outlets.

Trends

Previously the focus at the ELC was on the service/cost ratio. Then it shifted to service at optimal cost. Currently the impact or carbon footprint of ELC's activities is an additional focus besides service at optimal cost. Consequently NIKE is looking for opportunities to make more use of multimodal transport. Also bundling with other companies is being considered and explored.

NIKE ELC sees three trends for its own operations. First, it anticipates on a growth of NIKE only stores. Russia is considered its largest growth market, and there will be more collaboration with the larger clients.

5.7.5 Other anonymous case studies or distribution centre information

A: Catalogue Retailer

A high profile catalogue retailer sells their general merchandise and products for the home from over 700 stores throughout the UK and Republic of Ireland, as well as online and over the telephone. They serve over 130 million customers a year through its stores and take four million customer orders either online or over the phone. Their sales topped £3.8 billion in the last financial year. One of their distribution centres is located in Scotland and is responsible for meeting the daily requirements of around 100 retail stores. It provides 330.000 m^2 of warehouse capacity including 29.000 pallet locations and 7.000 pick slots. The permanent staff at the Scotland distribution centre consists of 256 people, from which 100 are warehouse staff. On average they pick 150.000 boxes per week, however during peak periods this can increase to around 550.000 cases per week. These large volume fluctuations mean that the retailer must bring in up to 500 additional staff on temporary contracts to maintain service levels during busy periods.

Here are various performance measures introduced by the company like: number of cases picked per hour, cages dispatched per hour or pallets moved per hour. The retailer maintains all these measures in order to maintain maximum accuracy across the £80 million worth of stock held at any one time. The deliveries to stores are made 5 up to 7 times a week, depending on the demand level. The returned goods are collected at a returns warehouse and up to eight loads (containing 26 pallets each) are transported to Estonia, Latvia, Holland, Germany and France.

B: Car Manufacturer Distribution Centre

A Japanese car manufacturer with highly successful operations around the world is maintaining optimum production efficiency in its production plants. One of them is located in the UK. The facility has two production lines, which produce around 250,000 units per year which equals one car every 90 seconds. The manufacturer requires maximum time efficiency from around 250 of its providers within manufacturing supply chain. The Swindon team is an integrated part of the car manufacturers operations, with 70 dedicated warehouse staff and 175,000 m^2 of storage area. Around 200 deliveries are made to the production plant on a daily basis. In 2007, the stockholding in the warehouse was brought down from 1.5 days to 0.8 days.

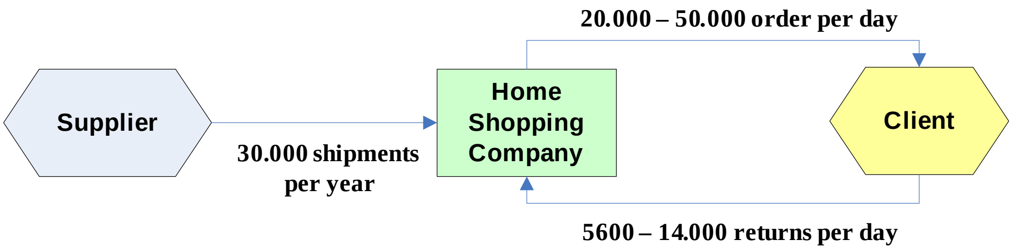
C: International Home Products Retailer

Currently, this home products retailer has 12 stores in the UK, which cover 10.000 different products form 1,800 suppliers in 55 countries worldwide. One of their British distribution centres is located in Peterborough. It has 85,000 m^2 of internal space divided between distribution centre (58,200 m^2) for delivery to stores and customer distribution centre (26,800 m^2) for delivery directly to customers. They receive palletized and un-palletized goods from its suppliers, usually stored on standard EUR pallets, half EUR pallets or larger pallets unique for the retailer. There are 132,529 pallet positions and 28 dedicated loading bays available at Peterborough. The facility is partly automated and the bar code labelling system is used to locate the correct storage location.

D: Home Shopping Company

A large home-shopping company in the Netherlands has a distribution centre located in Dedemsvaart. It has 33,000 m^2 of storage area and 300 employees. It has around 750 suppliers from 40 different countries and has to deal with around 30,000 shipments per year. The majority of goods that it handles are small hardware or fashion products. The number of orders fluctuates greatly not only depending on the season but also on the weekly or even daily basis (from 20,000 to 55,000 orders per day). A single order contains 1.8 items on average. The goods are palletized in Dedemsvaart and divided into so-called multiples (more than one unit per box) and singles. There are also other storage areas for hanging garments or valuable goods. Orders are processed 11 times per day. The company cooperates with a third party logistics provider, which dedicates several trucks for daily operations. A big challenge of the distribution centre is a high 28 % rate of returned products. Around 25 people per shift are dedicated to the process of sorting and reconditioning of returned products.

Figure 107 Logistics process of home shopping company



E: Automobile Group distribution centre

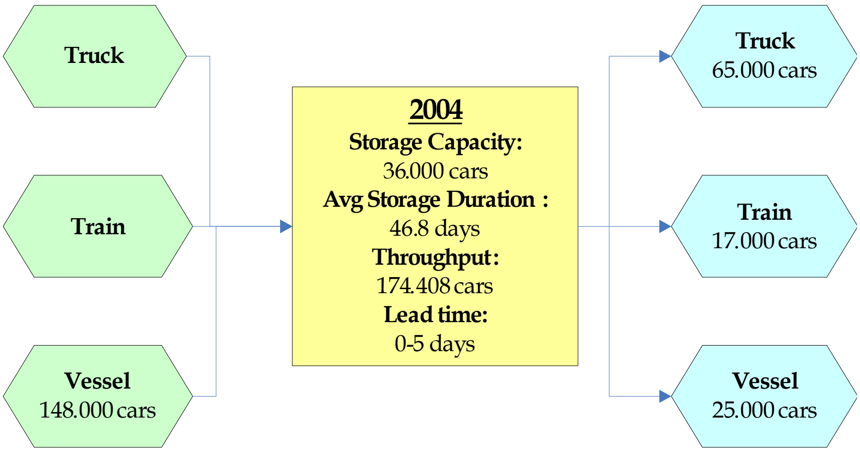
The Automobile Group is a logistics service provider in the field of the automotive industry and located in the Botlek port of the port of Rotterdam. They are the largest automotive logistics service provider in the Netherlands. More than 200,000 cars from car factories come to Automobile and then continue to be transported to dealers and importers in the Netherlands and the rest of Europe. Apart from transportation services, Automobile provides a number of value added services. These include the storage of cars, washing, inspection, modifications and damage repair.

In 2004 Automobile handled 174,408 cars with average storage duration of 46.8 days. This long storage duration is a consequence of the fact that Automobile has to store the car until the importer or dealer places a call for the car. The total storage duration of all cars corresponds to 7.8 million days. There were 142,927 cars that needed a washing and 68,858 cars that received a pre-delivery inspection. Almost 7 % of the total amount of handled cars is damaged, of which 5 % incurred during transport and 2 % at the Automobile terminal. The damage can vary from a small scratch till a total loss car. When the damage isn't commercially acceptable it has to be repaired. The treating of any car is between the 30 and 90 Euros. The average number of calls corresponded in 2004 to 573 cars each day.

The transport of cars consisted of three different modalities, namely truck, rail and vessel. In 2004 148,000 cars arrived at Automobile by vessel out of Asia and the remaining cars arrived by train and by truck. Between 20,000 and 30,000 cars are distributed to the dealers and importers by vessel, 17,000 cars by train and 65,000 cars by truck.

The total storage capacity of the Automobile terminal in Rotterdam consists of 36,000 cars but this storage capacity differs each day due to different length of cars. Furthermore there is a capacity for three vessels at the quay at the same time. The lead time, indicated as the time between the call for a car and the moment that the car is ready to be transported, is between 0 and 5 days.

Figure 108: Logistics process of automobile group



F: Fly Away Cargo distribution centre

Fly Away Cargo is part of the Fly Away International Group and is responsible for handling the cargo. The main activities of Fly Away Cargo will take place in the freight terminal at Schiphol. Every year there are 600,000 tonnes of cargo transported by Fly Away Cargo.

Fly Away Cargo has as target a time performance of 95 %. This means that 95 % of all the shipments must be delivered within time at the client.

Freight terminal 3 at Schiphol has a surface of 21,000 square meters. The throughput of freight terminal 3 was 245,000 tonnes in 2006. The maximum capacity at that time was 269,000 tonnes and 324,000 tonnes with additional resources.

Capacity utilisation without additional resources: 91.1 %.

Capacity utilisation with additional resources: 75.6 %.

The needed capacity in 2015 is estimated at 347,000 tonnes using an annual growth rate of 4 %. This means that with the current setting of resources the throughput could increase by only 5 % in order to meet the time performance target. The storage capacity of the racks in the terminal is currently employed for only 42 %.

G: Other information on distribution centres across Europe

Table 65 includes several distribution centres across Europe based on Fraunhofer[81] (2007). In addition, a questionnaire response from the Bucharest logistics service provider in Romania has been included. One remarkable observation is the number of logistics employees compared to the throughput in tonnes or pallets. The number of logistic employees is relatively high in Romania compared to Germany or Spain. Causes for this could be the level of automation being used in these different distribution centres and the labour costs are lower in Romania compared to Germany or Spain.

The delivery reliability as reported in this table seems to be very high (between 99 % and 100 %. However, the former case studies already indicated that a delivery reliability of higher than 95 % or 98 % is common for distribution centres.

Note that the inbound and outbound flows of goods use various loading devices. Within the distribution centre, consolidation or stripping and stuffing may take place after which a different loading device other than a pallet might be used. Therefore, inbound throughput and outbound throughput are more or less balanced, while the number of inbound and outbound pallets does not necessarily have to be balanced.

[81] Top 100 in European transport and logistics services, warehouse database.

Table 65: Data of European Distribution Centres 2006 (part 1)

Company	City/Location	Country	Number of employees of which in logistics	Pallets inbound (*1000)	Pallets Outbound (*1000)	# lorries inbound	# lorries outbound	Throughput inbound (Tonnes)	Throughput outbound (Tonnes)
Anonymous	Schwabach	DE	N.A.	N.A.	11.0	N.A.	N.A.	N.A.	3,525
Anonymous	Kassel	DE	49	13.5	1.4	N.A.	N.A.	3,088	3,088
Anonymous	Kempten	DE	66	0.8	2.0	N.A.	N.A.	1,173	1,360
Anonymous	Bad Säckingen	DE	33	3.3	3.7	N.A.	N.A.	N.A.	N.A.
Anonymous	München I	DE	6	4.8	7.6	N.A.	N.A.	4,398	4,408
Anonymous	Wiesloch	DE	107	60.0	80.0	N.A.	N.A.	5,661	5,661
Anonymous	München II	DE	23	10.6	15.9	0	0	7,904	7,327
Anonymous	Bucharest	RO	102	12.5	8.5	350	456	N.A.	N.A.

Table 66: Data of European Distribution Centres 2006 (part 2)

Company	City/Location	Country	Area of distribution centre (Net in m^2)	Total area of distribution centre (Gross)	Storage area (m^2)	Average delivery reliability (%)	Average order fulfillment cycle time (hours)	Average load factor (%)	Inbound mode	Outbound mode
Anonymous	Schwabach	DE	8,200	11,100	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Anonymous	Kassel	DE	N.A.	N.A.	1,051	N.A.	N.A.	N.A.	N.A.	N.A.
Anonymous	Kempten	DE	N.A.	N.A.	2,800	N.A.	N.A.	N.A.	N.A.	N.A.
Anonymous	Bad Säckingen	DE	N.A.	2,400	N.A.	99.95%	N.A.	N.A.	N.A.	N.A.
Anonymous	München	DE	1,397	1,397	652	N.A.	N.A.	N.A.	N.A.	N.A.
Anonymous	Wiesloch	DE	21,700	N.A.	14,200	100.00%	N.A.	N.A.	N.A.	N.A.
Anonymous	München	DE	3,637	3,787	1,464	N.A.	N.A.	N.A.	N.A.	N.A.
CEVA	Bucharest	RO	8,500	9,200	8,000	N.A.	2,4	85%	100% truck	100% truck
Anonymous	Dornbirn	AT	19,040	21,831	13,344	99.80%	N.A.	N.A.	100% truck	100% truck
Anonymous	Barcelona	ES	N.A.	16,891	8,551	98.60%	N.A.	N.A.	N.A.	N.A.

5.7.6 Comparison of European distribution centres

Similarities between distribution centres

In general distribution centres are characterized by its inbound flows from the source base (suppliers/manufacturers), distribution centre internal activities and outbound flows to the clients/customers. Inbound and outbound flows can be broken down into the different modes used (ocean shipping, ports, inland shipping, rail, truck etc.), loading devices used, 3PL or not, cost and lead time.

Internal activities at the distribution centre begin at the unloading docks, after which typically sorting, order picking, storage and loading for outbound flows takes place. Internally, resource planning and warehouse management are typical key activities. There are several internal performance indicators at the level of resource planning and warehouse management that are very detailed and business sensitive. More general, the most important performance indicator for distribution centres is the agreed level of on-time delivery or in other words the delivery reliability.

Differences between distribution centres

As there are many different product-market combinations in general and many different types of logistic services it is hard to compare a random selection of distribution centres across Europe. Parcel or express services cannot be compared with flowers or garments. Fast moving consumer goods have different characteristics than bulk products. For some distribution centres cost control might be key while others focus more on reliability or lead time. Warehouses have different capacities depending on the number of racks, storage space and level of automation.

6 Shipper's perspective

6.1 Background and objectives

In general the requirements of shippers are well known and documented in many research publications and studies. But shippers and their logistics partners often have insufficient information about the performance of individual transport modes or supply chains. If this shortcoming could be overcome, the actors would make decisions on the basis of solid facts rather than insufficiently substantiated opinions and prejudices. The focus of this task is the simulation of transport operations on a variety of different routes and for all modes. This produces a database that allows the assessment of the performance of individual transport modes and supply chains and will also provide information on the accessibility of different regional areas in Europe.

Based on real transport conditions, the estimation of transport costs, time and the reliability of the shipment of a 40 ft container for at least 60 types of virtual container journeys will be given. The 60 journeys are composed as follows: 5 major ports and 5 industrial centres as starting point to two different destinations for each origin, distinguished by 3 distance classes respectively. All relevant transport modes will be considered.

Therefore the work is structured into the following tasks:

- Selection of suitable relations
- Analysis of transport chains and simulation of transport operations
- Ranking and assessment of results

The main objective of the simulation is to achieve a general overview and enable a comparison between different origin- destination (OD) relations. This will be done for different transport modes in order to describe the characteristics of the transport corridors regarding transport costs, times and reliability.

6.2 Selection of suitable relations

A North-South (Scandinavia, Germany – France, Italy, Spain) and a West-East (Benelux, Germany, Czech Rep., Slovakia / Austria, Hungary Romania) corridor have to be considered in order to integrate the big transport flows in Europe. A special corridor is The Pan European-Corridor I (Via Baltica) Finland, Lithuania, Latvia, Estonia, Poland with extensions to the South), which is expected to become in future an important North-South link to connect Scandinavia and the Mediterranean Sea.

Within these major corridors, the following seaports and urban areas have been selected as starting points:

- Rotterdam as the biggest container port in Europe and as starting point on West – East Corridor
- Constanta as a port with growing container throughput at the Black-Sea
- Hamburg as a big container port on North-South corridor
- Genoa as a big container port at one end of North – South corridor
- Le Havre as one of the important North Range ports

However, there are other big seaports in Europe. But ports like Bremen, Zeebrugge and Antwerp have similar geographical position and nearly the same structure in transhipped commodities as the selected ones. Others like Algeciras or Gioia Tauro are transhipment ports and have- compared to other ports- no relevant hinterland connections.

An important selection criterion for the urban/industrial areas is that they are ranked as large metropolitan areas of Europe and therefore produce relevant freight transport volumes, especially container volumes. The selection also considers the results of the terminal perspective. Other reasons for the selection are the special location of the region, e.g. on the Via Baltica, and to get a spatial balanced allocation within Europe.

The following urban agglomerations have been selected as starting points:

- Metropolitan area of Madrid (Spain)
- Metropolitan area of Warsaw (Poland)
- Metropolitan area of Athens (Greece)
- Metropolitan area of Milan (Italy)
- Metropolitan area of London (Great Britain)

After having fixed the starting points for simulation of the container journey, suitable transport relations – two for each starting point - have been chosen from the selected corridors, covering medium, longer and very long transport distances. Origin-destination ports have been selected in a way that also short sea shipping could be part of a transport chain.

As a result, a structure for an origin – destination matrix with fixed starting and destination points for relations in three different distance bands has been developed (see *Table 67* and *Table 68*).

Table 67: Ports as origins

distance class / OD	Rotterdam	Hamburg	Constanta	Genoa	Le Havre
< 500 km	Cologne Bremen	Berlin Hannover	Bucharest Craiova	Milan Bologna	Paris London
500 - 1000 km	Mannheim Hamburg	Posen Dresden	Timisoara Sofia	Munich Lyon	Cologne Luxembourg
> 1000 km	Milan Vienna	Stockholm Budapest	Vienna Duisburg (Ruhr-area)	London Prague	Prague Madrid

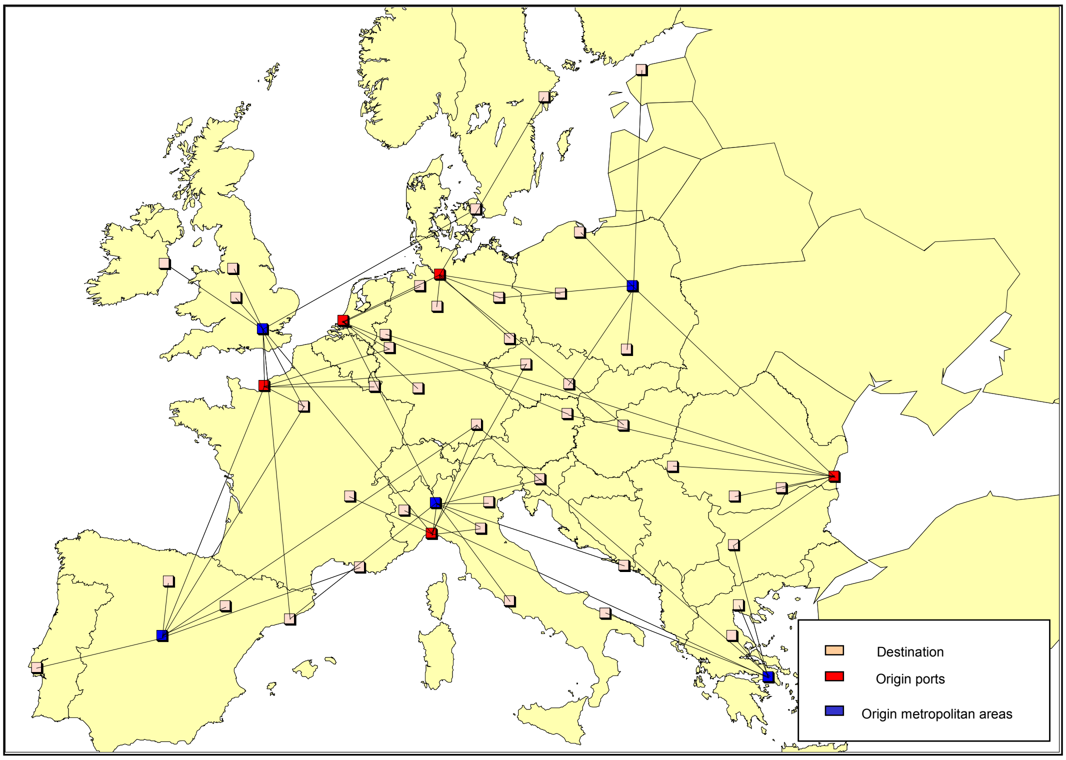
Source: own design

Table 68: Metropolitan areas as origins

distance class / OD	Madrid	Warsaw	Athen	Milan	London
< 500 km	Zaragoza Burgos	Krakow Gdansk	Thesaloniki Larisa	Bologna Padova	Birmingham Manchester
500 - 1000 km	Lisbon Marseille	Berlin Brno	Sofia Bari	Rome Ljubljana	Dublin Paris
> 1000 km	Munich Paris	Constanta Talinn	Munich Turin	Dubrovnik Barcelona	Copenhagen Barcelona

Source: own design

Figure 109: OD transport relations



Source: own design

6.3 Analysis of the transport chains and simulation of the transport operation

The result of this task is the description of the characteristics of the transport corridors regarding costs, times and reliability for all modes. A detailed analysis of possible transport chains for each mode – road, rail, inland waterway, air and intermodal transport – has been made[82]. Not only the overall transport times and costs are simulated but also special characteristics along the transport chain have been taken into account.

The calculation of the transport performance - like transport time and costs - are simulated and modelled considering the demand side perspective. That means that as much information from real transport operations as possible are used. The remaining data gaps are filled by using simulations and estimations. The result of this procedure is the characterisation of all 60 origin – destination relations, providing costs and times for the possible transport chains. Instruments for producing the results are route choice algorithms using intermodal network models, available at TCI[83]. Necessary adjustments and modifications have been done in order to get valid input attributes for the calculation e.g. cost structures and link categories in the chosen corridors. For this the matriculation principle has been used. This means that the starting point of the transport journey has been seen as the country in which the vehicle is registered and hence, country-specific transport characteristics have been used. E.g. the average cost structure for a German truck will be used as one component of the input for the simulation of the operating cost structure for a road transport from Hamburg to Budapest. This implies that – depending on the regional registration of a truck - different cost structures within the same corridor could occur. This is important because there is an increasing cross-trade and cabotage performance[84] especially by road hauliers from the ten member states that joined the EU in 2004. This counts for about 52% of total EU-cross-road transport in 2006 with a high uncertainty about the accuracy of the numbers[85]. But for the simulation approach the assumption that starting point and place of vehicles registration are the same, is a consistent way to simulate the effects of different cost structures because this scheme will also be used for transports from new member states into the old EU-countries.

In addition the modelling results have been validated by real transport operations and studies on transport performances during the model calibration. But

[82] Sources: TEN-STAC, TRANS TOOLS, PANEUROSTAR, REORIENT, RELEASE.
[83] As basic network input the network models of the TRANSTOOLS model environment has been used. This has been chosen as basic data and information source due to the fact that the input has been developed in charge of the EC and can therefore be used continuously for updates and new studies.
[84] Cross-trade is defined as international road transport from country A to country B by a haulier registered in country C, whereas cabotage is defined as road transport within country A by a haulier registered in country B.
[85] Eurostat (2008): Statistics in focus – Transport – 14/2008; Luxembourg; Eurostat (2009): Statistics in focus – Transport – 8/2009.

nevertheless it has to be noted that the simulated performance results can be more ore less different from real transport operations especially when operational concepts and supply chains are the main driver for the transport performances especially in rail, barge and intermodal transport chains.

In detail, the following data and basic inputs have been used as framework and simulation approach:

- **Road transport characteristics:**
  The operating costs of a road vehicle are mainly depending on the type of vehicle and its usage. For the simulation assessment, the following vehicle and performance characteristics and assumptions have been used:
  - Reference year is 2006
  - 40-tonne tractor with semi-trailer, 5 axles, emission standard Euro IV, loaded with a payload of 15 tonnes.
  - Average velocity structure:
    motorways: 75 km/h
    national roads: 45 km/h
    other non-urban roads: 40 km/h
    urban areas: 30 km/h
  - Driving time and rest periods :
    0:45 h break after a driving time of 4:30 h; after 9 h driving time a rest period of 11 h[86].
  - In general vehicles are operated and staffed with one driver
  - Operating costs are depending on variable (e.g. fuel, maintenance and abrasion) and fixed (e.g. taxes, depreciation) vehicle costs (vehicle kilometres related) and personnel costs (time related). Different average cost structure for western and eastern European countries have been used (a generalized list per country can be found in Annex 6.2[87]). Vehicle kilometres depending tolls are calculated separately based on rules and conditions for the year 2006.

[86] If the simulated analyses resulted in a shift change in the rest period of 11 h within the distance band of 20 km before the original destination, the destination has been shifted to this point. This is also marked in the detailed analysis.
It is assumed in the simulation that the permitted daily driving period of 9 hours will not be exceeded in journeys that last more than one day.

[87] The simulation results can differ from the generalized operation costs per vehicle-km due to different cost structure especially the time related personal cost.

