Contents of the e-learning Module:

Environmentally Friendly Maritime Transport

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Author:
Susanne Neumann with the collaboration of Thomas Pawlik

www.fh-kiel.de

Author of chapter 7:
Michael Laugesen

www.fdt.dk
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Glossary
List of Abbreviations

AG  Aktiengesellschaft; public limited company
approx.  approximately
ASEAN  Association of Southeast Asian Nations
CBT  clean ballast tanks
Cp.  Compare
CRM  Customer Relationship Management
DVZ  Deutsche Verkehrs-Zeitung
dwt  deadweight ton
EC  European Commission
EDP  Electronic Data Processing
ed.  Editor
EEA  European Economic Area
e.g.  exempli gratia
EMAS  Eco-Management and Audit Scheme
EMSA  European Maritime Safety Agency
EMS  Environmental Management System
esp.  especially
etc.  et cetera
EC  European Commission
EU  European Union
EU-15  Abbreviation for the 15 member states of the EU before enlargement in 2004 (Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, the Netherlands, Austria, Portugal, Finland, Sweden, United Kingdom).
EU-25  Abbreviation for the 25 member states since May 2004 (EU-15 plus Cyprus, Czech Republic, Estland, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia).
€, EUR  Euro, currency unit in most member states of the EU
e.V. eingetragener Verein; registered society, incorporated association
FI Freight Integrator
GDP Gross Domestic Product
grt gross registered tons
d.e. id est
IFNSA International Federation of the National Standardizing Associations
ILO International Labour Organization
ILU Intermodal loading unit
IMCO Inter-governmental Maritime Consultative Organization
IMO International Maritime Organization
incl. including
Incoterms International Commercial Terms
ISO International Organization for Standardization
km Kilometre
MARPOL Convention for the Prevention of Pollution from Ships
MERCOSUR Mercado Común del Sur
mm millimetre
MOS Motorways of the Sea
NAFTA North American Free Trade Agreement
NOBS Non-ballast water ships
NSR North Sea Region
OECD Organisation for Economic Co-operation and Development
OILPOL Convention for the Prevention of Pollution at Sea by Oil
PACT Pilot Actions for Combined Transport
REMARCC Network of REgional MARitime Competence Centres
SBT segregated ballast tanks
SECA Sulphur Emission Control Areas
SME small and medium-sized enterprises
SOLAS Convention for the Safety of Life at Sea
SSS Shortsea shipping
SUTRANET Sustainable Transport Research & Development Network in the North Sea Region
tonne
TBT Tribulyin Oxide
TEN-T Trans-European Network for Transport (Guidelines)
TEU Twenty Foot Equivalent Unit
THB Täglicher Hafenbericht
tonne kilometres
UNSCC United Nations Standards Coordination Committee
UVEK Eidgenössisches Departement für Umwelt, Verkehr, Energie und Kommunikation
VOC volatile organic compound
WP Workpackage
WTO World Trade Organization
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1. Introduction

This first chapter aims at providing the reader with definitions of some fundamental transport and environmentally related terms.

An outline of the broad field of transport and environment will be drawn and the e-learning module will focus on the subject of environmentally friendly maritime transport.

At the very beginning of this e-learning module a deeper understanding for transport, economical and environmental issues and the connection between these issues is sought. The reader is to be enabled to comprehend the vital importance of transportation as well as the environmental damage resulting from it. The following chapters will relate to these definitions and insights.

Illustration 1: Port of Hamburg.

![Port of Hamburg](image_url)

Source: Neumann.
1.1. **Current developments in the European Union (as per 12/2006):**

*Globalisation, economic growth, increase of traffic (esp. transport) and the link between these subjects*

In the past, many economies pursued development strategies with a special emphasis on self-sufficiency and the protection of domestic markets (protectionism). But ever since the late 70s of the twentieth century a major ideological shift has started with the “growing consensus that the route to prosperity lies in integration within the global economy”\(^1\). International trade is considered as the “primary engine of economic growth and development”\(^2\). The establishment of the World Trade Organization (WTO) in 1994, the formation and enlargement of the European Union and the integration of different countries e.g. in South America (MERCOSUR) as well as in North America (NAFTA) or in the Pacific Area (ASEAN) reduced trade barriers and allowed the trade liberalization to advance.\(^3\)

This trend of globalisation creates larger markets for companies to buy means of production (global-sourcing\(^4\)) or to sell their finished products.\(^5\) The increasing relaxation of restrictions on capital flows makes foreign direct investment, particularly in manufacturing, easier. This development has “induced many global and regional corporations to relocate some or all of their production sites to countries with lower labour costs”.\(^6\) But the trend towards

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5. Progress in the development of information and communication technology (e.g. internet), worldwide accepted standards (ISO) and decreasing transaction costs made it easier for companies to search for the needed materials, employees, know-how or to find the supplier with the best price-performance ratio as well as new customers. Cp. DHL Logistik-Lotse (2005: 2-8).

globalisation also implies stronger competition and leads to spatial separation of production and consumption.\(^7\) \(^8\)

Hence, globalisation causes an increasing need for transport services. Due to the strong worldwide competition, companies are constantly forced to optimize the quality and costs of their products – therefore the price for transportation is an important factor.\(^9\) “Consequently, the smart organization of the flow of goods, ranging from local to global scales by means of sophisticated logistics, has become an enormous challenge for transport operators.”\(^10\)

Another trend that creates demand for transportation is the concentration of firms on their core competences. Outsourcing or the reduction of vertical integration are usual consequences.\(^11\)

Additional trends that generate transport are the shift to a stockless economy, the global division of labour and the increased demand of consumers for worldwide traded goods – the latter two trends are especially facilitated by globalisation.

Beside the already mentioned reasons for the rising requirement for transportation, there is yet another: It is – even if it sounds like a contradiction – the growing environmental consciousness. The desire to recycle as much as possible lengthens logistics chains as already consumed goods need another transport to their final deposit, which in turn requires a sophisticated way of goods mobility.\(^12\)

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8 According to a survey carried out by the German Association of Chambers of Commerce and Industry, this trend towards globalisation will go on at least until 2009. More than one third of the 350 German companies questioned expect to make at least 50% of their turnover outside their home market until 2009. The German Chamber of Industry and Commerce is the parent organization of over 80 regional Chambers of Commerce and Industry. Cp. Helmke (2006: 5) and IHK.de/Wir über uns.