- **Rail transport characteristics:**
  For the simulation assessment, the following characteristics have been used:
  - Reference year is 2006
  - Average train configuration:
    30 wagons; weight: 550 tonnes/train; max. length:700 m
  - operating costs are depending on train path charges and traction costs. Therefore average train path charges for single countries and related traction costs (e.g. personal, energy, rolling stock provision) have been used.
  - Costs and times for pre- and post haulage and container handling have been assumed on an average European rate
  - Average driving times and speeds depending on track classification have been used.[88]

- **Inland waterway transport characteristics:**
  For the simulation assessment, the following characteristics have been used:
  - Reference year is 2006
  - operating costs (e.g. provision, traction, charges) are depending on the capacity of the barges which depends on the minimum CEMT[89] inland waterway classification in the corridors:
  - up to category IV: max. 75 TEU
  - category V and more: max. 200 TEU
  - Average transport times and speed are depending on inland waterway classification, direction of navigation (up- or downstream navigation) and number of watergates that have to been passed[90]
  - Costs and times for pre- and post haulage and container handling have been assumed on an average European rate.

- **Air transport characteristics:**
  The characteristics of specific air transport operations are based on existing services and transport operations in accordance with the IATA (International Air Transport Association) regulatory TACT (The Air Cargo Tariff). Only the long-distance transport relations have been analysed. For the simulation assessment, the following characteristics have been used:

[88] For the simulation assignment approach of driving times, speed of trains according to the methodology and input data used in the Trans Tools model have been used depending on track type (e.g. conventional, upgrated, and new lines) and country including time needs for critical border detentions.
[89] CEMT – European Conference of Ministers of Transport - now International Transport Forum (ITF)
[90] The used simulation assignment approach of driving times, speed of barge according to the methodology and input data used in the Trans Tools model ranges between 3 and 16 km/h.

- Reference year is 2006
- In general air cargo rates are depending on the type and weight of the commodity that is varying between different airlines on the market. As far as possible average rates for general cargo and special rates for heavy loads have been taken into account.
- The average additional handling for stripping of a 40´container to ULDs (Unit Load Devices) for air transport has been considered in the handling charges and times.

▪ **Intermodal transport characteristics:**
The analysis of intermodal transport is based on the single elements of the transport chain. The numbers are gathered by using information from the individual modes and completed with additional time and costs for container handling in the terminals. The latter are results from the "terminal perspective" analysis in this report and are completed with results from European Research Studies like RECORDIT. In addition the definition of intermodal transport chains and especially the selected transhipment points are also based on realistic and practicable feasible transport operations. Therefore again only the long –distance transport relations have been analysed as competitive and operationally practicable and effective intermodal transport chains (accompanied and unaccompanied). The defined intermodal transport chains can be seen in the following tables.

Table 69: Definition intermodal transport chains – ports

OD combined		transport chain
Rotterdam	Milan	Road:
		Rotterdam-Freiburg.
		Piggy back transport:
		Freiburg – Novara
		Road:
		Novara-Milan
	Vienna	Inland Water Way:
		Rotterdam-Duisburg
		Rail:
		Duisburg-Wels
		Road:
		Wels –Vienna
Hamburg	Stockholm	Short -Sea Shipping:
		Hamburg-Stockholm
	Budapest	Rail:
		Hamburg – Wels
		Road:
		Wels – Budapest
Constanta	Vienna	Road:
		Constanta – Brasov
		Rail:
		Brasov – Vienna
	Duisburg (Ruhr-area)	Road:
		Constanta – Budapest
		Inland Water Way:
		Budapest – Duisburg
Genoa	London	Short-Sea Shipping:
		Genoa- Felixstowe
		Road:
		Felixstowe – London
	Prague	Road:
		Genoa - Trento
		Piggy back transport:
		Trento – Regensburg
		Road:
		Regensburg – Prague
Le Havre	Prague	Short-Sea Shipping:
		Le Havre - Hamburg
		Rail:
		Hamburg – Prague
	Madrid	Short-Sea Shipping:
		Le Havre – Bilbao
		Road:
		Bilbao – Madrid

Table 70: Definition intermodal transport chains – metropolitan areas

OD combined		transport chain
Madrid	Munich	Road: Madrid – Perpignan Rail: Perpignan - Munich
	Paris	Road: Madrid – Bayonne Rail: Bayonne - Paris
Warsaw	Constanta	Rail: Warsawa – Budapest Road: Budapest - Constanta
	Talinn	Road: Warsawa – Gdansk Short-Sea Shipping: Gdansk - Talinn
Athen	Munich	Road: Athen – Patras RoRo (ferry): Patras – Venice Road: Venice – Munich
	Turin	Road: Athen – Patras RoRo (ferry): Patras – Venice Road: Venice – Turino
Milan	Dubrovnik	Road: Milano – Bari RoRo (ferry): Bari – Dubrovnik
	Barcelona	road: Milano – Genoa Short-Sea Shipping: Genoa – Barcelona
London	Copenhagen	Road: London – Felixstowe Short-Sea Shipping: Felixstowe - Copenhagen
	Barcelona	Road: London – Dover Short-Sea Shipping: Dover – Barcelona

- Reliability:
  The context of reliability is based on information on existing services and transport operations and is both operational and consumer based. Analysed attributes are damages, thefts, and the compliance of specific time frames. Sources are expert interviews, information from other projects and expert based estimation.

6.4 Results and conclusions of the transport analysis

The final results of this task are analyses of the transport performance based on the simulation of the characteristics of the selected transport corridors and relations regarding costs, times for all modes and intermodal transport. The detailed simulation results can be found in Annex 6.1

For road transport the following results are described in detail[91]:

- Transport kilometres in total
- Detailed transport kilometres per country
- Transport duration in total
- Transport duration separated into rest periods and driving time
- Transport costs in total
- Vehicle kilometres dependent tolls per country[92]
- Routing description

For rail and inland waterway transport the following results are described in detail:

- Transport kilometres in total
- Detailed transport kilometres per country
- Transport duration in total
- Transport costs in total
- Detailed transport costs separated into main, pre- and post haulage and container handling
- Routing description

For air transport the following results are described in detail:

- Transport kilometres in total
- Transport duration in total
- Transport costs in total
- Detailed transport handling costs

[91] The assumption for the simulation of transport driving times and costs is that in general the road vehicles are operated and staffed with one driver. In some cases, road transport is operated and staffed with 2 drivers to have fewer rest periods. The time and rest period regulation for two drivers specifies that at least an 8 hour daily rest period should be obtained in a resting or inactive vehicle. That means that the time advantage compared to a journey with 1 driver is max. 3 hours per rest period. But on the other hand the transport costs would increase due to the time depending personnel costs.
[92] Time related tolls are included in the average cost structure.

For intermodal transport the following results are described in detail:

- Description of the transport chain
- Transport kilometres in total
- Detailed transport kilometres per transport mode
- Transport duration in total
- Detailed transport duration time per transport mode and handling and waiting time[93]
- Transport costs in total
- Detailed transport costs per transport mode and handling costs

The performance results can be found in a nutshell in the following tables:

[93] Handling and waiting times in terminals are depending on daily and seasonal time frames. Especially cyclical effects are influencing capacity bottlenecks and waiting and handling times. Due to this and the wide range of waiting times reported in the "terminal perspective", average estimated waiting and handling times have been used for the simulation.

Table 71: Overview transport performance of costs and times – ports

rts			road		rail		IWW		air		intermodal	
	corridor	avg. road distance	costs	times	costs	times	costs	times	costs	times	costs	times
Cologne	IIa	280 km	300 €	4:00 h	430 €	6:30 h	330 €	44:00 h				
Bremen	IIa	420 km	470 €	6:45 h	560 €	9:30 h	410 €	93:00 h				
Mannheim	IIa	500 km	560 €	7:45 h	650 €	11:30 h	300 €	92:00 h				
Hamburg	IIa	530 km	590 €	8:00 h	580 €	11:30 h	460 €	123:00 h				
Milan	IIa/Ib	1045 km	1450 €	27:45 h	1.390 €	25:30 h	-	-	23.300 €	6:10 h	1.310 €	26:00 h
Vienna	IIa	1190 km	1664 €	28:45 h	1.250 €	27:30 h	750 €	253:00 h	23.500 €	6:45 h	1.380 €	73:00 h
Berlin	Ia	285 km	310€	04:15 h	800 €	05:30 h	330 €	44:00 h				
Hannover	Ia	155 km	170 €	02:30 h	580 €	03:00 h	300 €	31:00 h				
Poznan	IIa	515 km	680 €	08:45 h	980 €	13:00 h	420 €	126:00 h				
Dresden	IIa	560 km	560 €	7:45 h	890 €	9:30 h	370 €	64:00 h				
Stockholm	Ia	915 km	1590 €	29:00 h	1.600 €	23:30 h	-	-	25.000 €	6:30 h	650 €	41:00 h
Budapest	IIa	1165 km	1750 €	40:45 h	1.450 €	29:00 h	800 €	329:00 h	36.000 €	6:40 h	1.710 €	46:30 h
Bucharest	IIa	225 km	240 €	6:00 h	390 €	6:30 h	-	-				
Craiova	IIa	455 km	430 €	11:15 h	540 €	12:00 h	-	-				
Timisoara	IIa	690 km	890 €	21:50 h	770 €	21:30 h	-	-				
Sofia	IIa	575 km	740 €	22:15 h	710 €	19:00 h	-	-				
Vienna	IIa	1290 km	1.600 €	61:00 h	1.220 €	36:00 h	560 €	190:00 h	25.000 €	7:45 h	1.610 €	53:00 h
Duisburg (Ruhr-area)	IIa	2230 km	2.900 €	86:15 h	2.075 €	58:00 h	930 €	330:00 h	36.000 €	7:40 h	1.530 €	217:00 h
Milan	Ib	130 km	160 €	1:50 h	345 €	2:30 h	-	-				
Bologna	Ib	285 km	335 €	4:00 h	420 €	4:30 h	-	-				
Munich	Ib	700 km	1100 €	21:15 h	720 €	15:00 h	-	-				
Lyon	Ib/Ia	475 km	590 €	7:45 h	640 €	9:00 h	-	-				
London	Ib/IIa	1310 km	2370 €	43:20 h	1.610 €	24:00 h	-	-	28.500 €	7:00 h	2.875 €	188:00 h
Prague	Ib/IIa	1065 km	1550 €	27:45 h	1.050 €	25:30 h	-	-	31.500 €	6:30 h	1.030 €	22:30 h
Paris	Ia	210 km	250 €	3:00 h	440 €	4:30 h	280 €	20:00 h				
London	Ia	115 km	530 €	9:00 h	680 €	10:30 h	-	-				
Cologne	IIa	585 km	680 €	8:40 h	755 €	14:00 h	480 €	121:00 h				
Luxembourg	Ia	575 km	710 €	8 :45 h	775 €	11:30 h	-	-				
Prague	Ia/IIa	1245 km	1.950 €	41:15 h	1.425 €	29:30 h	730 €	240:00 h	36.000 €	6:40 h	1.220 €	73:00 h
Madrid	Ia	1355 km	2.070 €	44:15 h	1.495 €	29:30 h	-	-	34.000 €	7:00 h	1.025 €	55:30 h

Table 72: Overview transport performance of costs and times – metropolitan areas

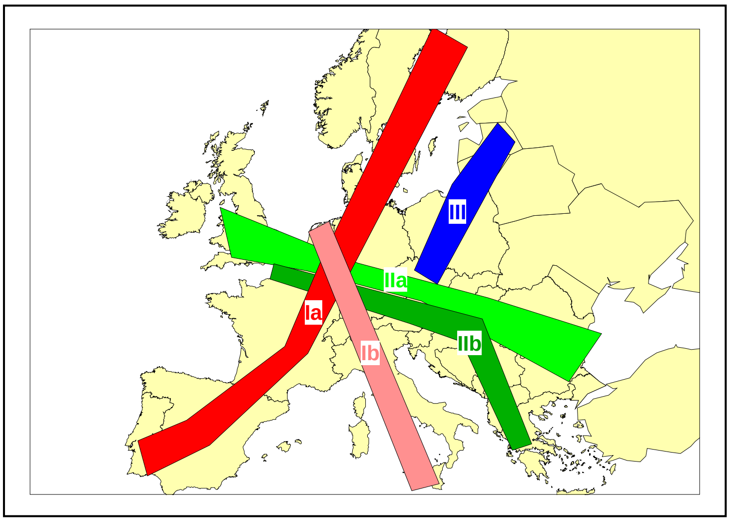
etropolitan areas			road		rail		IWW		air		intermodal	
	corridor	avg. road distance	costs	times	costs	times	costs	times	costs	times	costs	times
Zaragoza	Ia	315 km	340 €	4:30 h	480 €	6:30 h	-	-				
Burgos	Ia	245 km	260 €	3:30 h	431 €	5:30 h	-	-				
Lisbon	Ia	630 km	730 €	9:30 h	740 €	17:00 h	-	-				
Marseille	Ia/Ib	1105 km	1.540 €	27:45 h	1.180 €	43:30 h	-	-				
Munich	Ia	1990 km	2.800 €	62:45 h	2.530 €	71:30 h	-	-	22.000 €	7:30 h	2.555 €	65:00 h
Paris	Ia	1280 km	1.970 €	41:30 h	1.301 €	45:00 h	-	-	21.500 €	7:00 h	1.605 €	53:00 h
Krakow	III	360 km	343 €	7:00 h	446 €	8:00 h	290 €	40:00 h				
Gdansk	III	345 km	353 €	8:15 h	471 €	11:30 h	300 €	46:00 h				
Berlin	III/Ia	590 km	765 €	23:45 h	662 €	17:00 h	420 €	88:00 h				
Brno	III/Ia	570 km	720 €	22:15 h	643 €	15:30 h	-	-				
Constanta	III/Ia	1245 km	1.840 €	64:45 h	1.198 €	43:00 h	980 €	543:00 h	24.000 €	6:50 h	2.235 €	63:00 h
Talinn	III	1085 km	1.350 €	46:00 h	1.019 €	32:30 h	-	-	24.500 €	9:30 h	825 €	46:00 h
Thessaloniki	IIb	475 km	565 €	9:15 h	446 €	12:00 h	-	-				
Larisa	IIb	315 km	385 €	6:30 h	536 €	9:00 h	-	-				
Sofia	IIb	765 km	1.160 €	21:15 h	908 €	22:30 h	-	-				
Bari	IIb	215 km	820 €	21:00 h	2.378 €	66:00 h	-	-				
Munich	IIb	2000 km	3.030 €	66:45 h	2.041 €	59:30 h	-	-	24.000 €	7:30 h	1.470 €	54:45 h
Turin	IIb/Ib	1210 km	2240 €	68:45 h	2.049 €	60:30 h	-	-	21.500 €	7:30 h	1.420 €	54:00 h
Bologna	Ib	230 km	270 €	3:30 h	423 €	3:30 h	-	-				
Padua	Ib	240 km	290 €	3:45 h	419 €	3:30 h	-	-				
Rome	Ib	590 km	710 €	9:00 h	706 €	9:00 h	-	-				
Ljubljana	Ib/IIb	495 km	590 €	7:45 h	641 €	10:30 h	-	-				
Dubrovnik	Ib/IIb	1110 km	1.750 €	41:45 h	1.182 €	39:00 h	-	-	28.000 €	8:00 h	1.575 €	44:00 h
Barcelona	Ib/Ia	990 km	1.455 €	26:30 h	1.126 €	19:30 h	-	-	27.000 €	6:30 h	635 €	38:00 h
Birmingham	IIa	200 km	230 €	3:30 h	389 €	3:30 h	-	-				
Manchester	IIa	345 km	470 €	6:00 h	504 €	6:00 h	-	-				
Dublin	IIa	490 km	820 €	13:00 h	689 €	9:00 h	-	-				
Paris	IIa	420 km	832 €	07:45 h	631 €	8:00 h	-	-				
Copenhagen	IIa/Ia	1190 km	2.300 €	42:15 h	1.545 €	33:30 h	-	-	27.000 €	7:00 h	975 €	45:00 h
Barcelona	IIa/Ia	1455 km	2.530 €	45:45 h	1.555 €	28:30 h	-	-	32.500 €	7:15 h	2.025 €	133:30 h

- The gathering of information concerning the issues of reliability is based on information about existing services and transport operations and is both, operational and consumer based. Attributes that are analysed are damages, thefts, and the compliance with specific time frames (delivery in time / punctuality). Information sources are expert interviews[94] based on standardized questionnaires, The analysis was completed by literature reviews and information from other projects. For the expert interviews and questionnaires, reliability has been parameterised in terms of delivery in time, thefts and damages by mode and transport corridors in qualitative terms. Main transport corridors are defined (see below), for which estimations have been made in general on an geographical aggregated level. In more detail and as far as possible we collected information about congestion and bottlenecks. The following main transport corridors for assessment of reliability have been defined (see

- *Figure 110*):

- Ia North-South I
(Scandinavia, Germany – France, Spain)
- Ib North-South II
(Scandinavia, Germany, Italy)
- IIa West-East I
(GB, Benelux, Germany, Czech Rep., Slovakia / Austria, Hungary, Romania)
- IIb West-East II
(GB, Benelux, Germany, Czech Rep., Slovakia / Austria, Hungary, Croatia, Serbia / Bosnia-Herzegovina, Macedonia, Greece)
- III Pan European-Corridor I
(Baltic States, Poland with extensions down to the south)

Figure 110: Definition of transport corridors



94 The experts are coming from the business areas of shippers, forwarding companies, train operators, logistic consulting companies, freight insurance companies, terminal and port operators and are located in Germany, Netherlands, Austria, UK, Italy, Romania and Czech Republic.

Research projects and initiatives concerning reliability in freight transport often concentrate on the issue of damages and lack of security of commercial vehicles[95]. Because of the dominance of road freight transport in Europe and the fact that the observed numbers of thefts of road vehicles and their loadings is very high, there was the motivation to focus in this study for criminal issues on road freight transport too.

Several large metropolitan areas and the main transit countries are pointed out here as the main hot spots where multiple incidents have occurred and a comparable high risk of the occurrences of criminal incidents exists, e.g. Greater London, Flemish region (corridor Brussels-Antwerp), île-de-France, Lombardia (see *Figure 111*). Explanations for this are the close relationship with traffic and population density and lack and limited supply of secure parking areas in these regions.

Within the COMPETE project[96] five major potential bottlenecks for long-distance transports have been identified:

- Port bottlenecks in the North-Atlantic and Baltic ports, which offer good quality infrastructure, but in some cases operate close to capacity. This can also be seen in the results of the “Terminal perspective” (see chapter 5). Here especially the ports with a high rate of container throughput are operating close to capacity, e.g. Rotterdam, Antwerp, Hamburg and Bremen.
- Railway bottleneck in Eastern Europe due to partially low quality infrastructure and problems with interoperability and cross-border integration of networks.
- Railway bottleneck in Southwest Europe due to significant interoperability problems and partially low quality networks that are poorly interconnected.
- Road bottleneck in Eastern Europe due to high density of transport flows running on networks of varying quality and facing significant local bottlenecks.

[95] E.g. TAPA EMEA IIS (Transported Asset Protection Association) incident information database of reported criminal acts against cargo;
ECMT (2002): Crime in road freight transport;
European Parliament (2007): Organised theft of commercial vehicles and their loads in the European Union.
[96] COMPETE Final Report (2006): Analysis of the contribution of transport policies to the competitiveness of the EU economy and comparison with the United States.

The results concerning inter-urban road congestion and bottlenecks can be summarised as follows:

- "Germany, the Benelux countries and the southern part of the UK take an outstanding position because here the density of large urban areas causes considerable congestion on the entire trunk road network.
- France, Poland, Spain and a number of periphery countries perceive congestion on the trunk road network as a problem around urban areas.
- In a large number of periphery countries, including Scandinavia, the Baltic countries, Slovakia, Slovenia and Greece inter-urban congestion is not a real issue.
- The Alpine countries Switzerland and Austria mainly suffer from transit traffic from and to Italy. In particular the Brenner route in Austria also suffers from heavy lorry traffic.
- Road bottleneck in Central Europe due to high density of transport flows operating already close to capacity and facing significant regional bottlenecks."

The information most widely available for rail freight transport concerns the punctuality of trains. According to the data published by the CER[97] (see *Figure 112*), the punctuality of international combined transport trains- especially the level of compliance with timetables- is below 60%. According to the information published by CER the overall punctuality of freight trains is increasing slightly. In Austria, Denmark, Finland, the Netherlands, Sweden and Spain the level of punctuality of freight trains is, according to the operators' association, more than 90% for domestic traffic, and at least 80% in the majority of the EU-member states, also for domestic traffic.

In general a large number of the EU inland ports and inland navigation networks do not operate under full capacity utilisation and thus are less sensitive to congestion problems. This can also be emphasised and gathered from the results of the questionnaire within the chapter "Terminal perspective". The results also show a large variety in the storage capacity (see *Table 46*).

One big problem considering reliability of inland waterway transport and especially punctuality are water conditions when during floods (very high water) or extreme dry seasons (low water) inland waterway vessels cannot perform as usual.

[97] COMMUNITY OF EUROPEAN RAILWAY AND INFRASTRUCTURE COMPANIES - CER (2008): Rail freight quality progress report 2007/2008; Brussels.

These statements and findings have been approved and supported by reviews and estimations from experts and stakeholders (expert interviews). The experts and stakeholders are mainly transport operators or experts from insurances, forwarding companies, transport and logistic consultants and shippers. They have been asked to give a qualitative assessment for each criteria category (thefts - damages - delivery in time) by transport mode and transport corridor. They were asked to use the following weighting factors:

1 Unimportant factor - no problem at all
2 Neutral factor - just a few problems
3 Important factor - many problems (more than a few)
4 Critical factor - a lot of problems

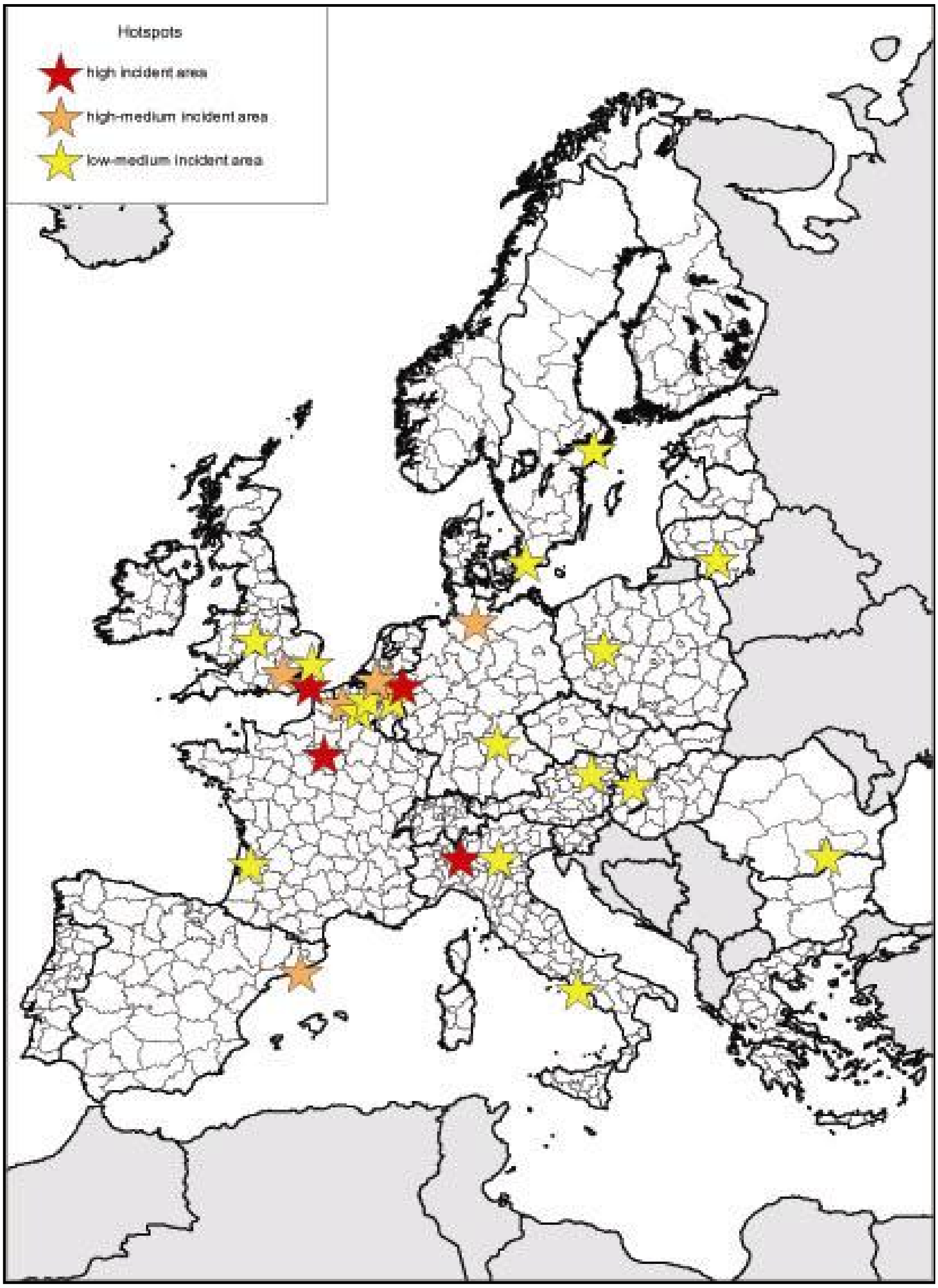
The main general findings of the expert interviews based on standardized questionnaires can be summarized as (see detailed analyses in Figure 113 and 114):

- Considering an average over all modes there is a high standard (between 1 and 2) of reliability on the analysed corridors for each attribute.
- In general freight transport by air achieved the best estimations for all attributes within each analysed corridor but is also by far the most cost-intensive transport mode.
- Except for air transport, Inland Waterway transport has been assessed as the most reliable transport mode considering an average of all attributes and corridors due to the fact that freight transport by barge is less vulnerable for thefts and damages.
- In general the aspect of "punctuality / delivery in time" has bees estimated by the expert as the most critical factor for all modes and within all corridors in the context of reliability.
- The North-South corridor Ia (Scandinavia, Germany – France, Spain) received the best and the corridor III (Corridor "Via Baltica") received the worst estimation in the average of all modes and all attributes.
- Especially for the attribute "thefts" and "damages" the worst estimation has been given to the corridor III followed by the West-East corridor IIa (GB, Benelux, Germany, Czech Rep., Slovakia / Austria, Hungary, Romania).
- Also for the category "delivery in time" the corridor IIa received the comparatively worst estimations. The main reason given by the experts is the long transit time within Eastern European countries and the partially low quality of network infrastructure and problems with interoperability and cross-border integration of networks.

In contrast the North-South corridor Ib (Scandinavia, Germany, Italy) received slightly better estimations for this attribute, except for rail transport due to multiple borders, technical and operating checks along the corridor.

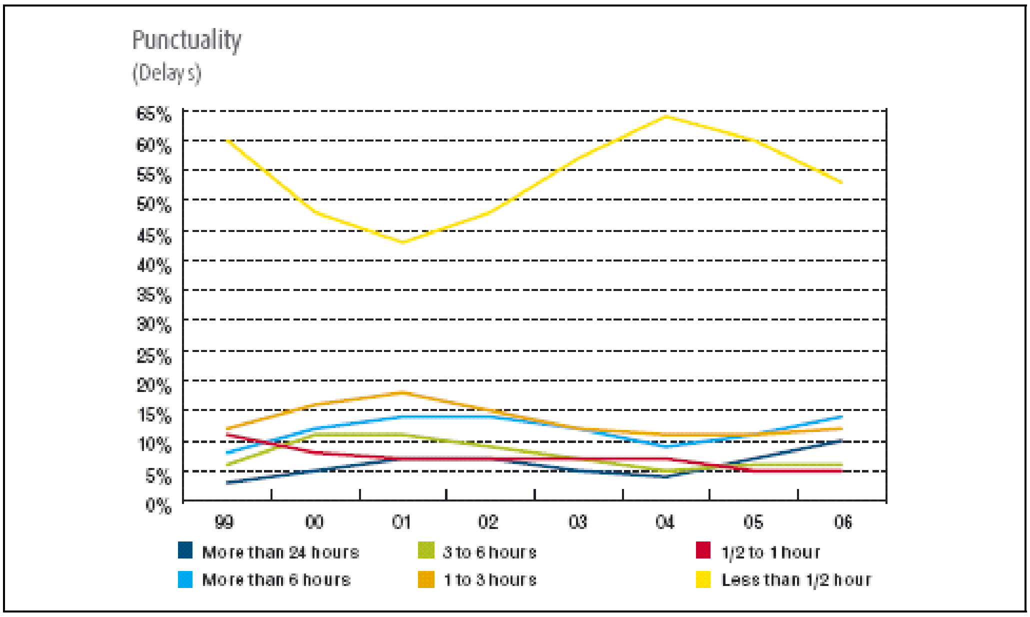
- In general for all corridors the worst estimations concerning “thefts” have been estimated for road freight transport.
- Road transport achieved the worst estimations of all modes for the North-South corridor Ia (Scandinavia, Germany – France, Spain) and IIa (GB, Benelux, Germany, Czech Rep., Slovakia / Austria, Hungary, Romania) for the attribute “delivery in time”. Again the reasons given by the expert for this is the long transit time within Eastern European countries and the partially low quality of network infrastructure (corridor IIa) and additional obstacles and bottlenecks (corridor Ia), e.g. sea crossing or the Pyrenees.
- Freight transport by barge and short-sea shipping achieved the worst estimations for the category “delivery in time” in the corridor IIa (GB, Benelux, Germany, Czech Rep., Slovakia / Austria, Hungary, Romania). Following the results from the expert interviews one important reason for this are seasonal determined water level conditions.
- Rail transport achieved the worst estimations of all modes for the West-East corridor IIb (GB, Benelux, Germany, Czech Rep., Slovakia / Austria, Hungary, Croatia, Serbia / Bosnia-Herzegovina, Macedonia, Greece) for the attribute “delivery in time”.

Figure 111: Location of hot-spots for criminal incidents in freight transport



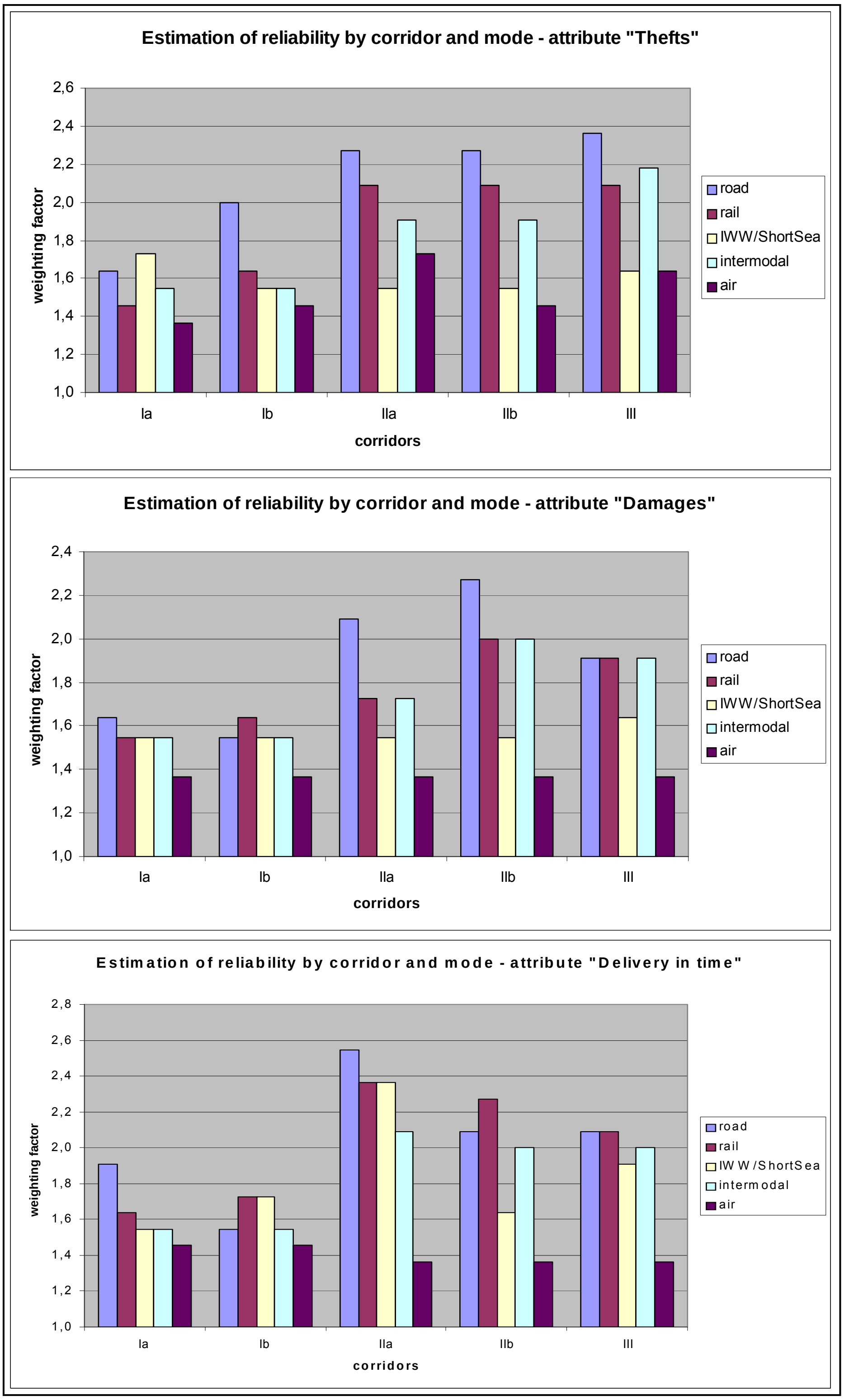
Source: European Parliament (2007); p.11

Figure 112: Punctuality of international intermodal freight trains



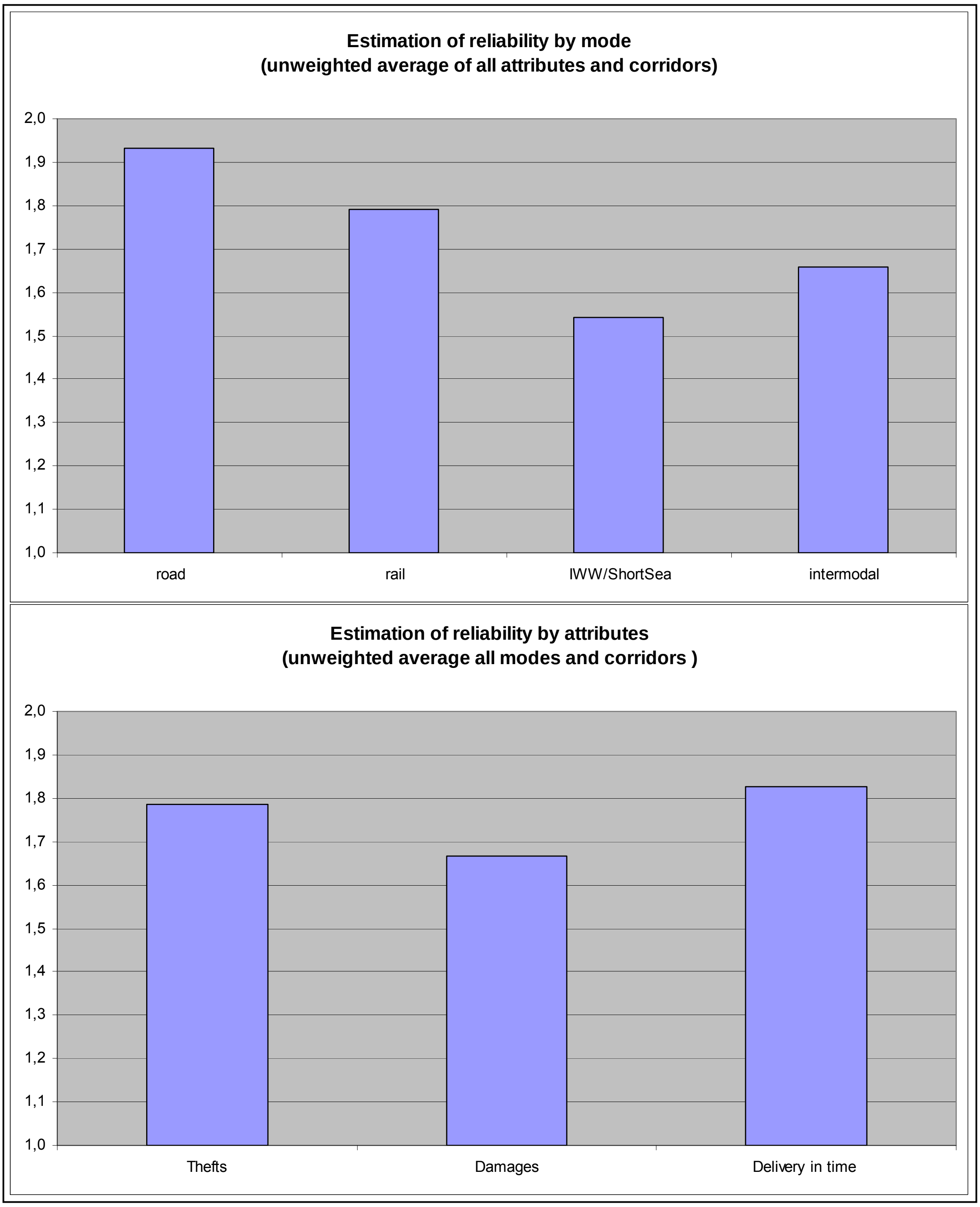
Source: CER- (2008); p.22

Figure 113: Reliability – qualitative analysis by corridor and mode – expert interviews[98]



[98] Scale: 1: no problems – 4: many problems.

Figure 114: Reliability – qualitative analysis by mode or attribute – expert interviews[99]



[99] Scale: 1: no problems – 4: many problems.

In addition the following simulation results of transport costs and times have been validated by real transport operations and studies on transport performances .As mentioned before the results of these simulation exercises can differ from real costs and times. In air transport only the long-distance transport relations have been analysed. The results are not completely comparable to the other modes in cases of unrealistic and not practicable transport alternative. Therefore air transport has not been taken into account concerning the following comparisons of transport costs and times by mode and transport corridors.

The results of the analysed transport performances of costs and times are compared and faced in a multidimensional way: in a first view, comparisons of the transport modes within the corridors (see Figure 115 and 116) and second within the distance classes (see Figure 117).

The main summarized general findings are:

- In general road transport in terms of transport costs and times is still the best performable mode in the short distance class due to the fact that no additional times and costs for handling in transhipment nodes is needed.
- The longer the transport distance the more the immanent advantages of freight transport with rail and inland water way comes into account.
- In general freight transport by barge and short-sea shipping in the longer distance classes can be competitive in terms of transport costs. Additionally- concerning the aspect of reliability- transport on inland waterways has also been assessed in the expert interviews as one of the most reliable transport mode of all attributes and corridors on average.
- Furthermore it can be shown that intermodal transport chains are competitive over long distances in terms of costs and times, if the single transport modes are coordinated and chosen in the most effective way and if additional handling and waiting times in the terminals are reduced to the absolute minimum. In particular, this holds if it is possible to adjust the transport chain and the operation of each used single transport mode in a way that avoids additional obstacles and bottlenecks (e.g. Rotterdam – Milan) or corridors with high density of transport flows running on networks of varying quality and facing significant local bottlenecks (e.g. Warsaw – Tallinn).

Comparisons of cost and time performance within the single distance classes and corridors:

- Distance class 1 (<500 km)
  - Road transport is the most effective mode in terms of costs and especially in terms of total transport times in door-to-door transport.
  - Rail transport is the most cost intensive mode in this distance class
  - Inland waterway transport the most time intensive mode in this distance class
  - For the transport relation between Constanta and Craiova rail and road transport have nearly same results concerning cost and times due to the fact that the transport distance is at the head of the distance class.

- Distance class 2 (500-1,000 km)
  - Concerning average simulation results for all relations within this distance class, road transport is still the most effective mode in terms of total transport times and costs in door-to-door transport.
  - Inland waterway transport is still the most time intensive mode in this distance class but also the most cost effective.
  - Rail transport is still the most cost intensive mode in this distance class and generally also more time intensive than road transport.
  - But comparing road and rail transport, the average transport costs and times are nearly converging to similar performances.

- Distance class 3 (>1,000 km)
  - Again concerning the average simulation results for all relations within this distance class, inland waterway transport is still the most time intensive mode but also the most cost efficient one.
  - Beside air transport rail transport turns in this distance band generally to the most effective mode in terms of total transport times.
  - Intermodal transport chains could almost be competitive in terms of costs and times if the single transport modes are coordinated and used in the most effective way, e.g. Rotterdam to Milan via Freiburg (Germany) by road, piggyback over the Alps and post-haulage from the rail terminal Novara to Milan. This example combines the advantages of each single transport mode in its most effective distance band and location. But often the disadvantages and underperforming of intermodal transport chains concerning transport times and costs especially compared to road transport are results of the additional handling and waiting times in the terminals.

Figure 115: Overview transport times and costs within the corridors (1)

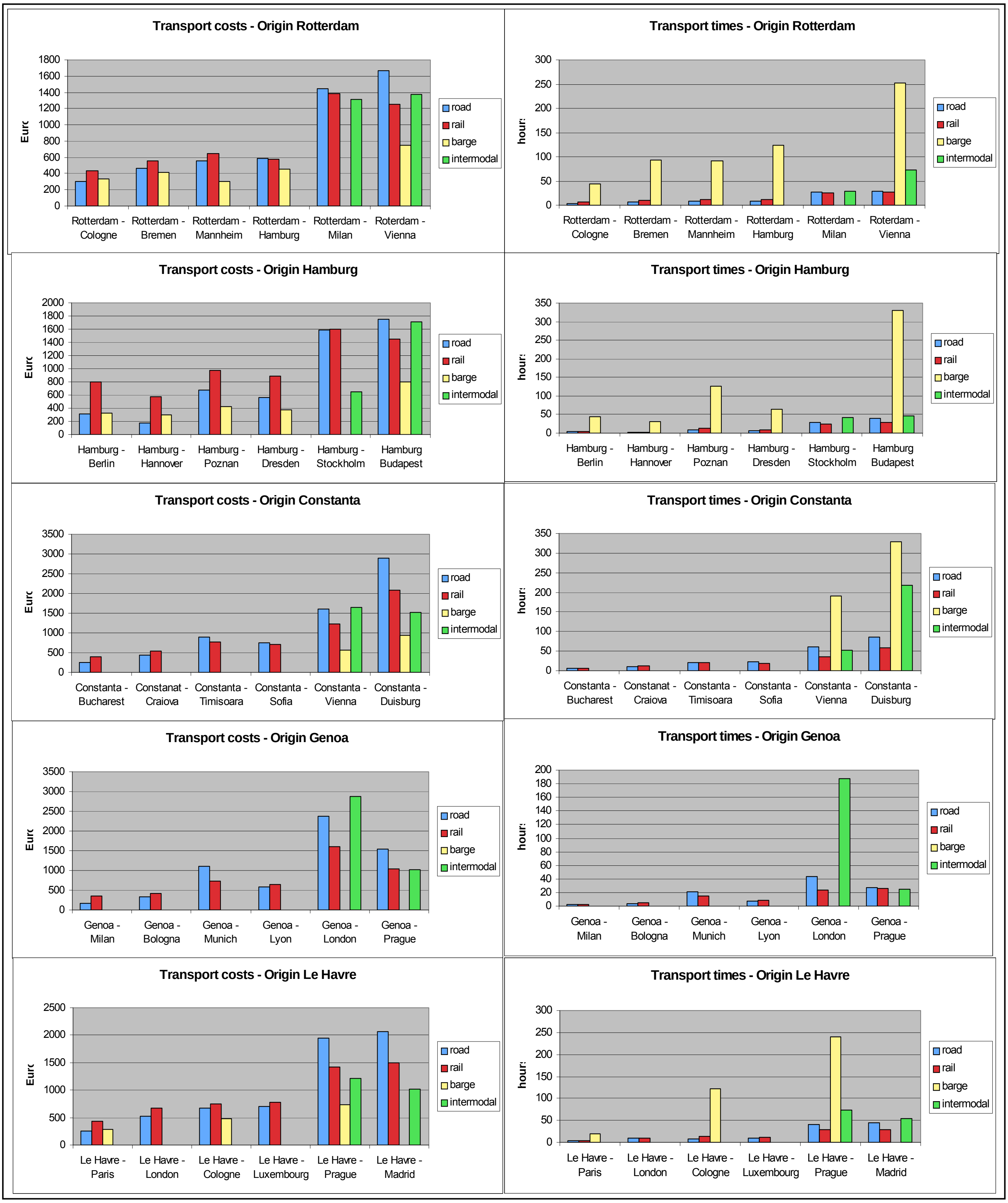


Figure 116: Overview transport times and costs within the corridors (2)

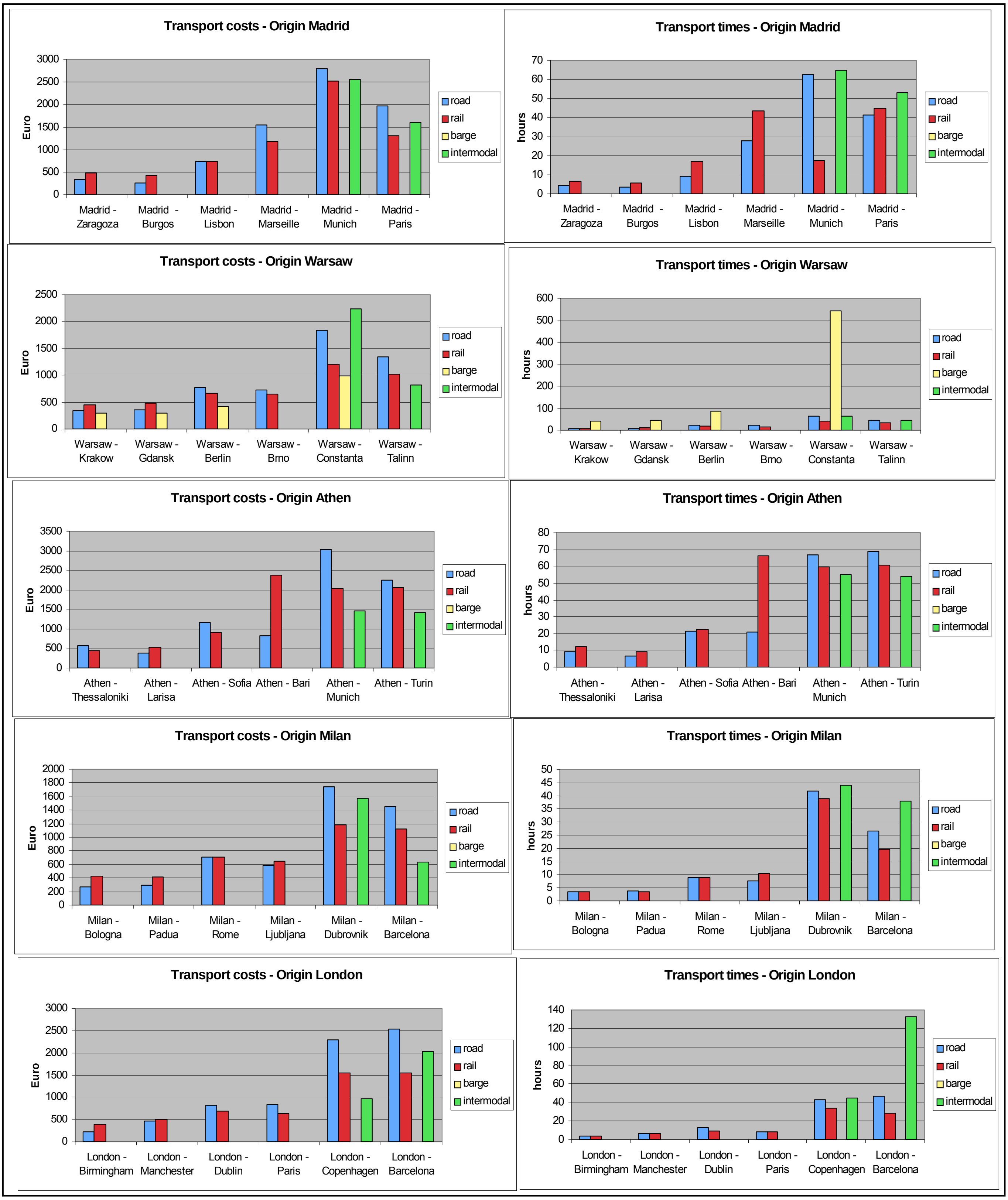
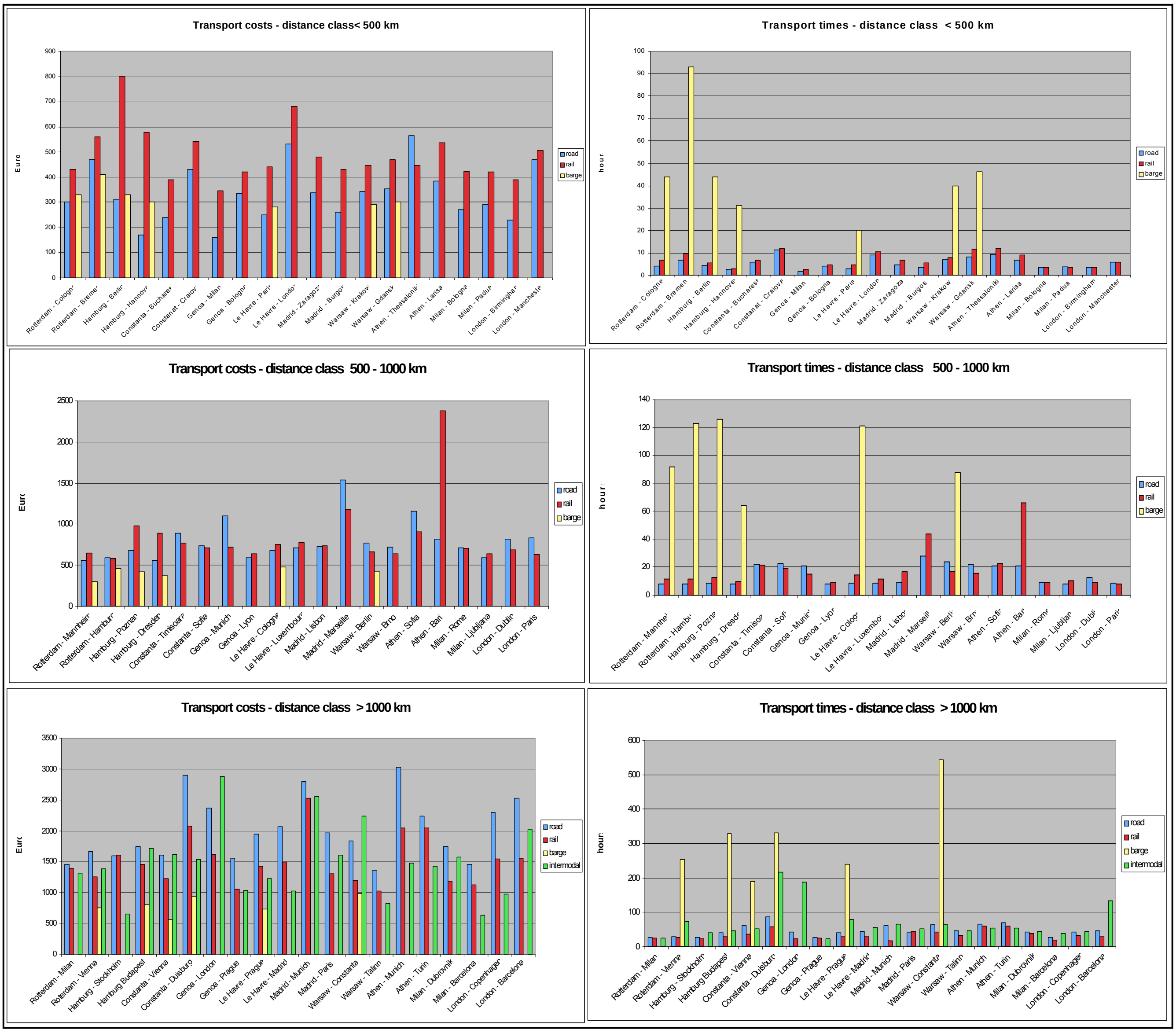