In the following, only the market of the European Union is to be examined. According to the explanations above, the reader could realize that mobility is a key feature of modern society.
In order that mobility – traffic – can emerge, a traffic system is needed. An undisturbed traffic flow is of vital importance for an economy to flourish.
At this point of our investigation, it is necessary to differentiate the terms ‘transport’ and ‘traffic’. For this it has to be mentioned that goods can be characterized by three features: physical, spatial and chronological features. The process that changes the spatial features is transport. Transport is a technical-organizational process that changes the spatial features of goods and people. Transport creates traffic and traffic results from transport. The need for movement of persons and goods is satisfied by the utilization of transport modes. Consequently there is traffic without transport: empty runs. Of particular importance for the differentiation between transport and traffic is the time aspect. The need for movement is a time-critical phenomenon. Insufficient timing could cause idle times. Additionally, the term ‘logistics’ needs further explanation: “Logistics is the process of planning, implementing and controlling the efficient, cost-effective flow and storage of raw materials, work in progress, finished goods and related information from point of origin to point of consumption for the purpose of conforming to customer requirements…Logistics can be understood as the production of availability.” According to common opinion, a key logistics activity is to provide all services and related information for the movement and storage of materials and goods from point of origin to point of consumption as well as to its ultimate point of disposal.

The following illustration clarifies the coherence mentioned above.

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**Illustration 2**: Differentiation between Transport, Traffic and Logistics.

<table>
<thead>
<tr>
<th>Transport</th>
<th>Encompasses the movement of goods and/or passengers</th>
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<tbody>
<tr>
<td>Traffic</td>
<td>Encompasses the movement of goods and/or passengers as well as empty runs</td>
</tr>
<tr>
<td>Logistics</td>
<td>Encompasses inbound, outbound, internal and external movement of goods and/or passengers as well as empty runs</td>
</tr>
</tbody>
</table>


In the further course of this examination, the emphasis should be placed on transport.
In general, transport can be divided into transportation of goods and passengers.\(^\text{16}\) This e-learning module will only deal with the transportation of goods.

One function of transportation is the creation of utility – it creates place and time utility.

Place utility is created when products are physically moved from where they originated to places where they are needed and have higher value. Hence, transportation adds value to goods.

Time utility is created when the goods arrive on time when the customers need them. “If a product is not available at the precise time it is needed, there may be expensive repercussions, such as lost sales, customer dissatisfaction, and production downtime, when the product is being used in the manufacturing process.”\(^\text{17}\)

To put this issue in a nutshell: Transportation provides an economy with value when products arrive on time, undamaged, in the proper place and in the quantities required, so customers can buy them.\(^\text{18}\)

**Illustration 3:** Feeder vessel in the Kiel Canal.

Source: Neumann.

---


Transportation involves among other activities the selection of the mode of transport.
A mode of transport is the technical equipment for moving passengers or freight by sea, land or by air.
In the transportation of freight there are six different means of transport:\footnote{19} \footnote{20}

\textbf{Illustration 4:} Means of transport.

\begin{center}
\includegraphics[width=0.7\textwidth]{transport_means.png}
\end{center}

Source: Own illustration.


\footnote{20} Altough the focus of this e-learning module should be set on maritime shipping, inland navigation will be briefly mentioned from time to time.
In the next chapters it will be described that the truck is the dominating mode of transport in the European Union.\footnote{Some people say that the modal split developed in favour of the truck. Therefore the term ‘modal split’ will be explained in the following: It is the entire transportation of freight split up into the different modes of transportation. Cp. Lohre (2005: 52), Bichler, Krohn and Philippi (2005: 124) and Bardi, Coyle and Novack (2006: 24).}

This has different reasons. But the most important advantage the truck offers in contrast to trains or vessels is seen in the relatively low load-carrying capacity (approx. 25t) – which is appropriate for the transport of only few pieces of freight for instance, in the all-area availability and in the possibility to carry out door-to-door services without transshipment of the goods. Some experts attribute the development in favour of the truck to the character of goods (increasing share of high quality goods while the share of bulk goods decline) and to the flexibility of this mode of transport (the shipper gets exactly the frequency he or she wants).

On the other hand, the vessel or the train may offer cost-advantages on longer distances.\footnote{Cp. Korf et al. (2005: 28ff. and 76) and Aberle (2005: 4).} Inland navigation for instance is particularly suitable for large amounts of freight as well as for unwieldy or heavy goods.\footnote{Cp. Korf et al. (2005: 381).}

**Illustration 5:** Trucks waiting in the port of Kiel.

\[\text{Source: Neumann.}\]
As stated at the beginning of this chapter, there are many reasons that generate an increasing demand for transportation. Especially the dynamics of the growth of transport of goods represent a major challenge for the EU. The following illustration shows the development goods traffic in the EU-15 from 1970 until 2002. The whole volume cargo carriage amounts to a total of 874 billion tkm (tonne kilometres) in the year 1970 and 1.737 billion tkm in 2002.

**Illustration 6:** Development of the transport of goods from 1970 until 2002.

\begin{figure}
\centering
\includegraphics[width=0.5\textwidth]{chart}
\caption{Development of the transport of goods from 1970 until 2002.}
\end{figure}

Source: Own figure based on data from Aberle (2005: 2).

‘‘Tonne kilometres’ (tkm) is “the unit by which the movement of freight is measured (i.e. tonnes lifted multiplied by the distance it is carried)”’. One tkm correspond to one tonne of freight transported over a distance of one kilometre.

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25 All numbers are presented in modern English notation, also referred to as Short Scale. Therefore 1 billion corresponds to $10^9$ (1000000000).

26 Only the three inland transport means road, rail and inland navigation are included in the survey.


As the reader could see from previous explanations, transport is an important factor for the generation of the Gross Domestic Product (GDP).

The following numbers show the development of the transport intensity from 1980 to 2001 and illustrate the increasing relevance cargo carriage for the GDP in the European Union:

- EU-15  1980:  230 000 tkm/1 million GDP
- EU-15  2001:  265 000 tkm/1 million GDP

The ‘transport intensity’ describes the arising effort in tkm that is necessary for the creation of 1 million GDP.\(^{30}\)

Since transportation has negative aspects as well, the EU attempts to decouple the growth of the GDP from the growth of goods traffic.

Despite the value and benefit transportation creates, the increasing transportation has disadvantages as well:
- Noise, air pollution, accidents, congestion of the European infrastructure, increasing consumption of resources, fragmentation of landscapes etc.\(^{31}\)
- “…distance means transport and transport pollutes the environment…”\(^{32}\)

The next chapters will deal with these problems.

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\(^{32}\)Vrenken, Macharis and Wolters (2005: 221).
1.2. Consequences of traffic for the society, the economy and in particular the environment

“No individual can make profit without making at least one other individual suffer a loss.”

Illustration 7: Port of Hamburg – Eurogate Terminal.

The following explanations of the various impacts of traffic (esp. transport) – the external effects – should enable the reader to understand that transport is not only of advantage to a society as described in the previous chapter.

As stated in the quotation above, somebody has to suffer a loss…

In most cases transportation pollutes the environment, generates noise and exploits natural resources, although most citizens think that the benefits provided by transport far exceed these negative effects.


Transportation is responsible for a number of external effects. These external effects are divided into

- negative external effects – the external costs and
- positive external effects – the external benefits.\(^{35}\)

In the following, only the external costs will be outlined. But first, it has to be mentioned that almost every negative external effect has a psychological dimension as well. These psychological external effects as part of the external costs are for instance the reduction of quality of life. These costs occur for instance when parents become frightened as soon as their children want to leave the house to play outside near a busy junction or heavily used roads.\(^{36}\)

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\(^{35}\) Cp. Korf et al. (2005: 50-51).

Illustration 8: Overview of the negative impacts of transport.

Source: Own illustration.

In the following, the various impacts will be discussed in more detail.
1.2.1. Accidents
One of the most negative by-products of traffic are accidents. Accidents cost a lot of money, may cause environmental damages or are responsible for injury or loss of life.

Truck accidents, train accidents due to derailment, oil spills when a ship runs aground, the threat of gas explosions while in transit – all these problems rise with the increasing volume of products being shipped.\(^{37}\)

Since more and more freight is being transported on roads, this represents a growing danger: 96% of all transport fatalities worldwide occur in road accidents. In the year 2000, there were 40,000 losses of life due to road accidents, 115 in rail transport and 140 in maritime transport in the European Union counted.\(^{38}\)

Road transport is regarded as the most dangerous way of transport. Although the road carriage of dangerous goods is strictly observed and controlled by numerous European multinational legislative institutions and the police, these efforts alone are not sufficient to eliminate the risk of heavy accidents.\(^{39}\)

It is considered that the most reasonable solution for the carriage of dangerous goods is to transport as much as possible by rail or waterway. “According to recent studies the total external costs of inland navigation (in terms of accidents…) are seven times lower than those of road transport. Inland navigation ensures a high degree of safety.”\(^{40}\)

But even if carriage by waterway (this includes inland navigation as well as shortsea shipping\(^{41}\)) is regarded as very safe, there is a residual risk of damage

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\(^{41}\) The term shortsea shipping needs further explanation. This is sought in chapter 2.4.2.
and loss concerning vessels and if an accident happens it can mean major environmental damage.\footnote{Cp. Musso and Marchese (2002: 292) and Bardi, Coyle and Novack (2006: 27-28).}

From time to time, containers go overboard in stormy weather. According to estimates, about 500-1,000 containers per year get lost merely in the southern part of the North Sea Region. Naming a specific example, the reader should be reminded of the French container ship SHERBRO which lost 88 containers in stormy weather at the end of 1993 in the English Channel. Some of these containers were filled with bags containing pesticides. More than 100,000 of these bags have been washed ashore on Dutch, the German and the Danish coasts.\footnote{Cp. Witthöft (2000: 135) and Pawlik (1999: 42).} The more recent example is the sinking of the oil-tanker PRESTIGE on 19\textsuperscript{th} November 2002 which lost 77,000 tons heavy oil close to the north western Spanish coast.\footnote{Cp. European Commission (2005d: 2-8).} These issues will be picked up again in chapter 3 and will be dealt with in greater detail.

Another disadvantage for the society results from accidents:
Concerning the expenses, the European Commission assesses the total costs of accidents at 2\% of the Gross National Product (GNP). These costs arise from the financial compensation of property or personal damage. There are expenses included that no insurance pays for (e.g. costs for the police operation at the scene of an accident).\footnote{CP. European Commission (2001: 31) and Hölzer (2004: 30).}
1.2.2. Air pollution

The main sources of CO$_2$-emissions are the energy sector, traffic sector, agriculture and industry sector. It is estimated by the European Commission that emissions in the energy sector will keep its status quo and emissions in the industry sector will even decrease by 15%, but emissions due to traffic (esp. transport) will rise by 39% until 2010 if no steps will be taken to stop this development. The EC referred to the development in the traffic sector in the past, when emissions increased by 22% between 1990 and 2002.\textsuperscript{46, 47}

The increasing demand for the carriage of goods is regarded as the reason for this development.

But not only CO$_2$-emissions pollute the air. The following table provides an overview of the polluting emissions generated by the transportation of goods.\textsuperscript{48}

\textbf{Table 1:} Polluting emissions\textsuperscript{49} generated by road, rail or sea transport (grams for tkm).

<table>
<thead>
<tr>
<th>Polluting emission</th>
<th>Road</th>
<th>Rail</th>
<th>Sea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon monoxide CO</td>
<td>0.5</td>
<td>0.2</td>
<td>0.04</td>
</tr>
<tr>
<td>Carbon dioxide CO$_2$</td>
<td>98</td>
<td>28</td>
<td>15</td>
</tr>
<tr>
<td>Hydrocarbon HC</td>
<td>0.2</td>
<td>0.1</td>
<td>0.01</td>
</tr>
<tr>
<td>Nitrogen oxide NO$_x$</td>
<td>1</td>
<td>0.5</td>
<td>0.3</td>
</tr>
<tr>
<td>Sulfur dioxide SO$_2$</td>
<td>0.03</td>
<td>0.04</td>
<td>0.3</td>
</tr>
<tr>
<td>Particles</td>
<td>0.08</td>
<td>0.03</td>
<td>0.006</td>
</tr>
</tbody>
</table>


\textsuperscript{47} 84% of transport emissions are road transport related. Cp. Rowlinson and Wixey (2005: 269).


CO₂ (“the main man-made greenhouse gas”\textsuperscript{50}) contributes to the global warming effect as well as NO\textsubscript{x} and HC. NO\textsubscript{x}, SO\textsubscript{2} and HC are also relevant contributors to acid rain\textsuperscript{51} and the build-up of tropospheric ozone. But these are only some effects. Completing the list of negative repercussions of these emissions, many other consequences like carcinogenic effects for instance have to be mentioned as well.\textsuperscript{52} And air pollution represents a big threat to people’s lives: Allergies, intoxication, respiratory diseases and other illnesses could be put down to emissions. About 2 to 8\% of all illnesses in the EU-25 result from air and noise pollution\textsuperscript{53}, the average life expectancy of the Europeans is reduced by nine months due to air pollution, more and more people are taken ill with respiratory diseases and 386.000 Europeans die early every year because of environmental factors.\textsuperscript{54}

Due to governmental requirements, reductions of these emissions have taken place in motor vehicle emission rates, but economic growth will result in persisting problems with pollution, thus much work remains to be done.\textsuperscript{55} It will be outlined in the next chapters that sea transport, despite the benefits of generating less of the most emissions per tkm than road or rail transport, entails other challenges for the environment (e.g. ballast water or the sulfur dioxide emissions that are ten times higher than in road transport).

\textsuperscript{50} Lowe (2005: 112).

\textsuperscript{51} Sulfur dioxide and nitrogen oxide combined with humidity in the air become sulphurous acid which comes down with rainfall (acid rain). Cp. Frerich and Müller (2004: 632, 650).


\textsuperscript{52} Cp. Lowe (2005: 112-113).


1.2.3. Climate change
Climate change is closely related to the greenhouse effect. “Basically, the greenhouse effect is the physical process by which solar energy passes through the atmosphere relatively free, while heat radiating from the earth is partially blocked or absorbed by particular gases in the atmosphere released by human activities such as transportation.”\textsuperscript{56} Because of this, temperatures are rising. And as a consequence of rising temperatures, in the long term the sea level will rise due to the melting polar ice caps. Increasingly, mankind must be prepared for all kinds of extreme weathers like storms, droughts or floods. Mainly responsible for the rising temperatures is carbon dioxide, which is emitted during every combustion process of engines.\textsuperscript{57}

\textsuperscript{56} Bardi, Coyle and Novack (2006: 27).