Figure 117: Overview transport times and costs within distance classes



7 Logistics performance indicators

In this chapter, a concept for a set of logistics performance indicators is being outlined. Performance indicators are productivity measures, i.e. ratios of variables and not the variables themselves. The data availability plays an important role although additional data to be included in the Eurostat reporting system is a priori not excluded but should at economically and financially difficult times be kept to a reasonable minimum.

Appropriate logistics performance indicators are meant to measure the functioning of the logistics sector thus being able to monitor its evolution over time and to compare across member state borders the level achieved in individual countries, as a tool for benchmarking. In addition, it is of interest to compare the advancement of the whole European Union with that of other global players such as the United States of America and Japan but ultimately also of important economies such as China, India, Brasil etc.

A preliminary literature and internet search did not produce significant results. Publicly available statistics describing logistics activities do exist neither at member state level nor for the EU as a whole nor for the USA, the EU's most important competitor. In the U.S., the Council of Supply Chain Management professionals (CSCMP) produces an annual "State of Logistics Report"[100] which has become the reference publication on logistics in the absence of any official publication (see Chapter 2). The main indicators presented in the CSCMP report are:

- Logistics costs as a percent of GDP
- Inventories (wholesale, retail and total business inventories)
- Inventory to sales ratio.

Taking the U.S. reference into account, the SEALS study team engaged in proposing logistics performance indicators based on the findings in the different work packages.

[100] CSCMP (2008): 19th Annual State of Logistics Report "Surviving the Slump", June 18, 2008.

7.1 Identification of indicators

From the analysis throughout chapters 3 to 5, feasible and relevant performance indicators are identified as follows:

1 Macro-economic indicators

From the basic structural and short-term business statistical variables (number of enterprises, number of employees, turnover, value added as well as costs and prices), a number of performance indicators can be derived. Once the data will be available according to the new NACE Rev. 2.0, it will be relatively straightforward to produce the relevant statistical variables for the outsourced logistics sector and for individual sub sectors:

1.1 Logistics sector Employment (full-time equivalents) in relation to total Employment

The first performance indicator represents the share of employment of the logistics sector in total national employment. This performance indicator is shown in Table 7 for the year 2005 and Table 8 for the year 2000. The variation of this indicator from country to country and over time should on the basis of proper statistical regression analyses allow to establish the weight of outsourced logistics jobs and total national employment. The basic hypothesis is that progressing outsourcing of logistics activities will increase continuously the share of this sector in a country's overall employments.

1.2 Logistics sector Turnover in relation to Gross Domestic Product

This second performance indicator comes closest to the "logistics costs per GDP" indicator used in the U.S.. The turnover data comes from structural business statistics, i.e. from the same source as the employment and the value added data. As a matter of fact, this ratio (in the U.S. around 10 %) overstates to a certain degree the importance of the logistics sector, since the concept of turnover or sales are combined with the concept of value added. But for benchmarking and monitoring over time, this indicator is suitable. Both parameters being monetary values, it can be based on both nominal and real values.

1.3 Logistics sector Value Added in relation to Gross Domestic Product

The third performance indicator represents the contribution of the logistics sector to GDP or its share in GDP. This performance indicator is shown in Table 9 for the year 2005 and Table 10 for the year 2000. The variation of this indicator from country to country and over time should on the basis of proper statistical regression analyses allow to establish the interdependence between logistics activities and economic development. The basic hypothesis is that outsourcing of logistics activities progresses with the status of the economy represented by GDP.

1.4 Value Added per Employee in total and by sub sector

The relevance of this fourth performance indicator lies in the monitoring of changes over time. For this purpose, Value Added should be computed in constant prices in order to more easily detect abnormal changes. The interpretation of inter-country comparisons and benchmarking are limited when the weights of individual sub sectors vary significantly. The Value Added per employee varies largely due to different levels of capital intensity of production (see Table 11).

1.5 Logistics Intensity

In Chapter 3 we have introduced logistics intensity as the percentage ratio of logistics costs (inputs) as share of total production cost and have applied these intensities to the production sectors selected by DG TREN as among the most important economic sectors regarding logistics activities. Purchases of logistics services do in this case include inputs for – business related – passenger travel which cannot be separated from freight-related purchases under the existing national accounts system. Logistics intensity can be used for inter-country comparison as well as for comparison over time (once time series or at least data relating to key years are available for all countries).

It is expected that logistics intensity generally increases over time. But this cannot be taken for granted!

1.6 Service Producer Price Indices (SPPI)

Service producer prices for sub sectors will become an important instrument to monitor cost changes. These price indicators are of particular importance since they are produced quarterly and will be available a couple of months after the end of the observation period. Short-term trends can be observed and compared with forecasts such as the quarterly ZEW/ProgTrans Transport Market Barometer.

2 Micro-economic indicators

2.1 Cost composition of transport by mode

The development of costs is one of the most discussed issues in the logistics industry: What is the difference of the costs between different countries within the EU? Are the Eastern European countries still best choices regarding costs? How do the costs develop in the different modes and countries? With the presented methodology of monitoring costs and cost structure, internal analysis and findings can be conducted e.g. to find out if the fuel prices have such an impact that a mode shift will take place, or how long it will still take that the costs between countries within the EU will converge (if they ever do).

The chosen methodology supports an independent way to monitor the performances mostly by using official data from Eurostat. It is recommended to verify the cost composition in a few years by conducting a market research.

2.2 Cost composition of warehousing

Comparable to the cost structure in transport by mode, the chosen methodology supports the monitoring of cost developments in the EU member states by using free data. Here, it is possible to observe the costs for warehousing and how the costs converge or diverge. It will be interesting to see the developments of the costs in real estate against the background of the financial crisis. Here, some research has to be done (besides the Eurostat data) to get the costs of real estate from some market players like Goodman or JonesLangLaSalle (which are mostly free of charge). As mentioned above, a verification of the composition of costs should be done in a few years.

2.3 Profitability margin by transport mode and warehousing

To monitor the performances of logistics companies on the micro level, the best way is to look on the profit margins per company (benchmarking approach) or per sector (macro approach as the dominance of one company like in the rail or post sector outshines the performances of smaller companies). This indicator outlines how well the jobs of the market players are done. The basis of the data is the commercial database AMADEUS from Bureau van Dijk (see the chapter on the micro-economics), which is not free of charge. This is the largest disadvantage of this approach, although the data reflects the real picture of company performances. It is recommended to conduct the research at least in a two-year-cycle, as the developments are very dynamic (see the chapter on profits in logistics).

The performance indicator "Profit margin per company" is mostly included in commercial studies on logistic markets as it describes the strength of the service providers acting in the country.[101]

With the given data from the database, it is also possible to build benchmarks like number of employees per company by transport mode and warehousing or operating revenue per company by transport mode and warehousing. These two indicators don't reflect the performances as clearly as the profit margin.

2.4 Turnover of stocks

The monitoring of performances in the warehousing sector hasn't been conducted in Europe, yet. The approach of looking on the turnover of stocks gives deep insights on how the management of inventories reacts on market impacts and improves its stock levels. Comparable to the profits, the data could be derived from the AMADEUS database. Therefore, the data also is not free of charge. But the large number of relevant companies (see above in chapter 4) gives an empirical picture of the performances in stocks.

This indicator has not been used in any report found. As there doesn't exist any monitoring programmes in Europe for inventory levels (only changes are computed), as in the US[102], this approach is the most appropriate to give a picture on the performances in logistics according inventory and warehouse processes on industry levels.

In this study, only six industries were observed. With this approach, a picture of performances in all industries in Europe can be drawn. Also, a differentiation of product groups within industries (like the meat market in the food sector mentioned in chapter 4)

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[101] E.g. the reports on logistics markets from Datamonitor (see for example http://www.datamonitor.com/products/free/Brief/BFAU0172/020bfau0172.htm) or from Analytiqa (see for example https://www.analytiqa.com/reports.aspx?ReportId=335 or https://www.analytiqa.com/reports.aspx?ReportId=262).

[102] Here, the newest edition of the study of Wilson, Rosalyn: 19th Annual State of Logistics Report, CSCMP, June 2008 should be mentioned, were the inventory level development in the U.S. is discussed yearly. In the U.S., this report is the standard reference on Logistics (comparable to Klaus/Kille 2007 in Germany).

can be conducted. These additional analyses can be conducted in a further step.

3 Terminal performance indicators

This section describes the various performance indicators on terminal level. Due to different terminal characteristics for the five types of terminals analysed in this study, some indicators are more specific for the type of terminal being considered. However, three performance indicators are very common for all types of terminals. These are the throughput, productivity and capacity utilisation (see 3.1-3.3). Furthermore, the delivery reliability and days of inventory are very specific performance indicators for distribution centres (3.4). To conclude the performance indicators from a terminal perspective, a new performance indicator for ports, port efficiency, which is currently being developed in the US, will be discussed (3.5).

3.1 Terminal throughput / airport workload unit (WLU)

The most common performance indicator for terminals is the throughput (TEU, tonnes or loading units) or growth in throughput per year. If the growth of throughput for the port of Hamburg is higher than the growth of throughput for the port of Antwerp, Hamburg is considered to perform better than Antwerp. This statistic is important for seaports, inland ports, road-rail terminals and airports. Airports use a slightly different throughput statistic in order to combine the number of passengers and throughput of freight. One WLU is equal to 100 tonnes of freight or 1,000 passengers. The growth of WLU indicates which airport is growing faster than the other.

3.2 Terminal / berth productivity

The terminal productivity is commonly related to the throughput per hectare terminal surface area. A terminal is considered to perform better if it has a larger throughput per hectare of space. However, other productivity indicators are also used like throughput per meter berth length or, as shown in chapter 5, the berth productivity in TEU per $1,000 per annum. This last one is relatively new and somewhat more advanced as it also includes terminal investments into the productivity indicator.

3.3 Terminal capacity utilisation

The capacity utilisation is the throughput divided by the capacity. In other words, what share of the capacity is being utilised. For this statistic some practical and methodological problems may occur. First the reported capacity could sometimes be dated and does not always represent the actual capacity. The capacity does not always relate to the handling equipment, but also sometimes to the accessibility of the terminal like for road-rail terminals. The maximum capacity for road-rail terminal is actually a theoretical capacity based on the accessibility by train (see chapter 5). Furthermore, from a time series perspective the throughput commonly increases or decreases steadily, while the capacity shows a stepwise increase (opening of a new berth).

3.4 Distribution Centres: delivery reliability, days of inventory

Distribution centres have different characteristics compared to the other types of terminals. Distribution centres are commonly a dedicated part (node) of the supply chain of a company. Therefore, delivery reliability, days of inventory and in some companies the supply chain responsiveness are important performance indicators.

3.5 Port efficiency

In recent years two American researchers[103] have been developing a port efficiency performance indicator in response to the conclusion that consistent data and methods to construct measures that allow comparisons across ports are not currently available even in developed countries. As stated in a report to Congress by the U.S. Department of Transportation, Maritime Administration (MARAD),

"MARAD concluded that it was unable to provide the requested comparison of the most congested ports in terms of operational efficiency due to a lack of consistent national port efficiency data … comparing port efficiency would require the creation of new methodologies and the collection of data that were not available for this report" (U.S. Department of Transportation, Maritime Administration, 2005, p. 8)

[103] Blonigen, B.A., Wilson, W.W., 'Port efficiency and trade flows', NETS, 2006 and 'New measures of port efficiency using international trade data' TRB, 2005.

The port efficiency estimates are primarily based on 'import charges'. The U.S. Census[104] defines import charges as:

"…the aggregate cost of all freight, insurance, and other charges (excluding U.S. import duties) incurred in bringing the merchandise from alongside the carrier at the port of exportation – in the country of exportation – and placing it alongside the carrier at the first port of entry in the United States."

The three primary components are: 1) costs associated with loading the freight and disembarking from the foreign port, 2) costs connected with transportation between ports, and 3) costs associated with port arrival and unloading of the freight.

The table on the next page shows the foreign (to the US) port efficiencies compared to Rotterdam, where the smaller (or more negative) the coefficient, the more efficient the port relative to Rotterdam, the Netherlands (the excluded port).

Column 1 of Table 73 ranks the non-US ports from the most efficient to the least efficient ones (according to the fixed effects statistical measure). Column 2 specifies the foreign port's market share of total U.S. imports, while column 3 provides the change in the foreign port's fixed effect coefficient from the early 1990s to the early 2000s relative to the Port of Rotterdam's effect on import charges.

A number of obvious patterns emerge in the rankings of the foreign ports. The upper half of the list (the most-efficient ports) is primarily European and Japanese ports. The middle of the list is generally populated by newly-industrialized countries in Southeast Asia, such as Taiwan and Korea, while the least-efficient ports are primarily Central American and Chinese ports (Blonigen and Wilson, 2006).

[104] http://www.census.gov/main/www/aboutus.html.

Table 73: Foreign port efficiencies compared to the port of Rotterdam

Port Name	Port Fixed Effects: Efficiencies Relative to Rotterdam	Port's Market Share of U.S. Import Volume, 1991- 2003 (percent)	Change in Port Efficiency Relative to Rotterdam from 1991-1993 Period to 2001-2003 Period
Zeebrugge, Belgium	-0.059	0.22	-0.488
Shimizu,Japan	-0.051	0.75	-0.101
Chiba, Japan	-0.027	0.69	0.141
Osaka, Japan	-0.016	1.15	0.102
Bremerhaven, Germany	-0.015	4.74	-0.021
Antwerp,Belgium	-0.011	2.62	0.063
Hakata, Japan	-0.002	0.31	0.167
Rotterdam, Netherlands	0.000	2.57	0.000
Chi Lung, Taiwan	0.015	2.27	0.000
Le Havre, France	0.017	1.35	-0.002
Emden, Germany	0.018	0.79	-0.176
Hamburg, Germany	0.018	0.62	-0.027
Bremen, Germany	0.029	0.76	0.014
Fos, France	0.029	0.21	-0.083
Kawasaki, Japan	0.037	0.25	0.359
Nagoya, Japan	0.055	3.86	-0.059
Toyohashi, Japan	0.055	2.97	-0.260
Tai Chung, Taiwan	0.056	0.30	0.060
Thamesport, United Kingdom	0.062	0.19	NA
Liverpool, United Kingdom	0.063	0.46	-0.064
Kao Hsiung, Taiwan	0.064	2.99	-0.017
Southhampton, United Kingdom	0.064	0.81	0.003
Kobe, Japan	0.075	2.60	-0.025
Haifa, Israel	0.075	0.36	-0.176
Tokyo, Japan	0.081	4.95	-0.066
Felixstowe, United Kingdom	0.084	1.18	-0.069
Inchon, South Korea	0.088	0.26	0.138
Puerto Plata, Dominican Rep	0.090	0.20	-0.169
All Other Ports, South Korea	0.097	0.29	0.093
Goteborg, Sweden	0.098	0.83	-0.057
Yokohama, Japan	0.101	3.28	0.041
Santo Domingo, Dominican Rep	0.101	0.14	0.073
Rio Grande, Brazil	0.103	0.26	-0.097
Pusan, South Korea	0.109	3.20	0.029
Hong Kong, Hong Kong	0.114	10.96	0.002

Yokkaichi, Japan	0.126	0.46	0.258
Yokosuka, Japan	0.127	1.07	-0.010
Rio Haina, Dominican Rep	0.127	0.31	-0.085
Mizushima, Japan	0.130	0.19	0.234
Victoria, Brazil	0.140	0.11	0.084
Buenos Aires, Argentina	0.141	0.22	-0.253
La Spezia, Italy	0.142	0.66	-0.100
All Other Ports, Japan	0.143	0.77	0.227
All Other Ports, Thailand	0.143	0.27	0.056
Penang, Malaysia	0.144	0.57	-0.030
Singapore, Singapore	0.144	1.90	-0.008
Genoa, Italy	0.145	0.59	-0.048
Johore, Malaysia	0.148	0.24	0.003
Buenaventura, Colombia	0.148	0.14	-0.309
Bilbao, Spain	0.151	0.13	-0.064
Durban, South Africa	0.157	0.28	0.014
Melbourne, Australia	0.164	0.26	-0.260
Las Salinas, Chile	0.171	0.18	-0.132
Karachi, Pakistan	0.172	0.33	-0.098
Limon, Costa Rica	0.174	0.37	-0.131
Point Lisas, Trinidad	0.178	0.14	-0.167
Leghorn, Italy	0.178	0.63	-0.086
Izmir, Turkey	0.179	0.17	0.032
Rio de Janeiro, Brazil	0.181	0.20	-0.153
Sydney, Australia	0.181	0.16	-0.174
Barcelona, Spain	0.183	0.14	-0.099
Kelang, Malaysia	0.191	0.47	-0.065
Puerto Cortes, Honduras	0.191	0.52	-0.017
Istanbul, Turkey	0.193	0.17	-0.001
Laem Chabang, Thailand	0.194	0.49	NA
Bangkok, Thailand	0.194	1.13	-0.013
Valencia, Spain	0.195	0.23	-0.146
Naples, Italy	0.196	0.17	-0.122
San Antonio, Chile	0.200	0.13	-0.200
Sao Paulo, Brazil	0.200	0.72	-0.216
All Malaysia Ports, Malaysia	0.200	0.34	-0.132
Callao, Peru	0.213	0.13	-0.076
Colombo, Sri Lanka	0.220	0.33	-0.091
Onsan, South Korea	0.221	0.37	0.265
Veracruz, Mexico	0.225	0.34	-0.162
All Other Ports, China	0.232	1.11	-0.013
Yantian, China	0.233	2.17	0.051

A recommendation is to do more in depth analysis on the proposed methodology on port efficiency and data requirements for this.

7.2 Assessment

The criteria for the practical usability of these indicators are listed below. We have designed a simple assessment scheme by assigning values to the different conditions of data production and availability. The number of points is marked in brackets.

1. **data availability 1**: the main data sources being
   a. national statistics, compulsory reporting (by law) [3]
   b. regular survey [2]
   c. special survey [1]

2. **data availability 2: the data made available by**
   a. public organisation [3]
   b. commercial organisation [2]

3. **data representativity**
   a. full EU and full national representativity [3]
   b. full EU but no full national representativity [2]
   c. limited representativity [1]

4. **timeliness of data availability**
   a. monthly or quarterly reporting [3]
   b. annual reporting (maximum 12 months after end of reporting period) [2]
   c. annual reporting (2 years and more after end of reporting period) [1]

Table 74 summarises data sources and assessment of the practical usage of the indicators.

The maximum number of points is 12. This number is achieved by the newly developed indices of service production prices. 11 and 10 points is a good score. The cost structure indices reach only 7 points because special surveys have to be carried out to collect the relevant information.

Table 74: Assessment of logistics performance indicators

	Indicator	Description	Data sources	Availability collection method	Availability public/ commercial	Repre-sentativity	Timeliness	Total
Macro-economic indicators								
1	sector employ-ments (full-time equivalents) / total employments	Share of logistics employments in total employments	Structural business statistics	3	3	3	2	11
2	logistik turnover / GDP	Share of logistics turnover (costs) in GDP	Structural business statistics, national accounts	3	3	3	2	11
3	sector value added / GDP (in real terms)	Share of logistics value added in GDP	Structural business statistics, national accounts	3	3	3	2	11
4	value added (in real terms) per employee in total and by subsector	Ratio of value added and employees	Structural business statistics	3	3	3	2	11
5	Logistics intensity	Ratio of logistics inputs and total inputs	National accounts, SIOT	3	3	3	1	10
6	service producer price indices by subsector	Evolution of service producer price indices	Service producer price indices	3	3	3	3	12
Micro-economic indicators								
7	Cost composition of transport by mode	Transportation costs per tonne by cost component	Various sources incl. questionnaires, bench-marking data, studies for base year; statistics, desk research, interviews for subsequent years	1	3	1	2	7
8	Cost composition of warehousing	Warehousing costs per tonne by cost component	Various sources incl. questionnaires, bench-marking data, studies for base year; statistics, desk research, inter-views for subsequent years	1	3	1	2	7
9	Profitability margin by trans-port mode and warehousing	Profitability of trans-port and logistics companies	Company information	3	2	3	2	10
10	Turnover of stocks	Turnover of stocks by manufacturing sector	Company information	3	2	3	2	10
Terminal indicators								
11	Throughput of terminals for commodity groups to be de-fined	Annual throughputs (tonnes, TEUs or LUs)	Company information, regular survey for seaports, inland ports and airports, commer-cially available	2	3	2	2	9
12	Terminal/berth productivity	Throughput per hectare or $1,000	Special surveys, com-mercially available	1	2	2	1	6
13	Terminal capacity utilisation	Share of throughput relative to the ca-pacity	Special surveys	1	1	1	1	4
14	DCs: delivery reliability; days of inventory	% on time delivery, days of inventory	Company information	1	1	1	1	4
15	Port efficiency	Multiple data sour-ces	Scientific methodology, being developed	1	1	1	1	4

8 Conclusions

8.1 Macro-economic perspective

Statistical information on outsourced freight logistics activities including transport is not readily available, neither at European Union nor at national level. The classification of economic activities in the EU combines passenger and freight transport. In view of varying patterns of passenger transport in the Union, a comprehensive econometric model to isolate freight from passenger transport activities is not feasible. A comprehensive database has been established and missing elements have been estimated on the basis of supplementary information. The importance of the freight logistics sector has been estimated with regard to employment and value added for the EU as a whole as well as separately for the “old” EU-15 and the “new” EU-12 member states and for each individual country. The main basis for this exercise was structural business statistics, supplemented by national accounts, transport statistics and information from individual transport operators.