1.2.4. Congestion of European infrastructure

Another negative external effect is congestion.

To present it in the abstract: Due to the addition of one more road-user to the already fully used infrastructure, the speed for all road-users will slow down and thus the traffic flow as well. This means time delays and therefore additional expenditures for all road-users.\footnote{Cp. Hölzer (2004: 31).}

Heavy traffic is a major problem in the European Union. Delayed journeys, frustrated drivers, payment of overtime and increasing fuel consumption are direct results from congested roads. Moreover, the amount of pollutants that is being discharged into the atmosphere is raised significantly and thus worsens environmental inefficiency.\footnote{Cp. Lowe (2005: 113).}

Congestion of the Trans-European Network (TEN-T, needs further explanation – see the glossary), especially of the roads, causes costs of 0.5\% of the European GDP. On average, there is a total of 7,500 km tailback on European roads per day, and 16,000 km of European railways are regarded as a bottleneck. That leads to decreasing competitiveness of the EU. However, until 2010 an increase of the volume of traffic up to 50\% is expected and the transport intensity\footnote{Transport intensity describes the expenses in tkm per 1 million GDP. Cp. Aberle (2005: 2).} shall grow even further.\footnote{Cp. Europa.eu/White Paper.}

And transportation of freight competes against passenger transport for the scarce European infrastructure and in most cases (esp. on railways), passenger transport has priority over goods transport which makes the problem of the decreasing competitiveness worse.\footnote{Cp. Grotrian and Ickert (2003: 65).}
Mainly, “congestion occurs where infrastructure capacity is insufficient to cope with the increasing demand, particularly at peak periods.”

Due to the increasing demand for transportation, the bottlenecks in the capacity of the TEN-T will grow as well.

Therefore the extension of the TEN-T is necessary, but there are problems that make it very difficult to carry out the Europe-wide infrastructure measures (e.g. the extension of the motorways).

It is necessary to take the high costs and the resistance of local residents, who are affected by the construction of a motorway, into consideration. About 600 billion € are needed to accomplish the extension of the TEN-T and even if the infrastructure measures are fundable and enforceable in terms of planning, it takes just a long time to complete them. Furthermore the expansion of road networks supports the comfort of road transport and results in further growth which accounts for the majority (84%) of CO$_2$-emissions in the whole transport sector. Apart from improving planning of road usage, mainly two solutions on traffic regulation are pursued. Firstly, the discouragement of creating traffic in a specific area by raising fees for their utilization. Secondly, the encouragement of using alternative – more environmentally friendly – modes of transport. This can be achieved by either governmental influence, or by

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63 The European infrastructure is not congested during the whole day but only for a few hours per day. The rest of the time traffic flows freely. Cp. Vrenken, Macharis and Wolters (2005: 231).

64 Lowe (2005: 113).


creating financial incentives.\textsuperscript{69} \textsuperscript{70}

\textsuperscript{69} Lowering congestion of land transport networks sometimes goes hand in hand with congestion in port nodes. Therefore, the extension of port infrastructure is important as well. Cp. Musso and Marchese (2002: 292).

1.2.5. Consumption of resources (energy consumption)

Raw materials like crude oil are scarce goods. Thus, it is recommended to be economical in the consumption of these kinds of raw materials. Since the beginning of the 1970s, transport (air, rail, road and waterway) has become a large consumer of non-renewable energy. As all power-driven modes of transport consume energy, consumption of resources has increased just as the transport volume has increased. And the energy consumption of the transport sector is responsible for 30% of the total final energy consumption in the European Union, which is almost equivalent to the energy consumption of the industry. Among all modes of transport, road transport is the worst offender in terms of energy consumption. Over 80% of the total energy used in the transport sector is consumed by road vehicles.\(^\text{71}\)

Consequently, in terms of energy consumption, it is better to use another mode of transport instead of the truck. Shortsea shipping for example is valued for its low energy consumption. Or, if possible, the use of inland navigation is highly recommended due to its energy-efficiency. The energy consumption per tkm for this mode of transport corresponds to one-sixth of the consumption of road transport.\(^\text{72}\)

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1.2.6. Land use / land utilization (the so-called “ecological footprints”\(^{73}\))

Transportation damages the environment not only in terms of energy consumption and air pollution, but also in terms of land utilization (land-take and -intrusion) for traffic infrastructure. Due to this, the impact on the environment is often irreversible. There is continuing concern that the consequence of the increasing demand for transportation will be an ever-increasing demand for the building of new roads.\(^{74}\)

Since enlarging the road infrastructure causes more and more damage to the environment, a consideration of alternative transport ways is essential. The European Union has access to a long coastline and many waterways, as well as a well extended rail network, which could be used for the transport of goods and thus reducing the dependence on roads.\(^{75}\)

One essential element of the external costs of land use are the opportunity costs. These costs result from the fact that land on which infrastructure is built cannot be used in another way.\(^{76}\)

As mentioned above, transport has a wide-ranging impact on nature and landscape. Three chains of influence on landscape were identified by a research project in 2004:

\(^{73}\) “Ecological footprint” is an indicator for the use of ecosystems and describes different dimensions of the consumption of resources like energy consumption and land utilization due to population and traffic. First and foremost in this context the term means a transformation of landscape due to the extension of infrastructure. The term has its origin in the social ecology and at this point it should be used as a metaphor to make the fact clearer that human activities like traffic have consequences and leave traces on the earth. Cp. Haberl, Adensam, Gaube and Erb (2004) and Simonis (2005: 8).


Table 2: Chains of influence on landscape.

<table>
<thead>
<tr>
<th>Loss of Habitat(^{77})</th>
<th>Fragmentation of Habitat</th>
<th>Loss of Habitat quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport requires land and thereby encroaches upon the habitats of flora and fauna.</td>
<td>Transport systems cut through the landscape and present to some extent insurmountable or life-threatening obstacles, especially for animals. Animals are therefore restricted in their movements. Their usable habitat is reduced and this can lead to the isolation of sub-populations and thereby to in-breeding.</td>
<td>Transport causes noise, dust, airborne pollutants and vibrations etc., which have a detrimental effect on the quality of habitats. It was not possible to assign a monetary value to this loss of quality.</td>
</tr>
</tbody>
</table>


\(^{77}\) Habitat = biotope, living space (explanation according to Oxfords Advanced Dictionary: place where a particular type of animal or plant is normally found).
1.2.7. Noise

Noise is a type of pollution that can be created by many sources – traffic is one of them. Although airplanes and motor vehicles are regarded as the major causes of noise, people who live near a harbour, a railway station or even a rail line feel disturbed. For both, animals and people, noise constitutes a large stress factor. But noise is not only a factor of annoyance, it is also a threat to human being’s life.

Thus, noise has an effect on people’s health in two ways: On the one hand, the auditory canal can be harmed (what leads to impaired hearing or even deafness) by a high noise level. On the other hand, the psychological stress might lead to a heart condition or circulatory diseases.

On behalf of the German Federal Environmental Agency (Umweltbundesamt) a study was carried out by the Robert-Koch-Institut in Berlin in 2003 to examine the consequences of noise on human health. Physical consequences of an average noise level of 55 decibel were examined at 1700 test subjects. The result was that the risk for these people to suffer from high blood pressure is twice as high as for people who are exposed to an average noise level of 50 decibel. The results also showed that good, uninterrupted sleep is only possible if the noise level does not exceed 40 decibel.

Additionally, living near sources of noise may cause avoidance costs like the procurement of noise-reducing windows or the construction of soundproofing walls that will generally not be paid by the people responsible for the noise.

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1.2.8. Reduction of water quality

In this section, dangers to water quality of both – surface water and sources of drinking water – should be summarized. “Both surface water and sources of drinking water are highly susceptible to many types of potential pollutants.”

The quality of drinking water is endangered by acid rain that seeps down into the ground water. Also dangerous liquids running out of damaged trucks due to road accidents may lead to lower water quality when these liquids reach the ground water. The quality of surface water is endangered by adverse effects of oil spills, garbage dumping from ships, hazardous material losses and by ballast water.

In the following, the topic of ballast water will be explained further. It is important for vessels to have a specific weight. If a vessel does not have enough heavy freight on board, a special tank has to be filled with ballast water to guarantee this weight. Hence, more than 40,000 ships registered worldwide carry approximately between three and twelve billion tons of ballast water all over the oceans. Due to estimates, more than 7,000 different animal species (algae, snails, crayfishes, shells or small fishes) are being transported within the ballast water tanks every day. As soon as the vessel has to be loaded, the ballast water has to be pumped out of the ballast water tank. As a consequence of this process, species which are not native in a specific region, like the North Sea Region, for example, are brought into that area. Some of these species die some days after they were pumped out of the ballast water tank, but some survive and endanger the natural balance in that region. And if the ecosystem is thrown off balance, the water quality would decrease.

Another problem that represents a danger to the water quality is the emission of nitrogen oxide. As mentioned before NO\textsubscript{x}-emissions can be put down to traffic.

These NO$_x$-emissions get into the North Sea Region by acid rain. Too much of nitrogen oxide in the North Sea Region is responsible for an excessive production of algae. In general algae are short-living plants, which die and sink to the bottom of the sea. The disposal of these algae at the bottom of the sea is carried out by special bacteria which need oxygen for this process. If there is not enough oxygen available in the North Sea Region, the rotting process begins and fermentation gas (hydrogen sulphide) will be created. Animals living in that area will be poisoned.\textsuperscript{83}

1.2.9. Vibration

Thinking of a truck loaded with heavy goods driving past old buildings that begin to vibrate illustrates best that vibration caused by motor vehicles (esp. trucks) is one responsible factor for damages to real estate. So this list of impacts of traffic (esp. transportation) would not be complete if vibration were not listed on it.

1.2.10. Consequences of traffic: Conclusion

From the discussion above, the reader could see that transportation covers its costs only partly. The external costs caused by emissions, noise or accidents for instance are mostly met by the general public and not by those responsible. 85 “In the interest of fairness under the ‘polluter pays’ principle, the aim is to identify these costs in order to charge them to the parties responsible, thereby internalising them.”86

Aim of the internalization of negative external effects is to make sure that the actual resource-utilization is reflected in the prices for transportation. Consequently, internalization will make the transport system’s user consider external effects when deciding between modes of transport. Therefore, it will raise the costs of all modes of transport, but not to the same extent as we will see later on.87

Despite the increasing costs for transportation, internalization has advantages as well: Some experts are of the opinion that the internalization of external costs will make a contribution towards the technical development of the different means of transport regarding resource-efficient as well as low-emission engines with lower noise-emission. Also, internalization will contribute to the minimization of empty runs due to the higher costs.88

Even though the necessity of this internalization is undisputed, there are some difficulties in doing so:

- There are different opinions about possible processes of internalization
- The amount of money due to external costs can only be estimated\(^9\)

So, the “environmental challenge of the future will be to accurately assess the relationship between industrial benefits and their external societal costs. There will be a growing challenge in the 21\(^{st}\) century to ensure efficient transportation facilities and mobility by maintaining our present system and developing new facilities to meet the growing needs of individuals and organizations.”\(^90\)

So far, due to increasing pressure from environmentalists some legal restrictions were introduced “that help govern the balance between a sound and efficient transportation system and a safe and clean environment.”\(^91\)

Some of these restrictions (measures) are regarded as very useful. The following list provides the reader with an overview of the five suitable measures which are known to minimize the external costs:

1) political measures (e.g. driving bans)
2) fiscal measures (e.g. taxes, road charges)
3) measures concerning regional development planning (e.g. bypasses)
4) logistic-organizational measures (e.g. support of multi-modal transport)
5) technical measures (e.g. particulate filter)\(^92\)

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\(^{90}\) Bardi, Coyle and Novack (2006: 25).
\(^{91}\) Bardi, Coyle and Novack (2006: 25).
\(^{92}\) Cp. Korf et al. (2005: 50-51).
Some of these measures are used in action plans or programmes as well as in the policy of the European Union. This will be discussed in the following part.
1.3. **Intervention of the European Union – attempt to ease the traffic situation in a sustainable way**

In chapter 1.1. and 1.2., the importance of transportation for the development and prosperity of every economy as well as the various negative effects of transportation on the environment, the society and the economy was examined. Even though most of the European citizens feel that the benefits of traffic (esp. transportation) far exceed the negative impacts, something has to be done to ease Europe’s transport and environmental situation. On the basis of the facts that have so far been discussed, one can imagine that the European policymakers are facing a dilemma. On the one hand they have the duty to guarantee a flourishing trade and not to disturb or rather to enhance economic growth. But on the other hand they are responsible to protect European citizen’s health as well as their quality of life.

The following part of this e-learning module focuses on the aim of the European Union, to ease the transport situation in the most sustainable way. In order to be in the position to follow this discussion, as an opening the term ‘sustainability’ should be explained in more detail.

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93 According to Korf et al. there is a natural tension ratio between economy and ecology. Cp. Korf et al. (2005: 50).

94 Since this e-learning module only deals with maritime transport (and only in passing with inland navigation), the focus of the following examination of the EU transport policy, action programmes and action plans will be on the former.
Sustainability

The term ‘sustainability’, although firstly mentioned in the eighteenth century\(^9\), has been redefined during the 1990s; starting point was the conference of the United Nations for environment and development in 1992 in Rio de Janeiro.\(^9\) The idea behind sustainability is the responsible use of limited resources to ensure future developments.