Prospects for future years are much better since the EU classification of economic activities has been changed with effect from 2008. Freight logistics activities are now separated from passenger transport related activities. The only remaining problem is the use of infrastructure for passenger and freight transport. But here, the separation of freight from passenger activities is much easier (in rail transport, for example, on the basis of train traffic (train-kilometres).

Logistics costs as share of total inputs were drawn from input-output data established by member states within the national accounts system. Here, we face two problems:

- National accounts are rather aggregated with four sub sectors covering the total passenger and freight transport, logistics and communications sector. Best estimates were achieved by eliminating the communications sub sector (including postal and courier services) but without separating (business related) passenger transport from pure freight logistics costs. The cost shares have been specified for the sectors of specific interest to the Commission.
- It takes the national statistical offices considerable lapses of time to produce and publish input-output tables. For the year 2000, the data basis was satisfactory, for 2005 it was not. A comparison of 2005 and 2000 was only possible for France and Germany.

National account statistics do not cover the value of inventories. Only the change of inventory in absolute terms is specified as a contribution to GDP. These data do not, however, confirm the anticipated trend to lower inventories as a result of production-to-order and just-in-time delivery. The subject has been addressed in the micro-economic analysis.

A system of service producer price indices is being implemented by member states. The reference year is 2006 and quarterly indices will be reported by member states. Whether and when it will be possible to consolidate these national indices into EU-wide indices remains to be seen. But national indices are very useful for benchmarking in country comparisons and for monitoring the evolution over time.

8.2 Micro-economic perspective

The micro-economic analysis gives a picture on the cost structures in logistics and their development over time. Regarding the transportation modes, all countries faced growing costs every year (without considering inflation). These are primarily caused by growing personnel and energy costs. In some countries (those with higher shares of personnel cost, especially in the "high cost" countries of the EU15), the increase was at lower rate than in the others. In the year 2006, fuel costs had the largest impact. Regarding the warehousing cost structure, the costs decreased in some countries in some years, as the costs for real estate fell. This is due to the fact, that real estate is often a speculative business with changing demands in some regions.

The analysis of the stock turnover ratio of more than 80.000 European companies has given an overview of the effectiveness of inventory planning within different sectors. The changes between the stock turnover rates of the investigated countries were often tremendous. This could have been caused by the different product groups resp. the shares of the specific products within an industry[105] and their varying stocks. In several sectors an increase in inventory turnover in 2003/2004 could be identified. Some East and North East European countries could obviously perform better than their western neighbours. The reason might be that they took advantage of the opportunity created by the accession to the European Union and their geographical adjacency to Central and Western Europe. Custom barriers disappeared and products exported to other EU member states do not need separate certificates to be sold there. This resulted in a rapid increase in export of products.

The profits of companies in the logistics sectors analyzed in this study show a varying performance in the EU., It is surprising, that in some cases companies of the Eastern European countries appear to have a better profit performance than the Western European (especially in the rail and road sectors). This can possibly be explained by the lower costs compared to the EU15 countries. Therefore, the companies have better possibility to get higher margins.

Regarding the modal choice, a qualitative analysis was given for those economic sectors of particular interest to the Commission. The transport modes were compared via ten criteria and then compared with the requirements of the different industries. It

[105] E.g. a relatively large share of dairies, fresh food etc. in a national food industry causes higher stock turnover rates than in an economy with larger share of canned food.

can be concluded that the road sector will keep its dominant role – but there are potentials for the rail mode: especially in the long distance transportation of non-time-critical products, rail has advantages compared to road. They will further grow, if e.g. the smaller ports in the Mediterranean like Koper in Slovenia or in the Black Sea as Constanta in Romania as well as the land-bridge from China will get more important.

8.3 Terminal perspective

- For four out of five terminal types it is possible to make a comparative analysis using (performance) indicators.
- For Distribution centres, such a competitive analysis is more difficult, because performance indicators differ greatly between different types of distribution centres.
- Statistics on seaports are largely available and are being collected by multiple institutes. Statistics for other terminal types are only sporadically collected centrally and on a regular basis.
- Statistics which are not regularly collected or which are very business sensitive, interviewing is the most effective method. An example of this is information on transhipment costs and waiting times at terminals or in ports. The next table summarizes the information found through the questionnaire.

Table 75: Transhipment costs and waiting times at terminals

	Transhipment costs (€ per move)	Waiting times
Seaports	80-125	10-15 hours
Inland shipping terminals	18-25	max 48 hours
Road-rail terminals	20-30	max 30 hours

Source: Questionnaire ECORYS 2008.

The transhipment costs are defined as the costs for one move of a loading unit. A move can be from the incoming modality to the stack, from the stack the outgoing modality, or directly from the incoming modality to the outgoing modality. Transhipment costs in seaport are much higher than in inland ports or inland terminals. Loading and unloading facilities and quays in the seaports are much more expensive than in the inland ports or terminals. The transhipment costs at road-rail terminals are on average slightly higher than at inland shipping terminals.

The waiting times listed in the above table are the maximum number of hours a vehicle/vessel or loading unit stays at the terminal (measured from the moment it enters the terminal area until the moment it leaves the terminal area). The average waiting times are much lower and estimated at several hours.

8.4 Shippers' perspective

The main findings from the simulation of transport performance in terms of cost and time within the chosen corridors are:

- Road transport is the best performing mode of transport in the short-distance class due to the fact that no transshipment is required.
- At longer transport distances, the inherent advantages of rail and inland water way freight transport come into play. Freight transport by barge and short-sea shipping is competitive for longer distance classes in terms of transport costs in specific corridors
- The simulations have also shown that intermodal transport chains are competitive over long distances in terms of both cost and time, if the single transport modes are coordinated and chosen in the most effective way and if additional handling and waiting times in the terminals are reduced to the absolute minimum. In particular, this holds if it is possible to adjust the transport chain and the operation of each used single transport mode in a way that avoids additional obstacles and bottlenecks.
- Concerning the aspect of reliability, transport on inland waterways has been assessed in the expert interviews as one of the most reliable transport mode of all attributes and corridors on average.

8.5 Implications of the economic recession

While the analysis in this report relates to data until 2006 in a continuously growing economy, the world financial and economic crisis that is affecting all economies has changed the outlook.

The latest survey of the Nuremberg (Germany)-based Fraunhofer Centre for Applied Research on Technologies for the Logistics Service Industries (ATL), carried out in September 2008, painted a highly positive picture. The European economy spent EUR 900 billion on logistics services in 2007, which amounts to 7 % more than in 2006. Similar gains were achieved in terms of tonnage, tonne kilometres, warehousing activities, handling and employment.

By late summer 2008, short-term forecasts indicated that economic growth was beginning to decelerate. By autumn of that year, the financial crisis of the US had extended worldwide pulling economies in Europe and elsewhere into an economic downturn which, in 2009, becomes a full-fledged recession. A dramatic plunge in expectations for economic growth, along with a simultaneous drop in sales in the automobile industry from October onwards was recorded. It has become more difficult to gauge what the effect on the logistics industry was in 2008 and what the prospects are for 2009. Will the top companies offering transport network services, contract logistics and global air and ocean services have to adapt to an abrupt disruption of their customary expansion, after years of seeing their sales go up (often by double-digit figures)?

Basic network services, such as parcel, express and general cargo deliveries will depend very much more on developments in the overall economy. This also applies to cargo transport services and global air and ocean logistics services. The volume of logistics services required by cyclical branches of the economy, such as the automobile and investment goods industries in particular, could plummet drastically in the case of a deep recession. Such an effect will be further exacerbated by price pressures and efforts to rationalise, driving down turnovers. To put it more concretely:

- If the uncertain credit situation causes a drop in the amount that is being invested in items such as machines, automobiles and factories, then this will lead to less work for service providers in this segment of the logistics industry. At worst this may cause logistics sales to decrease by 20 %, at best the decline is likely to be 10 %.
- The effects will be less dire in the daily consumer goods logistics sector, but even there we can expect that the psychology of recession will tend to throttle demand for postponable and expendable consumer purchases, such as clothing and electronics. Declines of 10 % are also possible in this sector. Only an economic programme designed to strengthen domestic demand can in the best case bring about a stagnation of private expenditure.
- Money paid out for the requirements of daily life, such as food, drinks, healthcare products, energy and services are unlikely to diminish.

The effects that an economic downturn will have on logistics service providers should be taken into account. Logistics companies need access to borrowed capital, as do companies operating in other sectors. The minimal equity positions common to medium-sized logistics companies make it harder for them to obtain financing. This will lead to bankruptcies and reductions in capacities, which will in turn open up isolated new opportunities for larger, more stable competitors.

Definite figures for 2008 are not yet available. A reasonable estimate puts the total EU logistics market in the order of 950 billion euro. What kind of volumes can we expect for Europeans' logistics markets in 2009? If we take into account a worst case scenario decline of 20 % for investment goods and 10 % for postponable purchases of long-term items for private use (such as furniture and domestic appliances) as well as cost increases of 2–5 % (for truck tolls, fuel, employees, etc), the worst case total logistics expenditure can be calculated to be 890 billion EUR in 2009 (11 % less than what is being estimated for 2008). Best case expenditure can be estimated at about 970 billion EUR (+2 %).

Annex 2.1: Sources

Data sources for macro-economic analysis

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National Accounts

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Transport Statistics

Road Transport

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Eurostat: Transport Statistics. http://epp.eurostat.ec.europa.eu

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ProgTrans AG: Estimation and forecast of short-term trends in passenger and goods transport and of the modal split in the European Union. Basel, 2008.

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Lufthansa: Geschäftsbericht (several years). www.lufthansa.com

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Maritime

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Annex 3.1: Statistical classifications

Table A- 1: Description of the NACE (rev. 1.1) Section "I" – Divisions 60-62

NACE	Description	Relevance for the study	Remarks
I	Transport, storage and communication		
60	Land transport; transport via pipelines		
60.1	Transport via railways	partly	passenger transport included
60.2	Other land transport		
60.21	Other scheduled passenger land transport	no	
60.22	Taxi operation	no	
60.23	Other land passenger transport	no	
60.24	Freight transport by road	yes	
60.3	Transport via pipelines	yes	
61	Water transport		
61.1	Sea and coastal water transport	partly	passenger transport included
61.2	Inland water transport	partly	passenger transport included
62	Air transport		
62.1	Scheduled air transport	partly	passenger transport included
62.2	Non-scheduled air transport	partly	passenger transport included
62.3	Space transport	no	

Table A- 2: Description of the NACE (rev. 1.1) Section "I" (continued) – Divisions 63-64

NACE	Description	Relevance for the study	Remarks
63	Supporting and auxiliary transport activities; activities of travel agencies		
63.1	Cargo handling and storage		
63.11	Cargo handling	partly	This class includes: – loading and unloading of goods or passengers' luggage irrespective of the mode of transport used for transportation – stevedoring This class excludes: – operation of terminal facilities, see 63.2
63.12	Storage and warehousing	yes	
63.2	Other supporting transport activities		
63.21	Other supporting land transport actvities	partly	This class includes: – activities related to land transport of passengers, animals or freight: – operation of terminal facilities such as railway stations, bus stations, stations for the handling of goods – operation of railroad infrastructure – maintenance and minor repair of rolling stock – operation of roads, bridges, tunnels, car parks or garages, bicycle parkings – winter storage of caravans
63.22	Other supporting water transport activities	partly	This class includes: – activities related to water transport of passengers, animals or freight: – operation of terminal facilities such as harbours and piers – operation of waterway locks, etc. – navigation, pilotage and berthing activities – lighterage, salvage activities – lighthouse activities
63.23	Other supporting air transport activities	partly	This class includes: – activities related to air transport of passengers, animals or freight: – operation of terminal facilities such as airway terminals, etc. – airport and air-traffic-control activities – ground service activities on airfields, etc. – activities of flying schools for commercial airline pilots This class excludes: – operation of flying schools, except for professional certificates, see 80.41
63.3	Activities of travel agencies and tour operators; tourist assistance activities	no	
63.4	Activities of other transport agencies	yes	
64	Post and telecommunications		
64.1	Post and courier activities		
64.11	National post activities	partly	This item includes: This class includes: – pick-up, transport and delivery (domestic or international) of mail and parcels – collection of mail and parcels from public letter-boxes or from post offices – distribution and delivery of mail and parcels – mailbox renting, poste restante, etc. This item excludes: This class excludes: – postal giro and postal savings activities and other financial activities carried out by national postal administrations, see 65.12
64.12	Courier activities other than national post activities	partly	This item includes: This class includes: – picking-up, transport and delivery of letters and mail-type parcels and packages by firms other than national post. Either only one kind of transport or more than one mode of transport may be involved and the activity may be carried out with either self-owned (private) transport or via public transport This item also includes: This class also includes: – home delivery services – city messenger and goods taxi services

Annex 3.2: Estimated shares of goods transport

Table A- 3: Estimated shares of goods transport in employment 2005

Country	Transport via railways	Freight transport by road for hire or reward	Sea and coastal water transport	Inland water transport	Air transport	Other supporting transport activities	Post and courier activities
BE	17%	100%	85%	90%	20%	50%	100%
BG	64%	100%	85%	90%	7%	50%	100%
CZ	58%	100%	-	90%	5%	50%	100%
DK	12%	100%	85%	90%	16%	50%	100%
DE	28%	100%	85%	90%	14%	47%	100%
EE	92%	100%	85%	90%	9%	50%	100%
IE	6%	100%	85%	90%	4%	50%	100%
GR	19%	100%	85%	90%	4%	50%	100%
ES	20%	100%	85%	90%	3%	50%	100%
FR	20%	100%	85%	90%	10%	42%	100%
IT	26%	100%	85%	90%	6%	50%	100%
CY	-	100%	85%	-	7%	29%	100%
LV	90%	100%	85%	90%	10%	50%	100%
LT	90%	100%	85%	90%	9%	50%	100%
LU	26%	100%	100%	90%	77%	50%	100%
HU	42%	100%	100%	90%	7%	50%	100%
MT	-	100%	85%	-	6%	30%	100%
NL	8%	100%	85%	90%	24%	54%	100%
AT	52%	100%	100%	90%	8%	58%	100%
PL	67%	100%	85%	90%	8%	50%	100%
PT	26%	100%	85%	90%	8%	50%	100%
RO	63%	100%	85%	90%	6%	50%	100%
SI	76%	100%	85%	90%	4%	50%	100%
SK	77%	100%	-	90%	3%	50%	100%
FI	51%	100%	85%	90%	6%	50%	100%
SE	47%	100%	85%	90%	9%	31%	100%
UK	16%	100%	85%	90%	5%	46%	100%

*NACE Groups 63.1, 63.4 and "Goods transport part" of 63.2 - not relevant

Source: own estimates

Table A- 4: Estimated shares of goods transport in employment 2000

Country	Transport via railways	Freight transport by road for hire or reward	Sea and coastal water transport	Inland water transport	Air transport	Other supporting transport activities	Post and courier activities
BE	24%	100%	85%	90%	16%	50%	100%
BG	61%	100%	85%	90%	10%	50%	100%
CZ	71%	100%	-	90%	6%	50%	100%
DK	14%	100%	85%	90%	20%	50%	100%
DE	25%	100%	85%	90%	13%	50%	100%
EE	90%	100%	85%	90%	4%	50%	100%
IE	11%	100%	85%	90%	5%	50%	100%
GR	17%	100%	85%	90%	7%	50%	100%
ES	25%	100%	85%	90%	4%	50%	100%
FR	24%	100%	85%	90%	10%	47%	100%
IT	23%	100%	85%	90%	6%	50%	100%
CY	-	100%	85%	-	4%	27%	100%
LV	90%	100%	85%	90%	7%	50%	100%
LT	90%	100%	85%	90%	8%	50%	100%
LU	35%	100%	100%	90%	76%	50%	100%
HU	46%	100%	100%	90%	11%	50%	100%
MT	-	100%	85%	-	6%	30%	100%
NL	9%	100%	85%	90%	22%	58%	100%
AT	50%	100%	100%	90%	7%	58%	100%
PL	69%	100%	85%	90%	9%	50%	100%
PT	25%	100%	85%	90%	10%	50%	100%
RO	58%	100%	85%	90%	7%	50%	100%
SI	80%	100%	85%	90%	6%	50%	100%
SK	80%	100%	-	90%	7%	50%	100%
FI	55%	100%	85%	90%	6%	50%	100%
SE	49%	100%	75%	90%	6%	34%	100%
UK	15%	100%	85%	90%	6%	44%	100%

Source: own estimates

Table A- 5: Estimated shares of goods transport in value added 2005

Country	Transport via railways	Freight transport by road for hire or reward	Sea and coastal water transport	Inland water transport	Air transport	Other supporting transport activities	Post and courier activities
BE	12%	100%	85%	90%	20%	50%	100%
BG	55%	100%	85%	90%	7%	50%	100%
CZ	48%	100%	-	90%	5%	50%	100%
DK	8%	100%	85%	90%	16%	50%	100%
DE	21%	100%	85%	90%	14%	47%	100%
EE	89%	100%	85%	90%	9%	50%	100%
IE	4%	100%	85%	90%	4%	50%	100%
GR	13%	100%	85%	90%	4%	50%	100%
ES	15%	100%	85%	90%	3%	50%	100%
FR	15%	100%	85%	90%	10%	42%	100%
IT	19%	100%	85%	90%	6%	50%	100%
CY	-	100%	85%	-	7%	29%	100%
LV	86%	100%	85%	90%	10%	50%	100%
LT	86%	100%	85%	90%	9%	50%	100%
LU	19%	100%	100%	90%	77%	50%	100%
HU	33%	100%	100%	90%	7%	50%	100%
MT	-	100%	85%	-	6%	30%	100%
NL	6%	100%	85%	90%	24%	54%	100%
AT	42%	100%	100%	90%	8%	58%	100%
PL	57%	100%	85%	90%	8%	50%	100%
PT	19%	100%	85%	90%	8%	50%	100%
RO	54%	100%	85%	90%	6%	50%	100%
SI	68%	100%	85%	90%	4%	50%	100%
SK	69%	100%	-	90%	3%	50%	100%
FI	41%	100%	85%	90%	6%	50%	100%
SE	37%	100%	80%	90%	9%	31%	100%
UK	11%	100%	85%	90%	5%	46%	100%

*NACE Groups 63.1, 63.4 and "Goods transport part" of 63.2 - not relevant

Source: own estimates

Table A- 6: Estimated shares of goods transport in value added 2000

Country	Transport via railways	Freight transport by road for hire or reward	Sea and coastal water transport	Inland water transport	Air transport	Other supporting transport activities	Post and courier activities
BE	17%	100%	85%	90%	16%	50%	100%
BG	52%	100%	85%	90%	10%	50%	100%
CZ	62%	100%	-	90%	6%	50%	100%
DK	10%	100%	85%	90%	20%	50%	100%
DE	18%	100%	85%	90%	13%	50%	100%
EE	86%	100%	85%	90%	4%	50%	100%
IE	8%	100%	85%	90%	5%	50%	100%
GR	12%	100%	85%	90%	7%	50%	100%
ES	18%	100%	85%	90%	4%	50%	100%
FR	18%	100%	85%	90%	10%	47%	100%
IT	16%	100%	85%	90%	6%	50%	100%
CY	-	100%	85%	-	4%	27%	100%
LV	86%	100%	85%	90%	7%	50%	100%
LT	86%	100%	85%	90%	8%	50%	100%
LU	27%	100%	100%	90%	76%	50%	100%
HU	36%	100%	100%	90%	11%	50%	100%
MT	-	100%	85%	-	6%	30%	100%
NL	6%	100%	85%	90%	22%	58%	100%
AT	40%	100%	100%	90%	7%	58%	100%
PL	59%	100%	85%	90%	9%	50%	100%
PT	19%	100%	85%	90%	10%	50%	100%
RO	48%	100%	85%	90%	7%	50%	100%
SI	73%	100%	85%	90%	6%	50%	100%
SK	72%	100%	-	90%	7%	50%	100%
FI	45%	100%	85%	90%	6%	50%	100%
SE	39%	100%	75%	90%	6%	34%	100%
UK	11%	100%	85%	90%	6%	44%	100%

*NACE Groups 63.1, 63.4 and "Goods transport part" of 63.2 - not relevant

Source: own estimates

Annex 3.3: Inventory of Symmetric Input-Output Tables

Table A- 7: Eurostat: availability of symmetric input-output tables (SIOT)

Code	Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
BE	Belgium	✓					✓					
BG	Bulgaria											2009
CZ	Czech Republic						✓					
DK	Denmark	✓					✓	✓	✓	✓	✓	
DE	Germany	✓					✓	✓	✓	✓	✓	✓
EE	Estonia			✓			✓					
IE	Ireland				✓		✓					2009
GR	Greece			✓	✓		2008					
ES	Spain	✓					✓					2009
FR	France	✓					✓	✓	✓	✓	✓	✓
IT	Italy	✓					✓					
CY	Cyprus						2009					2011
LV	Latvia		✓		✓							
LT	Lithuania						✓					
LU	Luxembourg											
HU	Hungary				✓		✓					
MT	Malta											
NL	Netherlands	✓	✓	✓	✓	✓	✓	✓	✓		✓	
AT	Austria	✓					✓					
PL	Poland						✓					
PT	Portugal					✓						
RO	Romania									✓	✓	
SI	Slovenia		✓				✓	✓				✓
SK	Slovakia	✓					✓					
FI	Finland	✓					✓	✓	✓		✓	✓
SE	Sweden	✓					✓					✓
UK	United Kingdom	✓					2011					2011

✓: Available

20xx: Year when table will be available

Annex 3.4: Input-Output Data

Table A- 8: Input-output data year 2000

EU27		2000									
NACE		15	24	27	32	34	51	52	Primary sector	Secondary sector	Tertiary sector
	Transport input in branches in Mio. €										
60	Land transport; transport via pipeline services	15'882	8'829	6'172	1'134	8'160	32'490	9'001	6'264	112'295	196'548
61	Water transport services	673	767	931	37	630	1'346	172	455	7'807	18'437
62	Air transport services	688	1'047	458	682	1'065	2'917	971	618	13'826	54'266
63	Supporting and auxiliary transport services; travel agency services	9'934	5'158	3'863	873	7'292	38'805	5'625	2'630	74'799	234'378
Total	Total Input	572'417	367'952	225'508	121'057	486'877	359'531	217'786	230'587	4'998'626	4'286'668
	Share of transport input in branches in %										
60	Land transport; transport via pipeline services	2.8	2.4	2.7	0.9	1.7	9.0	4.1	2.7	2.2	4.6
61	Water transport services	0.1	0.2	0.4	0.0	0.1	0.4	0.1	0.2	0.2	0.4
62	Air transport services	0.1	0.3	0.2	0.6	0.2	0.8	0.4	0.3	0.3	1.3
63	Supporting and auxiliary transport services; travel agency services	1.7	1.4	1.7	0.7	1.5	10.8	2.6	1.1	1.5	5.5
Total	Total Input	4.7	4.3	5.1	2.3	3.5	21.0	7.2	4.3	4.2	11.7

EU15		2000									
NACE		15	24	27	32	34	51	52	Primary sector	Secondary sector	Tertiary sector
	Transport input in branches in Mio. €										
60	Land transport; transport via pipeline services	14'999	8'326	5'711	1'032	7'638	29'953	8'281	5'565	104'654	187'593
61	Water transport services	665	742	928	37	626	1'334	171	443	7'732	18'127
62	Air transport services	647	1'021	447	672	1'042	2'753	930	589	13'443	52'945
63	Supporting and auxiliary transport services; travel agency services	9'805	5'093	3'819	862	7'228	37'757	5'184	2'519	73'844	228'298
Total	Total Input	536'425	355'095	212'684	112'315	466'416	342'308	204'892	207'562	4'743'280	4'135'604
	Share of transport input in branches in %										
60	Land transport; transport via pipeline services	2.8	2.3	2.7	0.9	1.6	8.8	4.0	2.7	2.2	4.5
61	Water transport services	0.1	0.2	0.4	0.0	0.1	0.4	0.1	0.2	0.2	0.4
62	Air transport services	0.1	0.3	0.2	0.6	0.2	0.8	0.5	0.3	0.3	1.3
63	Supporting and auxiliary transport services; travel agency services	1.8	1.4	1.8	0.8	1.5	11.0	2.5	1.2	1.6	5.5
Total	Total Input	4.9	4.3	5.1	2.3	3.5	21.0	7.1	4.4	4.2	11.8