‘Sustainable transport’ can be understood as ‘environmental sustainability’. Basically, sustainability has three dimensions: Society, economy and environment. From this follows that sustainable transport has to be environmentally friendly, economically efficient and socially fair.\(^9\)

\(^9\) Thomas Robert Malthus (British economist; 1766-1834) and William Stanley Jevons (British logician, methodologist and economist; 1835-1882) had already dealt with the subject of sustainability. Malthus predicted that the population growth would exceed the available food production and Jevons thought that Great Britain’s rising coal consumption in the second half of the 19\(^\text{th}\) century would overstretched the known resources and thus have a strong negative impact on the economic growth. Cp. Paehlke (2004: 38).


\(^9\) Over 15,000 delegates from 178 counties participated in the conference. Cp. Wiesmeth (2003: 8). In the following, an extract of the Rio Declaration on Environment and Development is quoted:

“The United Nations Conference on Environment and Development, having met at Rio de Janeiro from 3 to 14 June 1992, reaffirming the Declaration of the United Nations Conference on the Human Environment, adopted at Stockholm on 16 June 1972, and seeking to build upon it, with the goal of establishing a new and equitable global partnership through the creation of new levels of cooperation among States, key sectors of societies and people, working towards international agreements which respect the interests of all and protect the integrity of the global environmental and developmental system, recognizing the integral and interdependent nature of the Earth, our home, proclaims that:

Principle 1: Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.

Principle 3: The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.

Principle 11: States shall enact effective environmental legislation.

Principle 16: National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment.

Principle 27: States and people shall cooperate in good faith and in a spirit of partnership in the fulfilment of the principles embodied in this Declaration and in the further development of international law in the field of sustainable development.” Wiesmeth (2003: 9-11).

\(^9\) Cp. Sutranet.org.
development aims at the satisfaction of today’s generation’s demand without risking that future generations cannot satisfy their demands.\textsuperscript{99} The following illustration provides an overview of transport and its linkages to the sustainability triangle.

**Illustration 9:** Transport and its linkages to the sustainability triangle.


1.3.1. Introduction to the dilemma of EU’s policymakers

The European Union is willing to protect its citizens from decreasing quality of life and damage caused to their health due to environmental pollution. This commitment has been proven for instance in the EC-Treaty (from 1995)\(^{100}\) and by signing the Kyoto-Protocol on the 29\(^{th}\) April 1998.\(^{101}\) \(^{102}\) By signing this framework agreement the EU-15 is obliged to cut down their emissions until 2012 by 8% compared to the level of emissions level of 1990.\(^{103}\)

The European Commission deals with the question how to achieve these aims in its so-called White and Green Papers, which contain proposals and specific measures.\(^{104}\) These books should serve as a basis for the development of a common sustainable transport policy as well as a common sustainable maritime policy, for instance.

The main objective of a transport policy is the creation of conditions that lead to a properly functioning market and at the same time reducing the negative external effects of transport. Hence, a good policy must help transportation to move smoothly as well as to reduce pollutant emissions – within a tight financial budget.\(^{105}\)

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100 According to Art. 130r: Objectives of the European Union’s environmental policy are – among others – preservation and protection of the environment, protection of the European citizen’s health as well as prudent and efficient consumption of resources. Cp. Wiesmeth (2003: 207).

101 “The Kyoto-Protocol is a framework agreement of the United Nations signed by 141 countries, which commits the signatories to cut down their emissions. On the 16\(^{th}\) February 2005 the Kyoto-Protocol came into effect.” Umwelt für Europäer (2005c: 5). Translation Neumann.


103 “Most of the new members of the EU set themselves the same goals with the exception of Poland and Hungary, who want to cut down on their emissions by 6% compared to the level of emissions of 1990. Cyprus and Malta did not set any goals to reduce their emissions.” Umwelt für Europäer (2005a: 7). Translation Neumann. Romania and Bulgaria – the two new member states since the beginning of 2007 didn’t set any goals to reduce their emissions either.


In the search for a way out of this dilemma, the European Commission found a starting point: The recognition that as demand for transport services keeps increasing, the answer to this cannot just be to build new infrastructure (esp. roads). So the base for further consideration was ‘modal disequilibria’.\(^{106}\)

“Despite the considerable success of transport in meeting consumer demand, inadequate integration of modes is denying users of some practical alternatives to current services. Inadequate capacity in some modes is producing congestion and environmental damage, while, in others, underused capacities exist. Inadequate or incomplete networks cause bottlenecks in some areas; in others, they prevent fuller integration of peripheral regions into the single market.”\(^{107}\)

Therefore, the EC’s strategy is to introduce regulations and economic measures to promote environmentally friendly modes of transport with free capacities, like the vessel, without evoking distortions in the competition between the different modes. Consequently, according to the European Commission, bottlenecks could be removed in a sustainable manner.\(^{109}\)

In the following parts, it is sought to present the way in which the EU deals with the above mentioned dilemma in its White and Green Papers by introducing the Paper’s objectives and the specific measures to make transport move smoothly in the most sustainable way.


\(^{107}\) Lowe (2005: 24-25).

\(^{108}\) Reasons why imbalances and inefficiencies have arisen will be outlined in the following chapters.

1.3.2. EU’s White Paper\textsuperscript{110} and its aims

In 2001 the European Commission developed a second “White Paper” that contains Europe’s transport policy until 2010. In this, the main objective “shifting the balance of the modal split in favour of more environmentally friendly means of transport” (the “from Road to Waterway”-idea) was formulated.\textsuperscript{111} To achieve this goal, the White Paper contains almost 60 separate measures (e.g. the extension of the port infrastructure).\textsuperscript{112} Although further explanations concerning the contents and aims of this White Paper – European Transport Policy until 2010 – follow on the next pages, attention should be paid only to a few items. The document “White Paper – European Transport Policy for 2010: Time to Decide”\textsuperscript{113} provides the reader with a deeper understanding of the future European action plans regarding transport policy.

Illustration 10: Port of Hamburg – in the evening.

\begin{center}
\includegraphics[width=\textwidth]{port_of_hamburg.jpg}
\end{center}

Source: Neumann.

\textsuperscript{110} Only the latest released White Paper will be examined. “The first White Paper in 1992 put the main focus on opening up the traffic market and to develop a common traffic policy.” Europa.eu/White Paper.

\textsuperscript{111} Although these plans have existed since the early 1990s. Cp. Klotz (2005: 3).


\textsuperscript{113} Download: 
The European Commission reviewed in its White Paper – among others – the problems which arose by the relatively unchecked growth of road transport (e.g. traffic congestion, road transport as the largest polluter of the environment as well as its impact on the European citizen’s health, the dangers to the aim of meeting the sustainability objectives set in the Kyoto Protocol and other international agreements\textsuperscript{114}).\textsuperscript{115}

After a closer examination of the latter, the European Commission elaborated on a few objectives to meet the overall aim: “Integrating transport into sustainable development”\textsuperscript{116}.

The formulated objectives are for example to decouple transport from economic growth “without restricting mobility, by making more efficient use of means of transport”\textsuperscript{117}, to place the users at the heart of the transport policy as well as to remove bottlenecks and to reduce the market share of each mode of transport to the level of 1998\textsuperscript{118} by the year 2010 “in order to achieve a re-balancing between the modes”\textsuperscript{119} in favour of more environmentally friendly modes of transport than road haulage.\textsuperscript{120}

The European Commission highlighted three environmentally acceptable modes that are under-utilized and have therefore spare capacities to achieve a considerable shift from roads: Railways, inland navigation and shortsea shipping.\textsuperscript{121}

\textsuperscript{114} Rothengatter (2003: 316, 321).


\textsuperscript{116} European Commission (2001: 8).

\textsuperscript{117} European Commission (2001: 11).

\textsuperscript{118} Freight transport: Road transport 44\%, maritime shipping 41\%, rail transport 8\%, inland navigation 4\%, others 3\%. Cp. Frerich and Müller (2004: 287ff.).

\textsuperscript{119} Rowlinson and Wixey (2005: 261ff.).


In inland/maritime or shortsea shipping, infrastructure costs as well as external costs (with the exception of sulphur dioxide and nitrogen emissions) are considered as relatively low.\textsuperscript{122}

Also, shipping is regarded as being fuel efficient (there is quite a contrast in energy efficiency in tkm between road and water transport) and contributes to a reduction in road congestion. And according to the White Paper, the European Union has about 35,000 km of coastline, 25,000 km of navigable waterways as well as hundreds of sea and river ports. Therefore a modal shift “from Road to Waterway” would seem the obvious thing to do.\textsuperscript{123, 124}

But according to Lowe a modal shift is not as easy as it may seem: “As we have seen over so many years, commercial demand favours road haulage [due to its above mentioned flexibility] to the point where more than 80\% of all freight moved in the UK goes by road, and a broadly similar situation applies in Europe. There are so many reasons for this, not least the past inabilities and failures of the railways to provide the flexibility and levels of service…required to meet the demands of a sophisticated consumer-driven, Just-in-Time society.”\textsuperscript{125} And with regard to the costs, shipment by waterway is not always competitive with road transport: “The economies of scale derived from the larger tonnage movements by sea can easily be eroded by handling and transshipment costs. The road haulage has…an aggressive entrepreneurial stance.”\textsuperscript{126} However, concerning speed and flexibility many shippers have reservations about maritime or inland transportation.


\textsuperscript{124} Even though, the risks of possible consequences of maritime accidents must be minimized and therefore the White Paper insists on double-hull oil tankers for instance. Cp. Rowlinson and Wixey (2005: 261ff.).

\textsuperscript{125} Lowe (2005: 110).

\textsuperscript{126} Rowlinson and Wixey (2005: 261ff.).
Therefore the European Commission proposed measures and policies which help modernising services of the three environmentally acceptable modes mentioned above and which help charging transport effectively\textsuperscript{127}. And in the White Paper the European Commission established measures to facilitate intermodality\textsuperscript{128} (for long-distance freight) which combines the respective merits of road, rail and water transport to an operationally acceptable alternative and thus contribute to more efficient use of all modes.\textsuperscript{129} In order to do the latter “…the White Paper goes on to examine the way in which the various modes may be linked. It especially identifies the need for integration between sea, inland waterway, and rail where it notes there is a big missing link.”

For this reason the European Commission developed some initiatives, action plans and programmes like the extension-plan of the TEN-T, the “Motorways of the Sea”-initiative or the Marco Polo Programme (both will be further explained in chapter two) to help financing port infrastructure for example.

\textsuperscript{127} Due to the comparatively low costs for road transport as a result of not applying the ‘polluter-pays’ principle, the competition between the modes is being distorted.

\textsuperscript{128} Repeatedly the intermodal and the combined transport were mentioned in the White Paper as possibilities to make the modal shift easier. In chapter two, intermodal transport will be further examined.

Intermodal transport means that goods stay in one transport unit (container, inter-changeable container, truck or trailer etc.) during the whole transport chain (involved in this chain are at least two transport modes \(\rightarrow\) multimodal transport). A transshipment of the goods does not happen.

Combined transport means intermodal transport by truck only for pre- and on-carriage (should be kept as short as possible), main haul (the longer distance) takes vessel or rail. Cp. Walter (2005: 457ff.).

1.3.3. EU’s Green Paper\textsuperscript{130} and its aims

Concerning the contents and aims of the Green Paper on a Future Maritime Policy (published 07.06.2006), attention should be paid only to a few items. The document “\textit{Green Paper – Towards a future Maritime Policy for the Union: A European vision for the oceans and seas}”\textsuperscript{131} provides the reader with a deeper understanding of the future European action plans regarding maritime policy.

\textbf{Illustration 11:} North Sea near Friedrichskoog.

\textsuperscript{130} Only the latest released Green Paper should be examined. Another Green Paper that might be of interest for the reader is the Green Paper on Seaports and Maritime Infrastructure (released in 1997).

\textsuperscript{131} Download: \url{http://ec.europa.eu/maritimeaffairs/pdf/com_2006_0275_en_part2.pdf}
The Green Paper on a Future Maritime Policy 2006 was developed by the European Commission to constitute a first step towards an extensive future Maritime Policy for the European Union. The development of the Green Paper became necessary because one of the European Commission’s strategic aims for the years 2005-2009 was to draw up an extensive Maritime Policy which directs at the further development of the flourishing maritime economy in a sustainable manner. It was realized that the European Union “needs to look at the oceans and seas in an integrated manner, if Europe is to maintain its resource base and to continue being competitive in maritime affairs” 132.

The Green Paper “addresses a very broad range of what has traditionally been regarded as separate activities and policy areas. The idea of conducting an integrated analysis of maritime activities leading to coordinated actions is new” 133. Until the development of the Green Paper the different policies in the fields of industry, coastal regions, maritime traffic, offshore-energy, fishing and maritime environment as well as economical and social cohesion were established separately due to the fact that no one felt responsible to analyse the interdependencies between the several measures. But in 2004 the European Commission started to examine how to unite all these elements to establish a new Vision for the oceans and seas and an integral way of viewing maritime issues. It is not quite clear where the Green Paper draws the limits. “And that is not surprising as maritime and marine affairs are, by their very nature, global with multifaceted effects.” 134

As part of the EU-Policy for a sustainable development the Green Paper aims at making a contribution towards the protection of the oceans and seas as well

132 Europa.eu/Maritimeaffairs.
133 Europa.eu/Maritimeaffairs.
as a contribution towards economic growth and employment in the maritime sector.\textsuperscript{135}

The Green Paper is put up for discussion between stakeholders at all decision-making levels from 7 June 2006 until 30 June 2007. It is an objective of the European Commission to consult with stakeholders the recommendations of the Green Paper, to discuss possible obstacles and challenges and to identify gaps. Due to this, the Commission supports and organizes a lot of workshops and meetings to get contributions and ideas from the invited stakeholders so that the future Maritime Policy covers the requirements from all parties involved in the maritime sector. In the Green Paper it is emphasized that the European Union will only take action in maritime policy if the national or regional measures are insufficient or could be provided with added value by EU measures.\textsuperscript{136}

The Green Paper mainly focuses on five topics (will be briefly explained in the following):\textsuperscript{137}

a) Maintaining the leadership of the European Union in sustainable maritime development

b) Increasing the quality of life for citizens living in coastal regions
c) Identifying and providing tools to associate with the oceans
d) Maritime governance
e) Enhancing the European maritime heritage and consolidating the European maritime identity


1.3.3.1. Maintaining the leadership of the EU in sustainable maritime development

In the second chapter of the Green Paper the European Commission emphasizes that innovative products serve as a basis for the growth of the maritime economy; which is even more important in the age of globalization. A strategy for the establishment of an extensive Maritime Policy in a sustainable manner is regarded as very significant. The European Commission also analyzes what actions could be done to counteract the development that a decreasing number of Europeans decide to work in the maritime economy. Clustering as an integrated concept of the private sector is regarded as a good concept and will be facilitated by the future Maritime Policy.