EU12		2000									
NACE		15	24	27	32	34	51	52	Primary sector	Secondary sector	Tertiary sector
	Transport input in branches in Mio. €										
60	Land transport; transport via pipeline services	883	503	460	102	522	2'537	720	699	7'641	8'955
61	Water transport services	8	25	3	0	4	11	1	13	76	310
62	Air transport services	41	27	11	10	23	164	42	28	383	1'321
63	Supporting and auxiliary transport services; travel agency services	129	65	44	11	64	1'048	441	110	955	6'080
Total	Total Input	35'992	12'856	12'824	8'742	20'461	17'223	12'894	23'025	255'347	151'064
	Share of transport input in branches in %										
60	Land transport; transport via pipeline services	2.5	3.9	3.6	1.2	2.6	14.7	5.6	3.0	3.0	5.9
61	Water transport services	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.2
62	Air transport services	0.1	0.2	0.1	0.1	0.1	1.0	0.3	0.1	0.1	0.9
63	Supporting and auxiliary transport services; travel agency services	0.4	0.5	0.3	0.1	0.3	6.1	3.4	0.5	0.4	4.0
Total	Total Input	2.9	4.8	4.0	1.4	3.0	21.8	9.3	3.7	3.5	11.0

Table A- 9: Input-output data Germany 2000

DE		2000									
NACE		15	24	27	32	34	51	52	Primary sector	Secondary sector	Tertiary sector
	Transport input in branches in Mio. €										
60	Land transport; transport via pipeline services	1'658	1'411	1'429	168	2'521	9'954	2'046	468	14'824	30'403
61	Water transport services	26	274	224	12	255	665	-	161	1'251	1'449
62	Air transport services	164	436	123	449	559	325	152	97	4'984	4'943
63	Supporting and auxiliary transport services; travel agency services	1'602	406	246	124	2'498	17'162	579	72	8'547	52'759
Total	Total Input	89'904	78'333	42'190	27'358	157'625	71'154	53'339	31'325	985'277	761'213
	Share of transport input in branches in %										
60	Land transport; transport via pipeline services	1.8	1.8	3.4	0.6	1.6	14.0	3.8	1.5	1.5	4.0
61	Water transport services	0.0	0.3	0.5	0.0	0.2	0.9	-	0.5	0.1	0.2
62	Air transport services	0.2	0.6	0.3	1.6	0.4	0.5	0.3	0.3	0.5	0.6
63	Supporting and auxiliary transport services; travel agency services	1.8	0.5	0.6	0.5	1.6	24.1	1.1	0.2	0.9	6.9
Total	Total Input	3.8	3.2	4.8	2.8	3.7	39.5	5.2	2.5	3.0	11.8

Table A- 10: Input-output data France 2000

FR		2000									
NACE		15	24	27	32	34	51	52	Primary sector	Secondary sector	Tertiary sector
	Transport input in branches in Mio. €										
60	Land transport; transport via pipeline services	2'220	1'189	311	252	1'164	3'819	1'483	790	10'193	16'936
61	Water transport services	73	36	10	8	39	10	5	26	318	1'476
62	Air transport services	127	123	35	26	41	316	307	22	884	5'835
63	Supporting and auxiliary transport services; travel agency services	1'260	839	603	336	454	4'246	2'052	174	9'633	27'727
Total	Total Input	90'455	60'706	26'989	26'081	68'701	63'463	32'118	38'221	665'645	573'306
	Share of transport input in branches in %										
60	Land transport; transport via pipeline services	2.5	2.0	1.2	1.0	1.7	6.0	4.6	2.1	1.5	3.0
61	Water transport services	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.3
62	Air transport services	0.1	0.2	0.1	0.1	0.1	0.5	1.0	0.1	0.1	1.0
63	Supporting and auxiliary transport services; travel agency services	1.4	1.4	2.2	1.3	0.7	6.7	6.4	0.5	1.4	4.8
Total	Total Input	4.1	3.6	3.5	2.4	2.5	13.2	12.0	2.6	3.2	9.1

Annex 3.5: Logistics Intensity by economic sector

Figure A-11: Share of transport inputs in NACE 15: Manufacture of food products and beverages (in %)

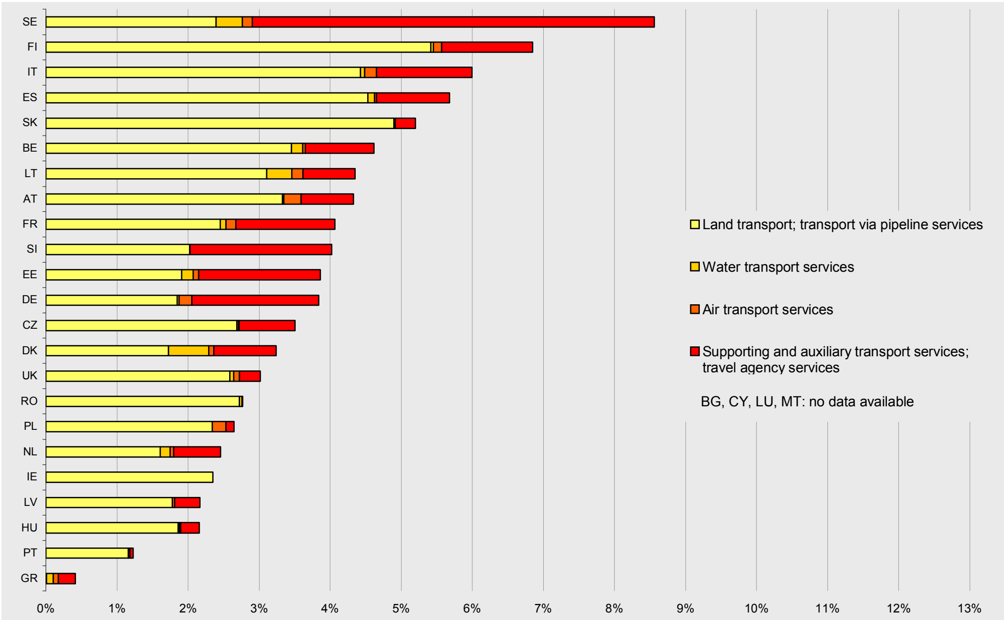


Figure A-12: Share of transport inputs in NACE 24: Manufacture of chemicals and chemical products (in %)

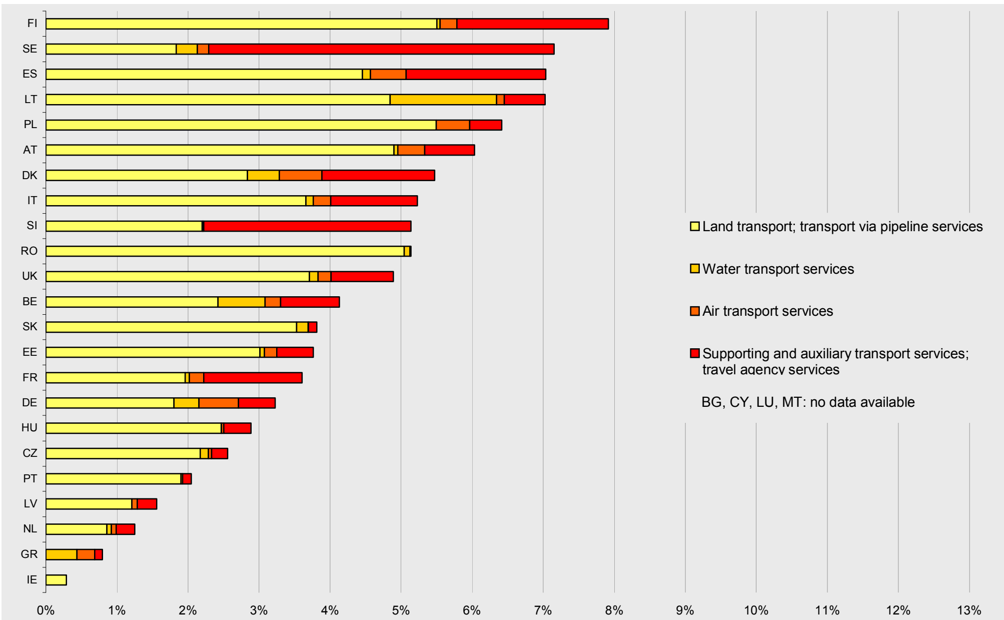


Figure A-13: Share of transport inputs in NACE 27: Manufacture of basic metals (in %)

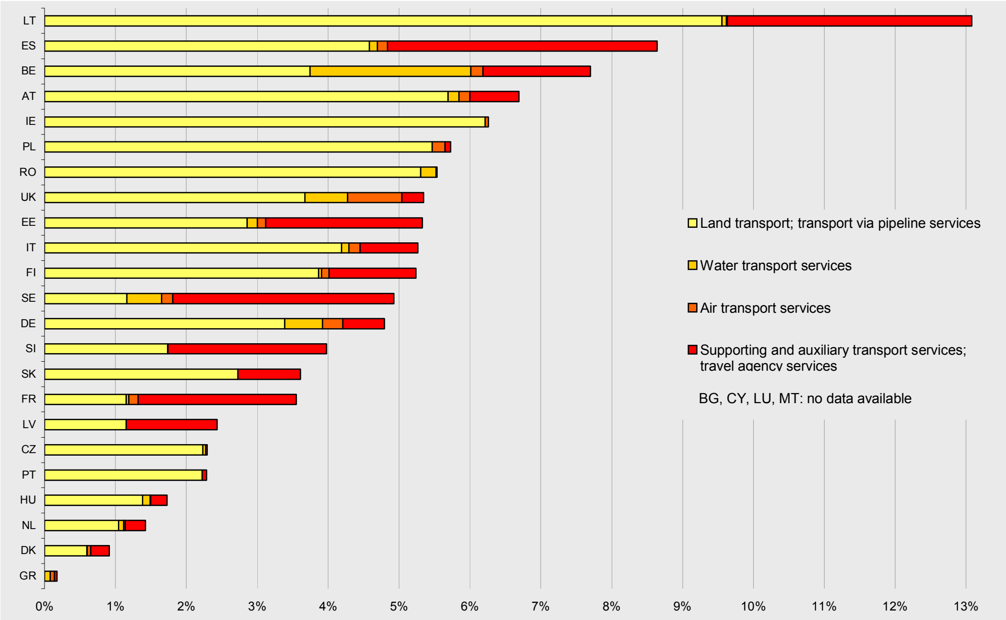


Figure A-14: Share of transport inputs in NACE 32: Manufacture of radio, television and communication equipment and apparatus (in %)

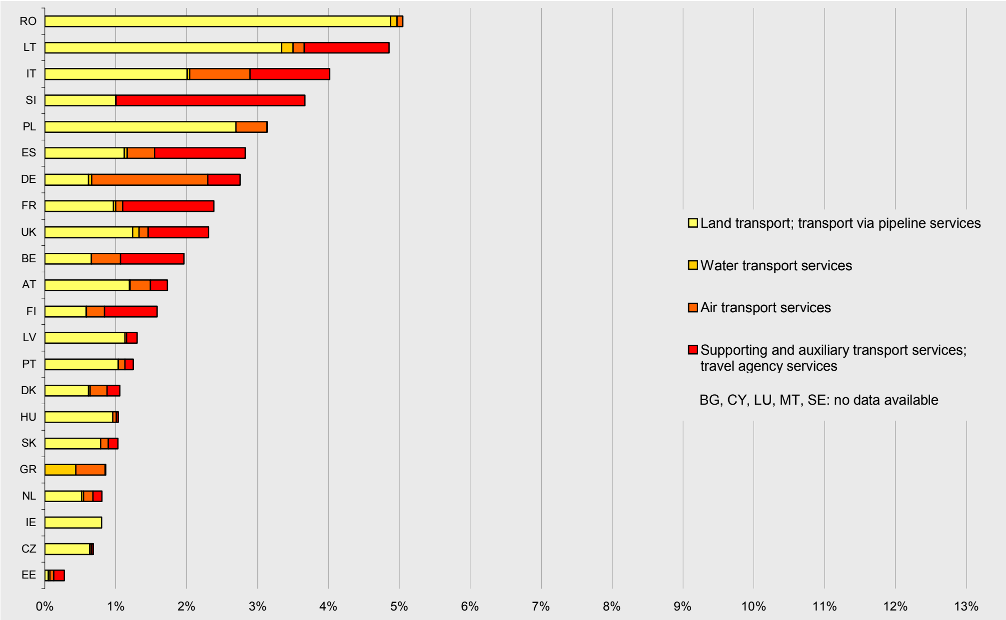


Figure A-15: Share of transport inputs in NACE 34: Manufacture of motor vehicles, trailers and semi-trailers (in %)

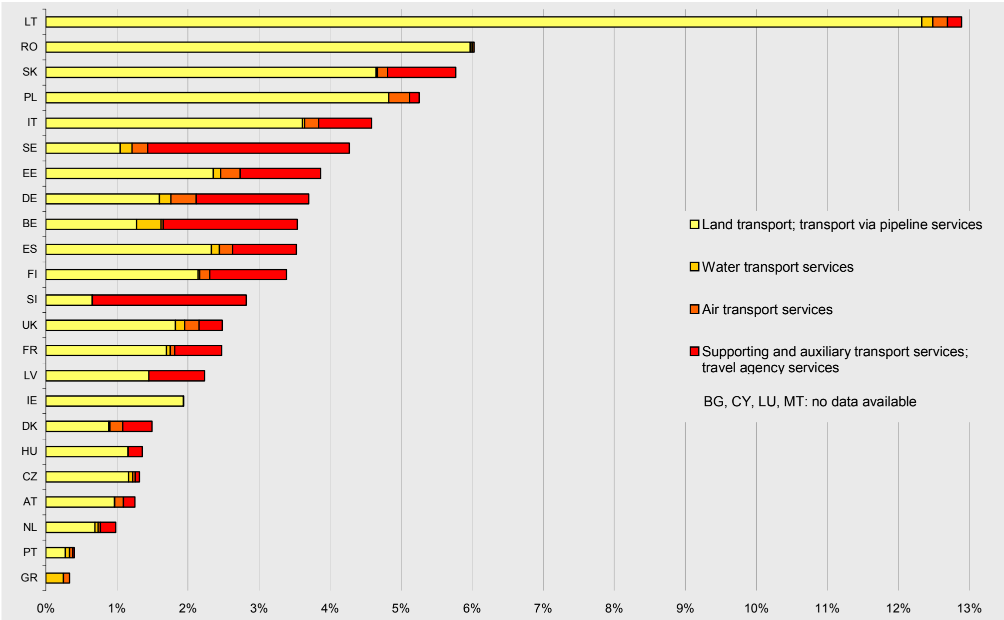


Figure A-16: Share of transport inputs in NACE 51: Wholesale trade and commission trade (in %)

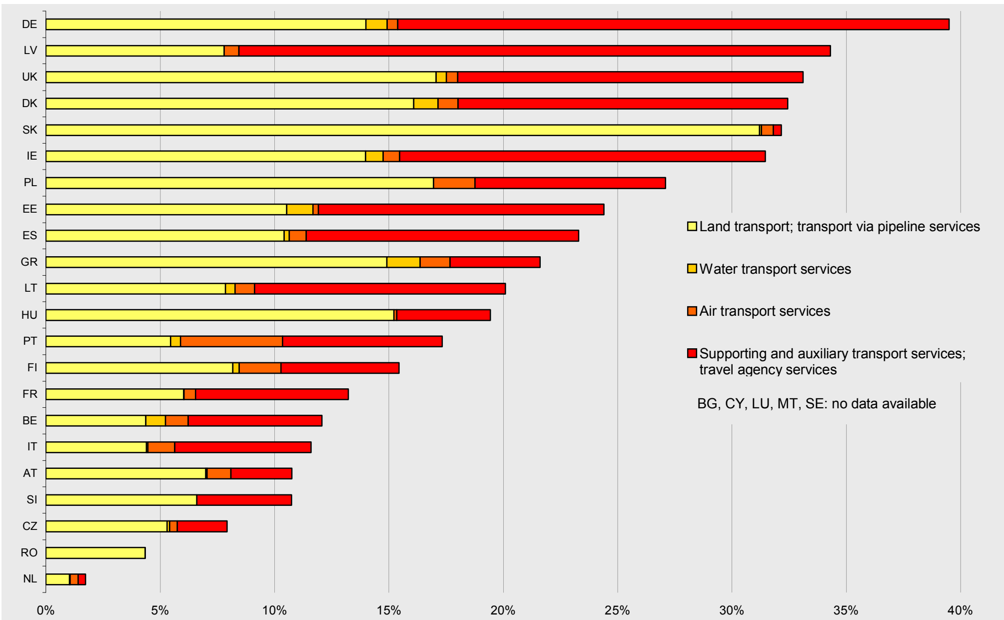
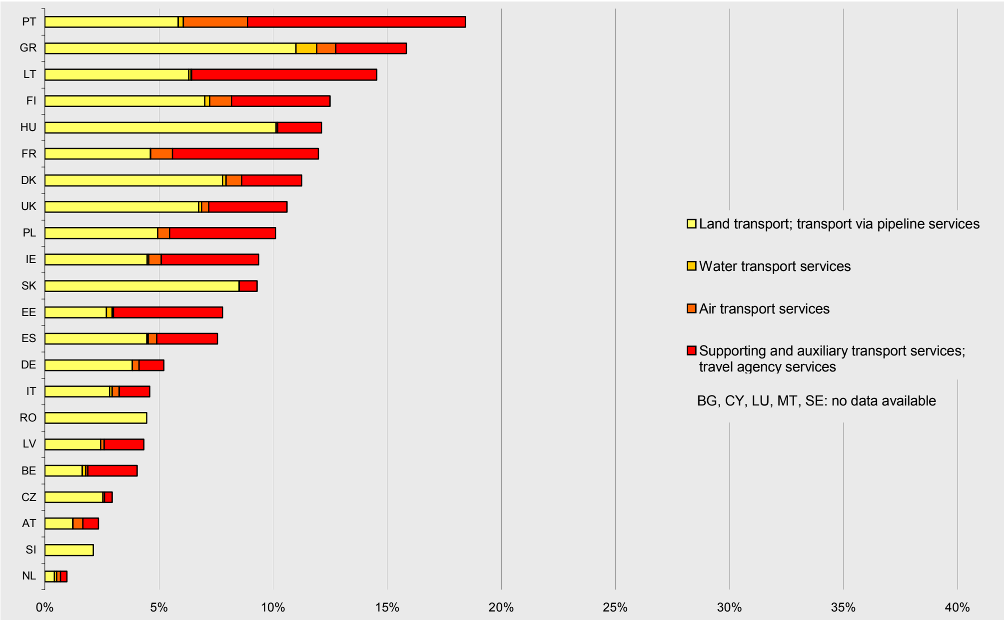


Figure A-17: Share of transport inputs in NACE 52: Retail trade (in %)



Annex 6.1: Transport cost and time analysis

Table A- 11 OD road transport – ports as origins

OD road		kilometres (total)	kilometres (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Toll costs	Short description routing
Rotterdam	Cologne	282 km	NL - 198 km D – 84 km	4:00 h	Running time: 4:00 h	300 €	Total: 8 € D - 80 km – 8 €	NL Rotterdam D Köln
	Bremen	420 km	NL - 235 km D - 185	6:45 h	Running time: 6:00 h Rest period: 45 min	470 €	Total: 17 € D – 173 km – 17 €	NL Rotterdam D Bremen
	Mannheim	502 km	NL - 199, km D - 303 km	7:45 h	Running time: 7:00 h Rest period: 45 min	560 €	Total: 29 € D - 292 km - 29 €	NL Rotterdam D Mannheim
	Hamburg	529 km	NL - 234 km D - 295 km	8:00 h	Running time: 7:15 h Rest period: 45 min	590 €	Total: 29 € D – 291 km - 29 €	NL Rotterdam D Hamburg
	Milan	1045 km	NL - 83 km B - 275 km L - 32 km F - 310 km CH - 290 km IT - 55 km	27:45 h	Running time:15:15 h Rest period: 0:45 h; 12:30 h	1450 €	Total: 57 € F – 125 km – 22 € CH - 289. km – 33 € I – 20 km - 2€	NL Rotterdam Port via B, L, F, CH to Milano.

OD road		kilometres (total)	kilometres (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Toll costs	Short description routing
Rotterdam	Vienna	1190 km	NL – 194 km D - 733 km A - 263 km	28:45 h	Running time: 27:45 h Rest period: 12:30 h	1664 €	Total: 141 € D - 734 km – 73 € A - 250 km - 68 €	NL Rotterdam Port, via D-Cologne, D-Nürnberg to A-Wels, A-Vienna
Hamburg	Berlin	284 km	D – 284 km	04:15 h	Running time: 04:15 h	310€	Total: 26 € D – 269 km – 26 €	D Hamburg Port – Schwerin – Berlin
	Hannover	155 km	D – 155 km	02:30 h	Running time: 02:30 h	170 €	Total: 12 € D – 128 km - 12 €	D – Hamburg Port - Hannover
	Poznan	517 km	D - 385 km P – 132 km	08:45 h	Running time: 08:00 h Rest period: 0:45 h	880 €	Total: 37 € D – 376 km – 37 €	D- Hamburg Port – Berlin – PL-Poznan
	Dresden	559 km	D - 559 km	7:45 h	Running time: 07:00 h Rest period: 0:45 h	560 €	Total: 47 € D – 476 km - 47 €	D-Hamburg Port – D-Magdeburg-Leipzig-Dresden
	Stockholm	914 km	D – 156 km DK – 202 km S – 556 km	28:00 h	Running time: 15:30 h Rest period: 12:30 h	1290 €	Total: 11 € D – 112 km – 11 €	D-Hamburg-Port – Putt-garden - Denmark – Sweden

OD road		kilometres (total)	kilometres (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Toll costs	Short description routing
Hamburg	Budapest	1165 km	D – 537 km CZ – 363 km SK – 85 km HU – 180 km	40:45 h	Running time: 17:15 h Rest period: 23:30 h	1750 €	Total: 46 € D – 467 km – 46 €	D-Hamburg-Port – CZ-Praha – SK - H
Constanta	Bucharest	225 km	RO – 225 km	6:00 h	Running time: 05:15 h Rest period: 0:45 h	240 €	Total: 7 € (Danube bridge between Fetesti-Cernavoda)	RO –Constanta port-Bucaresti
	Craiova	453 km	RO – 453 km	11:15 h	Running time: 10:30 h Rest period:0:45 h	430 €	Total: 7 € (Danube bridge between Fetesti-Cernavoda	RO –Constanta port-via Bucaresti, Pitesti to Craiova
	Timisoara	691 km	RO – 691 km	21:50 h	Running time: 10:35 h Rest period: 12:30 h	890 €	Total: 7 € (Danube bridge between Fetesti-Cernavoda	RO –Constanta port-via Bucaresti, Pitesti to Timisoara
	Sofia	577 km	RO - 60 km BG – 517 km	22:15 h	Running time: 10:30 h Rest period: 11:45 h	740 €		RO –Constanta port-via BG ro Sofia

OD road		kilometres (total)	kilometres (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Toll costs	Short description routing
Constanta	Vienna	1292 km	RO - 814 km HU - 394 km A – 84 km	61:00 h	Running time: 25:45 h Rest period: 35:15 h	1.600 €	Total: 27 €- 7 € (Danube bridge between Fetesti-Cernavoda) A – 78 km – 20 €	RO –Constanta port-via HU, A to Vienna
	Duisburg (Ruhr-area)	2232 km	RO - 814 km HU - 394 km A – 330 km D – 694 km	86:15 h	Running time: 38:30 h Rest period: 47:45 h	2.900 €	Total: 27,24 €- 7 € (Danube bridge between Fetesti-Cernavoda) A – 317 km – 85 € D – 693 km – 69	RO –Constanta port-via HU, A, D to Ruhr area
Genoa	Milan	130 km	IT – 130 km	1:50 h	Running time: 1:50 h	160 €	Total: 13 € I – 126 km – 13 €	Genoa port to Milano
	Bologna	285 km	IT – 285 km	4:00 h	Running time: 4:00 h	335 €	Total: 20 € I – 274 km – 20 €	Genoa port to Bologna

OD road		kilometres (total)	kilometres (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Toll costs	Short description routing
Genoa	Munich	696 km	IT - 483 km A - 110 km D – 103 km	21:15 h	Running time: 9:30 h Rest period: 11:45 h	1100 €	Total: 126 € I – 455 km – 46 € A – 110 km – 69 € (special toll A13 – 50 €) D – 101 km – 10 €	Genoa port via Brenne-ro, A, to Munich (D)
	Lyon	475 km	IT - 259 km F – 216 km	7:45 h	Running time: 7:00 h Rest period:0:45 h	590 €	Total: 55 € I – 218 km – 22 € F – 186 km – 33 €	Genoa port via frejus tunnel to Lyon
	London	1310 km	IT – 288 km F – 905 km GB – 117 km	43:20 h	Running time:19:50 h Rest period: 23:30 h	2370 €	Total: 458 € I – 245 km – 25 € F – 851 km – 150 € GB – 280 € (Eurotunnel))	Genoa port via Calais to London via I ,F, GB
	Prague	1067 km	IT – 483 km A – 109 km D – 307 km CZ – 174 km	27:45 h	Running time:15:15 h Rest period:12:30 h	1550 €	Total: 145 € I – 455 km – 47 € A – 110km – 70 € (special toll A13 – 50 €) D – 283km – 28 €	Genoa port via I,A,D, CZZ to Prague

OD road		kilometres (total)	kilometres (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Toll costs	Short description routing
Le Havre	Paris	208 km	F- 208 km	3:00 h	Running time: 3:00 h	250 €	Total: 20 € F – 99 km – 20 € (special toll pont du Tancarville 3,50€)	Le Havre - Paris
	London	115 km	GB – 115 km Ferry milage 180 km	9:00 h	Running time: 2:00 ferry time 7:00 h	530 €	250 € ferry cost	Le Havre port via ferry to Portsmouth to London
	Cologne	585 km	F – 315 km B – 190 km D – 80 km	8:40 h	Running time: 7:55 Rest period: 0:45 h	680 €	Total: 41 € F – 172 km – 30 € D – 77 km – 11 €	Le Havre port via F, B, D to Cologne
	Luxembourg	578 km	F – 559 km L – 19 km	8 :45 h	Running time: 8:00 Rest period: 0:45 h	710 €	Total: 68 € F – 364 km – 68 € (special toll pont du Tancarville 3,50€)	Le Havre port via F, L to Luxembourg
	Prague	1247 km	F – 590 km D – 490 km CZ – 167 km	41:30 h	Running time: 18:00 h Rest period: 23:30 h	1.950 €	Total: 121 € F – 417 km – 77 € (special toll pont du Tancarville 3,50€) D – 445 km – 45 €	Le Havre port via F, D ,CZ to Prague

OD road		kilometres (total)	kilometres (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Toll costs	Short description routing
Le Havre	Madrid	1353 km	F – 870 km ESP – 483 km	44:15 h	Running time: 20:45 h Rest period:23:35 h	2.070 €	Total: 104 € F – 481 km – 91 € (special toll pont de Normandie 6,30 €) E – 97 km – 12 €	Le Havre port via F, E to Madrid

Table A- 12: OD road transport – metropolitan areas as origins

OD road		kilometres (total)	kilometres (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Toll costs	Short description routing
Madrid	Zaragoza	316 km	ESP – 316 km	4:30 h	Running time: 4:30 h	340 €		Madrid - Zaragoza
	Burgos	245 km	ESP – 245 km	3:30 h	Running time: 3:30 h	260 €		Madrid - Burgos
	Lisbon	632 km	ESP – 415 km P – 217 km	9:30 h	Running time: 8:45 h Rest period:0:45 h	730 €	Total: 25 € P – 190 km – 25 €	Madrid via P to Lisbon
	Marseille	1105 km	ESP – 761 km F – 344 km	27:45 h	Running time: 15:15 h Rest period: 11:45 h	1.540 €	Total: 100 € E – 400 km – 52 € F – 280 km – 48 €	Madrid via E, F to Marseille
	Munich	1988 km	ESP – 760 km F – 621 km CH – 393 km A – 25 km D – 189 km	62:45 h	Running time: 27:30 h Rest period: 35:15 h	2.800 €	Total: 215 € E – 400 km – 52 € F – 552 km – 97, € CH – 393 km – 45 € A – 18 km – 5 € D – 157 km – 16 €	Madrid via E,F,CH,A,D to Munich
	Paris	1280 km	ESP – 483 km F – 797 km	41:30 h	Running time: 18:00 h Rest period: 23:30 h	1.970 €	Total: 113 € E – 97 km – 12 € F – 570 km – 101 €	Madrid via E,F to Paris

OD road		kilometres (total)	kilometres (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Toll costs	Short description routing
Warsaw	Krakow	360 km	PL – 360 km	7:00 h	Running time: 6:15 h Rest period: 0:45	343 €		Warsaw via PL to Krakow
	Gdansk	343 km	PL – 343 km	8:15 h	Running time: 7:30 h Rest period: 0:45	353 €		Warsaw via PL to Gdansk
	Berlin	587 km	PL – 492 km D – 95 km	23:45 h	Running time: 12:00 h Rest period: 11:45	765 €	Total: 8 € D – 80 km – 8 €	Warsaw via PL, D to Berlin
	Brno	569 km	PL – 365 km CZ – 204 km	22:15 h	Running time: 10:30 h Rest period: 11:45	720 €		Warsaw via PL, CZ to Brno
	Constanta	1247 km	PL – 408 km UA – 382 km RO – 557 km	64:45 h	Running time: 29:30 h Rest period: 35:15	1.840 €		Warsaw via PL, UA, RO to Constan-ti
	Talinn	1084 km	PL – 326 km RUS – 170 km LT – 184 km LV - 209 km EST - 195 km	46:00 h	Running time: 21:45 h Rest period: 23:15	1.350 €		Warsaw via PL, LT, LV, EST to Talinn

OD road		kilometres (total)	kilometres (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Toll costs	Short description routing
Athens	Thessaloniki	474 km	GR – 474 km	9:15 h	Running time: 8:30 h Rest period:0:45	565 €		Athen via GR to Thesaloniko
	Larisa	317 km	GR – 317 km	6:30 h	Running time: 5:45 h Rest period:0:45	385 €		Athen via GR to Larisa
	Sofia	764 km	GR – 586 km BG – 178 km	21:45 h	Running time: 10:00 h Rest period: 11:45 h	1.160 €		Athen via GR, BG to Sofia
	Bari	215 km	GR – 215 km ferry milage - 500 km	21:00 h	Running time: 04:00 h Ferry time ca. 17:00 h	820 €	Ferry cost : avg. 550 €	Athen via Patras and ferry link to Bari
	Munich	1997 km	GR – 517 km MK – 173 km CS – 493 km HR – 307 km SLO – 187 km A – 106 km D – 114 km	66:45 h	Running time: 30:45 h Rest period: 36:45 h	3.031 €	Total: 100 € A – 206 km – 88 € D – 114 km – 12 €	Athen via GR, MK, CS, HR, SLO, A, D to Munich
	Turin	1211 km	GR – 215 km ferry milage - 500 km IT – 996 km	68:45 h	Running time: 39:15 h Rest period: 12:30 h Ferry time ca. 17:00 h;	2240 €	Total: 95 € I – 948 km – 95 € Ferry cost : avg. 550 €	Athen via Patras ferry link to Bari, and to Torino

OD road		kilometres (total)	kilometres (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Toll costs	Short description routing
Milan	Bologna	227 km	IT – 227 km	3:30 h	Running time: 3:30 h	270 €	Total: 20 € I - 200 km – 20 €	Milano to Bologna
	Padua	241 km	IT – 241 km	3:45 h	Running time 3:45 h	290 €	Total: 22 € I – 215 km – 22 €	Milano to Padova
	Rome	590 km	IT – 590 km	9:00 h	Running time 8:15 h Rest period: 0:45 h	710 €	Total: 55 € I – 545 km – 55 €	Milano to Roma
	Ljubljana	495 km	IT – 410 km SLO – 85 km	7:45 h	Running time 7:00 h Rest period: 0:45 h	590 €	Total: 37 € I – 357 km – 37 €	Milano via I, SLO to Ljubljana
	Dubrovnik	1110 km	IT – 421 km SLO – 29 km HR – 660 km	41:45 h	Running time 18:15 h Rest period: 23:30 h	1.750 €	Total: 37 € I – 357 km – 37 €	Milano via I, SLO, HR to Dubrovnik
	Barcelona	988 km	I – 294 km F – 531 km ESP – 163 km	26:30 h	Running time 14:00 h Rest period: 12:30 h	1.455 €	Total: 134 € I – 276 km – 28 € F – 488 km – 86 € E – 148 km – 20 €	Milano via I, F, ES to Barcelona

OD road		kilometres (total)	kilometres (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Toll costs	Short description routing
London	Birmingham	198 km	GB – 198 km	3:30 h	Running time: 3:30 h	230 €		London to Birmingham
	Manchester	343 km	GB – 343 km	6:00 h	Running time: 5:15 h Rest period: 0:45	470 €	73 € special toll	London to Manchester
	Dublin	490 km	GB – 485 km (Ferry milage 90 km) IRL – 5 km	13:00 h	Running time: 8:15 h Rest period:0:45 h ferry time ca. 4:00 h	820 €	73 € special toll	London via ferry Holyhead to Dublin
	Paris	418 km	GB – 115 km F – 303 km (EuroTunnel milage 30 km)	07:45 h	Running time: 6:45 h Rest period: 0:45 h during the crossing of the Euro-Tunnel ; EuroTunnel time ca. 1:00 h	832 €	Total: 283 € GB – EuroTunnel – 283 €	London via EuroTunnel to Paris

OD road		kilometres (total)	kilometres (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Toll costs	Short description routing
London	Copenhagen	1190 km	GB – 115 km F – 65 km B – 210 km NL – 75 km D – 559 km DK – 166 km (EuroTunnel milage 30 km) (Ferry milage Puttgarden-Rodby 20 km)	42:15 h	Running time: 28:30 h Rest period: 0:45 h during the crossing of the Euro-Tunnel); 22:45; EuroTunnel time ca. 1:00 h; Ferry time ca. 1:00 h	2.300 €	Total: 485 € GB – EuroTunnel – 283 € D – 522 km – 52 € DK – ferry charging ca. 150 €	London via EuroTunnel; F, B, NL,D, ferry to DK to Copenhagen
	Barcelona	1454 km	GB – 115 km F – 1175 km ESP – 164 km (EuroTunnel milage 30 km)	45:45 h	Running time: 16:15 h Rest period:0:45 h during the crossing of the Euro-Tunnel; 23:30 h EroTunnel time ca. 1:00 h	2.530 €	Total: 439 € GB – EuroTunnel – 283 € E – 148 km – 19 €	London via EuroTunnel; F, E to Barcelona

Table A- 13: OD rail transport – ports as origins

OD rail		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costs detail	Short description routing
Rotterdam	Cologne	241 km	NL - 168 km D - 73 km	6:30 h	430 €	main haulage rail: 200 € crane: 2*40 € pre- post haulage truck: 150 €	NL Rotterdam D Köln
	Bremen	404 km	NL - 205 km D - 199 km	9:30 h	560 €	main haulage rail: 330 € crane: 2*40 € pre- post haulage truck: 150 €	NL Rotterdam D Bremen
	Mannheim	502 km	NL - 168 km D - 334 km	11:30 h	650 €	main haulage rail: 420 € crane: 2*40 € pre- post haulage truck: 150 €	NL Rotterdam D Mannheim
	Hamburg	517 km	NL - 205 km D - 312 km	11:30 h	580 €	main haulage rail: 430 € crane: 2*40 € pre- post haulage truck: 150 €	NL Rotterdam D Hamburg
	Milan	1071 km	NL - 69 km B - 274 km L - 34 km F - 330 km CH - 302 km IT - 62 km	25:30 h	1.390 €	main haulage rail: 1160 € crane: 2*40 € pre- post haulage truck: 150 €	NL Rotterdam Port via B, L, F, CH to Milan.

OD rail		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costs detail	Short description routing
Rotterdam	Vienna	1193 km	NL - 168,0 km D - 742 km A - 283 km	27:30 h	1.250 €	main haulage rail: 1020 € crane: 2*40 € pre- post haulage truck: 150 €	NL Rotterdam Port, via D-Cologne, D-Nürnberg to A-Wels, A-Vienna
Hamburg	Berlin	296 km	D – 296 km	05:30 h	800 €	main haulage rail: 570 € crane: 2*40 € pre- post haulage truck: 150 €	D Hamburg Port – Berlin
	Hannover	181 km	D - 181 km	03:00 h	580 €	main haulage rail: 350 € crane: 2*40 € pre- post haulage truck: 150 €	D – Hamburg Port - Hannover
	Poznan	540 km	D - 375 km P – 165 km	13:00 h	980 €	main haulage rail: 750 € crane: 2*40 € pre- post haulage truck: 150 €	D- Hamburg Port – Berlin – PL-Poznan
	Dresden	463 km	D - 463 km	9:30 h	890 €	main haulage rail: 660 € crane: 2*40 € pre- post haulage truck: 150 €	D-Hamburg Port – Dresden
	Stockholm	941 km	D – 163 km DK – 222 km S – 556 km	23:30 h	1.600 €	main haulage rail: 1370 € crane: 2*40 € pre- post haulage truck: 150 €	D-Hamburg-Port – ferry Puttgarden - Denmark –Stockholm

OD rail		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costs detail	Short description routing
Hamburg	Budapest	1216 km	D – 506 km CZ – 323 km SK – 97 km HU – 1790 km	29:00 h	1.450 €	main haulage rail: 1220 € crane: 2*40 € pre- post haulage truck: 150 €	D-Hamburg-Port – CZ-Praha – SK - HU Budapest
Constanta	Bucharest	222 km	RO – 222 km	6:30 h	390 €	main haulage rail: 160 € crane: 2*40 € pre- post haulage truck: 150 €	RO –Constanta port-Bucaresti
	Craiova	424 km	RO – 424 km	12:00 h	540 €	main haulage rail: 310 € crane: 2*40 € pre- post haulage truck: 150 €	RO –Constanta port- Craiova
	Timisoara	747 km	RO – 747 km	21:30 h	770 €	main haulage rail: 540 € crane: 2*40 € pre- post haulage truck: 150 €	RO –Constanta port- Timisoara
	Sofia	662 km	RO - 105 km BG – 557 km	19:00 h	710 €	main haulage rail: 480 € crane: 2*40 € pre- post haulage truck: 150 €	RO –Constanta port-via BG ro Sofia
	Vienna	1301 km	RO - 825 km HU - 399 km A – 77 km	36:00 h	1.220 €	main haulage rail: 990 € crane: 2*40 € pre- post haulage truck: 150 €	RO –Constanta port-via HU, A to Vienna

OD rail		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costs detail	Short description routing
Constanta	Duisburg (Ruhr-area)	2290 km	RO - 825 km HU - 399 km A – 359 km D – 707 km	58:00 h	2.075 €	main haulage rail: 1845 € crane: 2*40 € pre- post haulage truck: 150 €	RO –Constanta port-via HU, A, D to Ruhr area
Genoa	Milan	136 km	IT – 136 km	2:30 h	345 €	main haulage rail: 115 € crane: 2*40 € pre- post haulage truck: 150 €	Genoa port to Milan
	Bologna	298 km	IT – 298 km	4:30 h	420 €	main haulage rail: 190 € crane: 2*40 € pre- post haulage truck: 150 €	Genoa port to Bologna
	Munich	687 km	IT - 505 km A - 63 km D – 119 km	15:00 h	720 €	main haulage rail: 490 € crane: 2*40 € pre- post haulage truck: 150 €	Genoa port , A, Munich
	Lyon	464 km	IT - 247 km F – 217 km	9:00 h	640 €	main haulage rail: 410 € crane: 2*40 € pre- post haulage truck: 150 €	Genoa port - Lyon

OD rail		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costs detail	Short description routing
Genoa	London	1329 km	IT – 246 km F – 964 km GB – 119 km (EuroTunnel milage 30 km)	24:00 h	1.610 €	main haulage rail: 1180 € crane: 2*40 € pre- post haulage truck: 150 € Eurotunnel: ca. 200 €/LU	Genoa port via IT ,F, EuroTunnel to London
	Prague	1117 km	IT – 505 km A – 63 km D – 364 km CZ – 185 km	25:30 h	1.050 €	main haulage rail: 820 € crane: 2*40 € pre- post haulage truck: 150 €	Genoa port via IT,A,D,CZ to Prague
Le Havre	Paris	235 km	F- 235 km	4:30 h	440 €	main haulage rail: 210 € crane: 2*40 € pre- post haulage truck: 150 €	Le Havre - Paris
	London	517 km	F - 398 km GB – 119 km	10:30 h	680 €	main haulage rail: 450 € crane: 2*40 € pre- post haulage truck: 150 €	Le Havre port via EuroTunnel to London
	Cologne	621 km	F – 375 km B – 168 km D – 78 km	14:00 h	755 €	main haulage rail: 525 € crane: 2*40 € pre- post haulage truck: 150 €	Le Havre port via F, B, D to Cologne

OD rail		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costs detail	Short description routing
Le Havre	Luxembourg	573 km	F – 546 km L – 27 km	11:30 h	775 €	main haulage rail: 545 € crane: 2*40 € pre- post haulage truck: 150 €	Le Havre port via F, L to Luxembourg
	Prague	1401 km	F – 647 km D – 582 km CZ – 172 km	29:30 h	1.425 €	main haulage rail: 1195 € crane: 2*40 € pre- post haulage truck: 150 €	Le Havre port via F, D ,CZ to Prague
	Madrid	1528 km	F – 1024 km ESP – 504 km	29:30 h	1.495 €	main haulage rail: 1265 € crane: 2*40 € pre- post haulage truck: 150 €	Le Havre port via F, ESP to Madrid

Table A- 14: OD rail transport – metropolitan areas as origins

OD rail		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costst detail	Short description routing
Madrid	Zaragoza	327 km	ESP – 327 km	6:30 h	480 €	main haulage rail: 250 € crane: 2*40 € pre- post haulage truck: 150 €	Madrid - Zaragoza
	Burgos	262 km	ESP – 262 km	5:30 h	431 €	main haulage rail: 201 € crane: 2*40 € pre- post haulage truck: 150 €	Madrid - Burgos
	Lisbon	666 km	ESP – 413 km P – 253 km	17:00 h	740 €	main haulage rail: 510 € crane: 2*40 € pre- post haulage truck: 150 €	Madrid via P to Lisbon
	Marseille	1201 km	ESP – 823 km F – 378 km	43:30 h	1.180 €	main haulage rail: 950 € crane: 2*40 € pre- post haulage truck: 150 €	Madrid via F to Marseille
	Munich	2091 km	ESP – 828 km F – 756 km CH – 292 km A – 14 km D – 201 km	71:30 h	2.530 €	main haulage rail: 2300 € crane: 2*40 € pre- post haulage truck: 150 €	Madrid via ,F,CH,A,D to Mu-nich

OD rail		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costst detail	Short description routing
Madrid	Paris	1295 km	ESP – 504 km F – 791 km	45:00 h	1.301 €	main haulage rail: 1071 €	Madrid via F to Paris
Warsaw	Krakow	298 km	PL – 298 km	8:00 h	446 €	main haulage rail: 216 € crane: 2*40 € pre- post haulage truck: 150 €	Warsaw - Krakow
	Gdansk	332 km	PL – 332 km	11:30 h	471 €	main haulage rail: 241 € crane: 2*40 € pre- post haulage truck: 150 €	Warsaw - Gdansk
	Berlin	577 km	PL – 495 km D – 82 km	17:00 h	662 €	main haulage rail: 432 € crane: 2*40 € pre- post haulage truck: 150 €	Warsaw via PL, D to Berlin
	Brno	568 km	PL – 377 km CZ – 191 km	15:30 h	643 €	main haulage rail: 413 € crane: 2*40 € pre- post haulage truck: 150 €	Warsaw via PL, CZ to Brno
	Constanta	1339 km	PL – 409 km UA – 387 km RO – 543 km	43:00 h	1.198 €	main haulage rail: 968 € crane: 2*40 € pre- post haulage truck: 150 €	Warsaw via PL, UA, RO to Constanta

OD rail		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costst detail	Short description routing
Warsaw	Talinn	1087 km	PL – 232 km BY – 61 km LT – 347 km LV - 232 km EST - 214 km	32:30 h	1.019 €	main haulage rail: 789 € crane: 2*40 € pre- post haulage truck: 150 €	Warsaw via PL, BY, LT, LV, EST to Talinn
Athens	Thessaloniki	489 km	GR – 489 km	12:00 h	446 €	main haulage rail: 216 € crane: 2*40 € pre- post haulage truck: 150 €	Athens- Thesaloniko
	Larisa	360 km	GR – 360 km	9:00 h	536 €	main haulage rail: 306 € crane: 2*40 € pre- post haulage truck: 150 €	Athens - Larisa
	Sofia	826 km	GR – 627 km BG – 199 km	22:30 h	908 €	main haulage rail: 677 € crane: 2*40 € pre- post haulage truck: 150 €	Athens via GR, BG to Sofia
	Bari	2709 km	GR – 540 km MK - 180 km SCG - 518 km HR - 313 km SLO - 208 km IT - 950 km	66:00 h	2.378 €	main haulage rail: 2148 € crane: 2*40 € pre- post haulage truck: 150 €	Athens via GR, MK, SCG, HR, SLO, IT to Bari

OD rail		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costst❌ detail	Short description routing
Athens	Munich	2049 km	GR – 540 km MK – 180 km SCG – 518 km HR – 278 km SLO – 175 km A – 208 km D – 150 km	59:30 h	2.041 €	main haulage rail: 1711 € crane: 2*40 € pre- post haulage truck: 150 €	Athens via GR, MK, SCG, HR, SLO, A, D to Munich
	Turino	2310 km	GR – 540 km MK - 180 km SCG - 518 km HR - 313 km SLO - 208 km IT - 551 km	60:30 h	2.049 €	main haulage rail: 1819 € crane: 2*40 € pre- post haulage truck: 150 €	Athens via GR, MK, SCG, HR, SLO, IT to Torino
Milan	Bologna	227 km	IT – 227 km	3:30 h	423 €	main haulage rail: 193 € crane: 2*40 € pre- post haulage truck: 150 €	Milan - Bologna
	Padua	222 km	IT – 222 km	3:30 h	419 €	main haulage rail: 189 € crane: 2*40 € pre- post haulage truck: 150 €	Milan – Padua

OD rail		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costst detail	Short description routing
Milan	Rome	560 km	IT – 560 km	9:00 h	706 €	main haulage rail: 476 € crane: 2*40 € pre- post haulage truck: 150 €	Milan – Roma
	Ljubljana	499 km	IT – 399 km SLO – 100 km	10:30 h	641 €	main haulage rail: 411 € crane: 2*40 € pre- post haulage truck: 150 €	Milan via IT, SLO to Ljubljana
	Dubrovnik	1249 km	IT – 399 km SLO – 209 km BIH - 506 km HR – 135 km	39:00 h	1.182 €	main haulage rail: 952 € crane: 2*40 € pre- post haulage truck: 150 €	Milan via IT, SLO, HR to Du-brovnik
	Barcelona	1068 km	IT – 286 km F – 614 km ESP – 168 km	19:30 h	1.126 €	main haulage rail: 896 € crane: 2*40 € pre- post haulage truck: 150 €	Milan via IT, F, ESP to Barce-lona
London	Birmingham	187 km	GB – 187km	3:30 h	389 €	main haulage rail: 159 € crane: 2*40 € pre- post haulage truck: 150 €	London - Birmingham

OD rail		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costst‌ detail	Short description routing
London	Manchester	323 km	GB – 323 km	6:00 h	504 €	main haulage rail: 274 € crane: 2*40 € pre- post haulage truck: 150 €	London - Manchester
	Dublin	540 km	GB – 445 km (Ferry milage 90 km) IRL – 5 km	9:00 h	689 €	main haulage rail: 459 € crane: 2*40 € pre- post haulage truck: 150 € ferry charging: ca. 150 €/LU	London via ferry Holyhead to Dublin
	Paris	472 km	GB – 121 km F – 321 km (EuroTunnel milage 30 km)	8:00 h	631 €	main haulage rail: 401 € crane: 2*40 € pre- post haulage truck: 150 € Eurotunnel: ca. 200 €/LU	London via EuroTunnel to Paris
	Copenhagen	1412 km	GB – 121 km F – 115 km B – 205 km NL – 50 km D – 698 km DK – 173 km (EuroTunnel milage 30 km) (Ferry milage Puttgarden-Rodby 20 km)	33:30 h	1.545 €	main haulage rail: 1315 € crane: 2*40 € pre- post haulage truck: 150 € Eurotunnel: ca. 200 €/LU ferry charging Puttgarten-DK: ca. 150 €/LU	London via EuroTunnel; F, B, NL,D, ferry to DK to Copenha-gen

OD rail		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costst detail	Short description routing
London	Barcelona	1560 km	GB – 121 km F – 1236 km ESP – 173 km (EuroTunnel milage 30 km)	28:30 h	1.555 €	main haulage rail: 1325 € crane: 2*40 € pre- post haulage truck: 150 € Eurotunnel: ca. 200 €/LU	London via EuroTunnel; F, ESP to Barcelona

Table A- 15: OD inland waterway transport – ports as origins

OD inland waterway		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costs detail	Short description routing
Rotterdam	Cologne	295 km	NL - 130 km D -165 km	44:00 h	330 €	main haulage IWW: 100 € crane: 2*40 € pre- post haulage truck: 150 €	NL Rotterdam D Köln : River Rhein
	Bremen	485 km	NL - 290 km D - 195 km	93:00 h	410 €	main haulage IWW: 180 € crane: 2*40 € pre- post haulage truck: 150 €	NL Rotterdam D Bremen: River Rhein via West-German Canals, Mittelland Canal, River Weser to Bremen
	Mannheim	564 km	NL - 130 km D - 434 km	92:00 h	300 €	main haulage IWW: 170 € crane: 2*40 € pre- post haulage truck: 150 €	NL Rotterdam D Mannheim: River Rhein
	Hamburg	717 km	NL - 130 km D - 587 km	123:00 h	460 €	main haulage IWW: 230 € crane: 2*40 € pre- post haulage truck: 150 €	NL Rotterdam D Hamburg: River Rhein via West-German Canals, Mittelland Canal, Elbe-Seiten-Canal, River Elbe to Hamburg

OD inland waterway		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costs detail	Short description routing
Rotterdam	Vienna	1534 km	NL - 130 km D - 1108 km A - 296 km	253:00 h	750 €	main haulage IWW: 520 € crane: 2*40 € pre- post haulage truck: 150 €	River Rhein, River Main; Main-Danube Canal; Danube river
Hamburg	Berlin	336 km	D – 336 km	44:00 h	330 €	main haulage IWW: 100 € crane: 2*40 € pre- post haulage truck: 150 €	D Hamburg Port – Berlin: River Elbe, Elbe-Havel Canal to Berlin
	Hannover	242 km	D - 242 km	31:00 h	300 €	main haulage IWW: 70 € crane: 2*40 € pre- post haulage truck: 150 €	D – Hamburg Port - Hannover: River Elbe, Elbe-Seiten Canal; Mittelland Canal to Hannover
	Poznan	577 km	D - 427 km P – 150 km	126:00 h	420 €	main haulage IWW: 190 € crane: 2*40 € pre- post haulage truck: 150 €	River Elbe, Elbe-Havel Canal, River Spree, River Oder, River Warthe to Poznan
	Dresden	457 km	D - 457 km	64:00 h	370 €	main haulage IWW: 140 € crane: 2*40 € pre- post haulage truck: 150 €	River Elbe

OD inland waterway		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costs detail	Short description routing
Hamburg	Budapest	1765 km	D – 1397 km A – 201 km SK – 20 km HU – 147 km	329:00 h	800 €	main haulage IWW: 670 € crane: 2*40 € pre- post haulage truck: 150 €	River Elbe, Elbe-Seiten Canal, Mittelland Canal, West-German Canals, River Rhein, River Main, Rhein-Main-Donaube-Canal, Danube river
Constanta	Vienna	1350 km	RO - 320 km BG - 330 km SCG - 320 km HU - 300 km SK - 20 km A – 60 km	190:00 h	560 €	main haulage IWW: 330 € crane: 2*40 € pre- post haulage truck: 150 €	Danube River
	Duisburg (Ruhr-area)	2370 km	RO - 320 km BG - 330 km SCG - 320 km HU - 300 km SK - 20 km A – 200 km D - 880 km	330:00 h	930 €	main haulage IWW: 700 € crane: 2*40 € pre- post haulage truck: 150 €	Danube River, Rhein-Main-Danube Canal, River Main, River Rhein

OD inland waterway		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costs detail	Short description routing
Le Havre	Paris	160 km	F- 160 km	20:00 h	280 €	main haulage IWW: 50 € crane: 2*40 € pre- post haulage truck: 150 €	Canal de Tancarville, River Seine
	Cologne	765 km	F – 345 km B – 145 km NL - 145 km D – 130 km	121:00 h	480 €	main haulage IWW: 250 € crane: 2*40 € pre- post haulage truck: 150 €	Canal de Tancarville, River Seine, River Oise, Canal Sambre-Oise, River Sambre, River Meuse, River Rhein, West-German Canals, Mittelland Canal, River Elbe
	Prague	1500 km	F – 345 km B – 145 km NL - 145 km D – 750 km CZ - 115 km	240:00 h	730 €	main haulage IWW: 500 € crane: 2*40 € pre- post haulage truck: 150 €	Canal de Tancarville, River Seine, River Oise, Canal Sambre-Oise, River Sambre, River Meuse, River Rhein

Table A- 16: OD inland waterway transport – metropolitan areas as origins

OD inland waterway		kilometres (total)	kilometres (detail)	Duration time (total)	Costs (total)	costs detail	Short description routing
Warsaw	Krakow	250 km	PL – 250 km	40:00 h	290 €	main haulage IWW: 60 € crane: 2*40 € pre- post haulage truck: 150 €	River Weichsel
	Gdansk	290 km	PL – 390 km	46:00 h	300 €	main haulage IWW: 70 € crane: 2*40 € pre- post haulage truck: 150 €	River Weichsel
	Berlin	610 km	PL – 490 km D – 120 km	88:00 h	420 €	main haulage IWW: 190 € crane: 2*40 € pre- post haulage truck: 150 €	River Warta, River Notéc, River Oder; Spree-Oder-Canal
	Constanta	3560 km	PL - 520 km D - 1550 km A - 200 km SK - 20 km HU - 300 km SCG - 320 km BG - 330 km RO - 320 km	543:00 h	980 €	main haulage IWW: 750 € crane: 2*40 € pre- post haulage truck: 150 €	River Weichsel, River Neiße, Spree-Oder-Canal, Elbe-Havel Canal, Mittellland Canal, West-German Canals, River Rhein, River Main, Rhein-Main- Danube Canal, Danube River

Table A- 17: OD air transport – ports as origins

OD air		kilometers (total)	Duration time (total)	Handling costs (origin and destination)	total cost	comments
Rotterdam	Milan	800 km	Via Paris Orly 4:00 h; Amsterdam-Milan: 1:10 h + 5 hours handling and waiting time	1.700 €	23.300 €	Milan Malpensa
	Vienna	960 km	Via Hamburg 4:30 h; Amsterdam-Vienna: 1:45 h + 5 hours handling and waiting time	1.700 €	23.500 €	
Hamburg	Stockholm	720 km	1:30 h + 5 hours handling and waiting time	1.500 €	25.000 €	
	Budapest	950 km	1:40 h + 5 hours handling and waiting time	1.100 €	36.000 €	
Constanta	Vienna	830 km	01:45 h + 5 hours handling and waiting time	1.500 €	25.000 €	Airport Bucarest-Otopeni
	Duisburg (Ruhr-area)	1600 km	2:40 h + 5 hours handling and waiting time	1.100 €	36.000 €	Origin:Airport Bucarest-Otopeni; Destination: Düsseldorf
Genoa	London	1050 km	2:00 h + 5 hours handling and waiting time	2.000 €	28.500 €	London Stanstead
	Prague	760 km	1:30 h + 5 hours handling and waiting time	1.200 €	31.500 €	
Le Havre	Prague	1030 km	1:40 h + 5 hours handling and waiting time	1.200 €	36.000 €	Origin: Paris Orly
	Madrid	1050 km	2:00 h + 5 hours handling and waiting time	1.200 €	34.000 €	Origin: Paris Orly

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Table A- 18: OD air transport – metropolitan areas as origins

OD air		kilometers (total)	Duration time (total)	Handling costs (origin and destination)	total cost	comments
Madrid	Munich	1480 km	2:30 h + 5 hours handling and waiting time	1.100 €	22.000 €	
	Paris	1070 km	2:00 h + 5 hours handling and waiting time	1.200 €	21.500 €	
Warsaw	Constanta	940 km	1:50 h + 5 hours handling and waiting time	1.200 €	24.000 €	Destination: Bucarest-Otopeni
	Talinn	850 km	via Helsinki: 4:30 h + 5 hours handling and waiting time	1.200 €	24.500 €	
Athens	Munich	1500 km	2:30 h + 5 hours handling and waiting time	1.100 €	24.000 €	
	Turin	1560 km	2:30 h + 5 hours handling and waiting time	1.200 €	21.500 €	
Milan	Dubrovnik	830 km	via Munich: 3..00 h + 5 hours handling and waiting time	1.200 €	28.000 €	
	Barcelona	720 km	1:30 h + 5 hours handling and waiting time	1.200 €	27.000 €	
London	Copenhagen	980 km	2:00 h + 5 hours handling and waiting time	3.200 €	27.000 €	
	Barcelona	1150 km	2:15 h + 5 hours handling and waiting time	2.100 €	32.500 €	

Table A- 19: OD intermodal transport – ports as origins

OD intermodal		Detailed transport chain	kilometers (total)	kilometers (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Costs (detail)
Rotterdam	Milan	Road: Rotterdam-Freiburg. piggyback transport: Freiburg – Novara Road: Novara-Milan	1070 km	Road: Rotterdam-Freiburg: 620 km piggyback transport: Freiburg – Novara 400 km Road: Novara-Milan 50 km	26:00 h	Road: Rotterdam-Freiburg: 09:00 h handling and waiting time: 03:00 h piggyback transport: Freiburg – Novara 10:00 h handling and waiting time: 03:00 h Road: Novara-Milan: 01:00 h	1.310 €	Road: Rotterdam-Freiburg: 750 € piggyback transport: Freiburg – Novara 500 € Road: Novara-Milan: 60 €
	Vienna	IWW: Rotterdam-Duisburg Rail: Duisburg-Wels road: Wels -Vienna	1170 km	IWW: Rotterdam-Duisburg: 200 km Rail: Duisburg-Wels: 800 km road: Wels -Vienna: 170 km	73:00 h	road: pre haulage: 01:00 h handling and waiting time: 07:00 h IWW: Rotterdam-Duisburg: 30:00 h handling and waiting time: 05:00 h Rail: Duisburg-Wels: 22:00 h handling and waiting time: 05:00 h road: Wels -Vienna: 03:00 h	1.380 €	IWW: Rotterdam-Duisburg: 70 € handling costs: 2* 25 € Rail: Duisburg-Wels: 1000 € handling costs: 2* 30 € road: Wels -Vienna: 200 €

OD intermodal		Detailed transport chain	kilometers (total)	kilometers (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Costs (detail)
Hamburg	Stockholm	Short-Sea Shipping: Hamburg - Stockholm	900 km	SSS: Hamburg - Stockholm 900 km	41:00 h	road: pre haulage: 01:30 h handling and waiting time: 4:00 h Short-Sea Shipping: Hamburg -Stockholm: 30:00 h handling and waiting time: 04:00 h road: post haulage: 01:30 h	650 €	main haulage ferry: 500 € pre- post haulage truck: 150 €
	Budapest	Rail: Hamburg – Wels road: Wels – Budapest	1300 km	Rail: Hamburg – Wels: 900 km road: Wels – Budapest: 400 km	46:30 h	Rail: Hamburg – Wels: 25:00 h handling time: 02:00 h road: Wels – Budapest: 06:30 h	1.710 €	Rail: Hamburg – Wels: 1.150 € handling costs: 2* 30 € road: Wels – Budapest: 500 €

OD intermodal		Detailed transport chain	kilometers (total)	kilometers (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Costs (detail)
Constanta	Vienna	road: Constanta – Brasov rail: Brasov - Vienna	1300 km	road: Constanta – Brasov 350 km rail: Brasov - Vienna 950 km	53:00 h	road: Constanta – Brasov 08:00 h handling and waiting time: 07:00 h rail: Brasov - Vienna 30:00 h handling and waiting time: 07:00 h road: post haulage: 01:00 h	1.610 €	road: Constanta – Brasov 400 € handling costs: 2 * 30 € rail: Brasov - Vienna 1.000 € pre-post haulage 150 €
	Duisburg (Ruhr-area)	road: Constanta – Budapest IWW: Budapest – Duisburg	2250 km	road: Constanta – Budapest 1.000 km IWW: Budapest – Duisburg 1.250 km	217:00 h	road: Constanta – Budapest 22:00 h handling and waiting time : 07:00 h IWW: Budapest – Duisburg 180:00 h handling and waiting time: 07:00 h road: post haulage: 01:00 h	1.530 €	road: Constanta – Budapest 1.000 € handling costs: 2 * 40 € IWW: Budapest – Duisburg 300 € pre- post haulage: 150€

OD intermodal		Detailed transport chain	kilometers (total)	kilometers (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Costs (detail)
Genoa	London	SSS: Genoa- Felixstowe Road: Felixstowe – London	5150 km	SSS: Genoa- Felixstowe: 5.000 km Road: Felixstowe – London 150 km	188:00 h	road: pre haulage: 01:00 h handling and waiting time: 08:00 h SSS: Genoa- Felixstowe: 170:00 h handling and waiting time: 08:00 h road: Felixstowe – London 02:00 h	2.875 €	SSS: Genoa- Felixstowe: 2500 € km handling costs: 100 € Road: Felixstowe – London 200 € pre haulage 75 €
	Prague	road: Genoa - Trento piggy back transport: Trento – Regensburg road: Regensburg – Prague	1000 km	road: Genoa - Trento : 300 km piggy back transport: Trento – Regensburg: 450 km road: Regensburg – Prague: 250 km	22:30 h	road: Genoa - Trento 04:00 h handling and waiting time: 03:00 h piggy back transport: Trento – Regensburg 09:00 h handling and waiting time : 03:00 h road: Regensburg – Prague: 03:30 h	1.030 €	road: Genoa - Trento : 330 € piggy back transport: Trento – Regensburg 400 € road: Regensburg – Prague: 300 €

OD intermodal		Detailed transport chain	kilometers (total)	kilometers (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Costs (detail)
Le Havre	Prague	SSS: Le Havre - Hamburg rail: Hamburg - Prague	1650 km	SSS: Le Havre - Hamburg: 1.000 km rail: Hamburg - Prague: 650 km	73:00 h	road: pre haulage: 01:30 h handling and waiting time: 07:00 h SSS: Le Havre - Hamburg: 35:00 h handling and waiting time : 07:00 h rail: Hamburg - Prague: 20:00 h handling and waiting time: 07:00 h road : post haulage: 01:30 h	1.220 €	SSS: Le Havre - Hamburg: 550 € handling cost: 50 € rail: Hamburg - Prague: 500 € handling cost: 20 € post-haulage: 100 €
	Madrid	SSS: Le Havre – Bilbao road: Bilbao – Madrid	1350 km	SSS: Le Havre – Bilbao: 1.000 km road: Bilbao – Madrid 350 km	55:30 h	road: pre haulage: 01:00 h handling and waiting time: 07:00 h ' SSS: Le Havre – Bilbao: 35:00 h handling and waiting time: 07:00 h road: Bilbao – Madrid: 04:30 h	1025 €	SSS: Le Havre – Bilbao: 550 € handling costs: 50 € road: Bilbao – Madrid: 350 € post haulage: 75 €

Table A- 20: OD intermodal transport – metropolitan areas as origins

OD intermodal		Detailed transport chain	kilometers (total)	kilometers (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Costs (detail)
Madrid	Munich	road: Madrid - Perpignan rail: Perpignan - Munich	1900 km	road: Madrid - Perpignan 700 km rail: Perpignan - Munich 1.200 km	65:00 h	road: Madrid - Perpignan 10:00 h handling and waiting time: 07:00 h rail: Perpignan - Munich 40:00 h handling and waiting time: 07:00 h road: post haulage: 01:00 h	2.555 €	road: Madrid - Perpignan 800 € handling costs: 2 * 40 € rail: Perpignan - Munich 1.600 € post haulage: 75 €
	Paris	road: Madrid - Bayonne rail: Bayonne - Paris	1250 km	road: Madrid - Bayonne 500 km rail: Bayonne - Paris 750 km	53:00 h	road: Madrid - Bayonne 08:00 h handling and waiting time: 07:00 rail: Bayonne - Paris 30:00 h handling and waiting time: 07:00 road: post haulage: 01:00 h	1.605 €	road: Madrid - Bayonne 650 € handling costs: 2 * 40 € rail: Bayonne - Paris 800 € post haulage: 75 €

OD intermodal		Detailed transport chain	kilometers (total)	kilometers (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Costs (detail)
Warsaw	Constanta	rail: Warsawa – Budapest road: Budapest - Constanta	1800 km	rail: Warsawa – Budapest: 800 km road: Budapest - Constanta: 1000 km	63:00 h	road: pre haulage 01:00 h handling and waiting time: 07:00 rail: Warsawa – Budapest: 21:00 h handling and waiting time: 07:00 h road: Budapest - Constanta: 27:00 h	2.235 €	rail: Warsawa – Budapest: 600 € handling costs: 2* 30 € road: Budapest - Constanta: 1500 € pre haulage: 75 €
	Talinn	road: Warsawa – Gdansk SSS: Gdansk - Talinn	1050 km	road: Warsawa – Gdansk: 350 km SSS: Gdansk - Talinn: 700 km	46:00 h	road: Warsawa – Gdansk: 08:00 h handling and waiting time: 07:00 SSS: Gdansk - Talinn: 23:00 h handling and waiting time: 07:00 road: post haulage: 01:00 h	825 €	road: Warsawa – Gdansk: 350 € SSS: Gdansk - Talinn: 400 € post haulage: 75 €

OD intermodal		Detailed transport chain	kilometers (total)	kilometers (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Costs (detail)
Athens	Munich	road: Athens – Patras RoRo (ferry): Patras – Venice road: Venice - Munich	1710 km	road: Athesn – Patras: 180 km RoRo (ferry): Patras – Venice: 1.100 km road: Venice - Munich: 430 km	54:45 h	road: Athens – Patras: 03:00 h handling and waiting time: 05:00 RoRo (ferry): Patras – Venice: 35:00 h handling and waiting time: 05:00 road: Venice - Munich: 06:45 h	1.470 €	road: Athens – Patras: 220 € RoRo (ferry): Patras – Venice: 800 € road: Venice - Munich: 450 €
	Turin	road: Athens – Patras RoRo (ferry): Patras – Venice road: Venice – Turino	1680 km	road: Athens – Patras: 180 km RoRo (ferry): Patras – Venice: 1.100 km road: Venice - Turino: 400 km	54:00 h	road: Athens – Patras: 03:00 h handling and waiting time: 05:00 RoRo (ferry): Patras – Venice: 35:00 h handling and waiting time: 05:00 road: Venice - Turino: 06:00 h	1.420 €	road: Athens – Patras: 220 € RoRo (ferry): Patras – Venice: 800 € road: Venice - Munich: 400 €

OD intermodal		Detailed transport chain	kilometers (total)	kilometers (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Costs (detail)
Milan	Dubrovnik	road: Milan – Bari RoRo (ferry): Bari - Dubrovnik	1050 km	road: Milan – Bari: 850 km RoRo (ferry): Bari - Dubrovnik: 200 km	44:00 h	road: Milan – Bari: 24:00 h handling and waiting time: 05:00 RoRo (ferry): Bari - Dubrovnik: 09:00 h handling and waiting time: 05:00 road: post haulage: 01:00 h	1.575 €	road: Milan – Bari: 1.200 € RoRo (ferry): Bari - Dubrovnik: 300 € post haulage: 75 €
	Barcelona	road: Milan – Genoa SSS: Genoa – Barcelona	1030 km	road: Milan – Genoa: 130 km SSS: Genoa – Barcelona: 700 km	38:00 h	road: Milan – Genoa: 02:00 h handling and waiting time: 05:00 h SSS: Genoa – Barcelona: 23:00 h handling and waiting time: 05:00 road: post haulage: 01:00 h	635 €	road: Milan – Genoa: 160 € SSS: Genoa – Barcelona: 400 € post haulage: 75 €

OD intermodal		Detailed transport chain	kilometers (total)	kilometers (detail)	Duration time (total)	Duration time (detail)	Costs (total)	Costs (detail)
London	Copenhagen	road: London – Felixstowe SSS: Felixstowe - Copenhagen	1150 km	road: London – Felixstowe: 150 km SSS: Felixstowe - Copenhagen : 1000 km	45:00 h	road: London – Felixstowe: 02:00 h handling and waiting time: 05:00 SSS: Felixstowe - Copenhagen : 32:00 h handling and waiting time: 05:00 road: post haulage: 01:00 h	975 €	road: London – Felixstowe: 200 € SSS: Felixstowe - Copenhagen : 700 € post haulage: 75 €
	Barcelona	road: London – Dover SSS: Dover - Barcelona	3615 km	road: London – Dover: 115 km SSS: Dover - Barcelona: 3500 km	133:30 h	road: London – Dover: 02:30 h handling and waiting time: 05:00 h SSS: Dover - Barcelona: 120:00 h handling and waiting time: 05:00 road: post haulage: 01:00 h	1.950 €	road: London – Dover: 150 € SSS: Dover - Barcelona: 1800 € post haulage: 75 €

Annex 6.2: Transport cost structures

Table A- 21: Heavy Duty Vehicles (HDV) – specific operation costs per vehicle-km 2005

	HDV Specific costs (EUR/veh-km)
Belgium	1.34
Czech Republic	0.52
Denmark	1.39
Germany	1.10
Estonia	0.39
Greece	0.62
Spain	0.84
France	1.26
Irland	0.92
Italia	0.94
Cyprus	0.77
Latria	0.30
Lithuania	0.34
Luxembourg	1.40
Hungary	0.50
Malta	0.70
Netherlands	1.35
Austria	1.39
Poland	0.43
Portugal	0.75
Slovenia	0.63
Slovakia	0.43
Finland	1.36
Sweden	1.43
United Kingdom	1.18
USA	1.00
Switzerland	1.61
EU 25	1.03
Western EU *	1.11
Eastern EU **	0.46

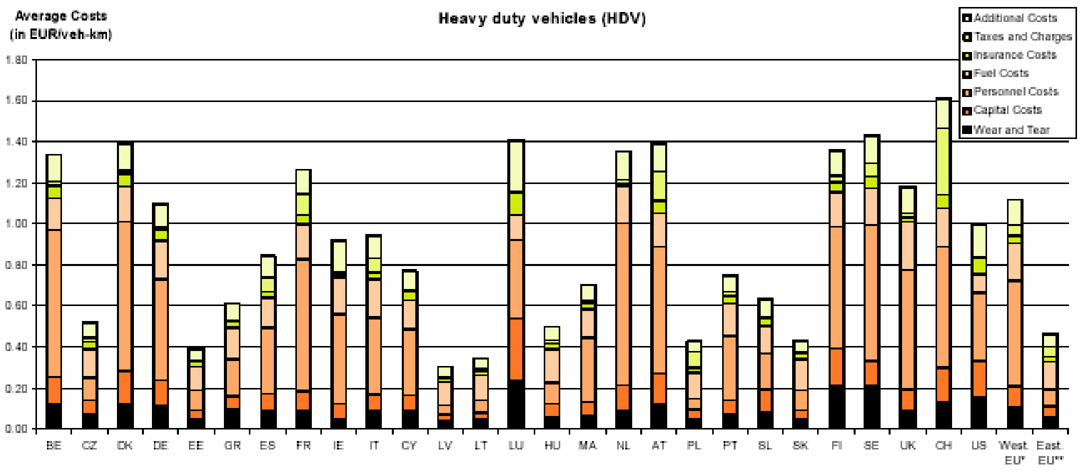
Source::EC (2006); p.19.[106]

* Western Europe means here EU15

** Eastern Europe means: Czech Republic, Hungary, Poland, Slovenia and Slovakia.

[106] European Commission (2006): COMPETE Final Report, Annex 1: Analysis of operating cost in the EU and the US; Brussels.

Figure A-29: Heavy Duty Vehicles (HDV) – structure of average operating costs per vehicle-km 2005



* Western Europe means here EU15. ** Eastern Europe means: Czech Republic, Hungary, Poland, Slovenia and Slovakia.

Source: EC (2006); p.20

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