1.3.3.2. Increasing the quality of life for citizens living in coastal regions

The Green Paper gives in its third chapter a broad outline of the fact that a healthy maritime environment is of particular importance for a constantly increasing number of European citizens living in coastal areas. The essential factors that represent threats to coasts and citizens (see chapter 1.2. in this e-learning module) and how to handle these threats are explained.

1.3.3.3. Identifying and providing tools to associate with the oceans

In the fourth chapter the European Commission stresses the need of an extensive EU network of maritime data and the further integration and development of networks to identify vessel movement in EU coastal waters. This especially is of importance in case of accidents.

Additionally, in this chapter the European Commission places emphasis on the significant part of European funds (esp. the cohesion fund and the structure fund) to support the development of coastal regions.

1.3.3.4. Maritime governance\textsuperscript{141}

In the fifth chapter of the Green Paper it is mentioned that there is an urgent need for an integrated Maritime Policy according to the principle of subsidiarity\textsuperscript{142}.

The European Commission points out that the various offshore activities of the member states in coastal waters are hardly integrated and that common activity would offer advantages. Especially cooperation in the field of ocean and sea surveillance is regarded reasonable. Due to the increase in committed offences (incl. the smuggling of human beings and terrorism as well as water pollution due to the illegal washing of oil tanks) a better coordination of existing national resources and activities is recommended. The establishment of a common EU coastguard service instead of many national coastguards that do not communicate to a sufficient extent is suggested.

And according to the Green Paper, it would be easier to work on issues concerning climate change, fishing and shipping if there are international agreements. It is mentioned that a future Maritime Policy will take the diverse needs of the different member states into account.

\textsuperscript{141} Cp. European Commission (2006b: 4-5).

\textsuperscript{142} “When responsibilities are shared, the guiding principle behind the division between the political levels is that of subsidiarity. This means that the highest political level only acts insofar as the objectives of the action proposed cannot be sufficient achieved down the line.” Vrenken, Macharis and Wolters (2005: 224).
1.3.3.5. Enhancing the European maritime heritage and consolidating the European maritime identity\textsuperscript{143}

The sixth chapter examines how education can contribute to making people identify with their European maritime heritage. This would facilitate an environmentally friendly behaviour with regard to the oceans and seas. A straight answer is not found.

\textsuperscript{143} Cp. European Commission (2006b: 5).
1.3.3.6. Green Paper: Conclusions

Nevertheless, even if the Green Paper provides some good ideas and stimulations for future Maritime Policy, there are also critical voices:

“Again, a clear delineation and hierarchy is lacking in the Green Paper, which will pose an extra hurdle for a structured discussion with member states. The Green Paper is an admirable attempt to define a European Maritime Policy Framework. However, the lack of clear system boundaries, the structural lack of data on maritime and marine affairs, as well the absence of a policy hierarchy and the complex links with other international and EU policy domains, does not facilitate the task of making a constructive contribution to the discussion.”144

2. Modal shift “from Road to Waterway” – one aim of the European Union to relieve the environment

Since in Europe, roads are clogged with trucks carrying containers, there is a mounting pressure on the European Union to provide solutions in order to enable an undisturbed transport flow and therewith prevent Europe from a decrease in competitiveness. Due to the lack of environmental friendliness of trucks in comparison to other modes of transport, the extension of the road infrastructure does not always seem to be a good option. Hence, the European Union formulated in its White Paper policy the aim to divert distribution of containers from land to a waterborne option.\footnote{Cp. United Nations (2001: 33).}

In the first part of this chapter, a comparison of the transport modes will give an understanding why the European Union regards maritime transport as being a reasonable alternative to road transport. Afterwards the reader will be provided with an overview of how the “from Road to Waterway”-objective will be pursued. Especially, because \( \frac{3}{4} \) of the surface of the earth is covered with water, it seems a common thought to make use of these opportunities.\footnote{Cp. Korf et al. (2005: 432).}

“How inappropriate to call this planet Earth when it is quite clearly Ocean.”\footnote{Attributed to Arthur C. Clarke.}

Illustration 12: Oslofjord.

Source: Neumann.

\footnote{Cp. United Nations (2001: 33).}
\footnote{Cp. Korf et al. (2005: 432).}
\footnote{Attributed to Arthur C. Clarke.}
2.1. **Comparison of the various transport modes with regard to their environmental impact**

When taking all means of transportation together, transport creates approximately 25% of all CO\textsubscript{2}-emissions worldwide. These 25% break down into 75% generated by road vehicles\textsuperscript{148}, 12% by air transport, 7% by maritime transport and 6% created by other modes.\textsuperscript{149} As mentioned in chapter 1.2. CO\textsubscript{2}-emissions are responsible for a myriad of threats to the human health as well as for environmental damages (e.g. the effect of global warming). The following table provides an overview of other harmful emissions generated by modes of transport.

**Table 3:** Polluting emissions\textsuperscript{150} generated by road, rail or sea transport (grams for tkm).

<table>
<thead>
<tr>
<th>Polluting emission</th>
<th>Road</th>
<th>Rail</th>
<th>Sea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon monoxide CO</td>
<td>0.5</td>
<td>0.2</td>
<td>0.04</td>
</tr>
<tr>
<td>Carbon dioxide CO\textsubscript{2}</td>
<td>98</td>
<td>28</td>
<td>15</td>
</tr>
<tr>
<td>Hydrocarbon HC</td>
<td>0.2</td>
<td>0.1</td>
<td>0.01</td>
</tr>
<tr>
<td>Nitrogen oxide NO\textsubscript{x}</td>
<td>1</td>
<td>0.5</td>
<td>0.3</td>
</tr>
<tr>
<td>Sulphur dioxide SO\textsubscript{2}</td>
<td>0.03</td>
<td>0.04</td>
<td>0.3</td>
</tr>
<tr>
<td>Particulates</td>
<td>0.08</td>
<td>0.03</td>
<td>0.006</td>
</tr>
</tbody>
</table>


Maritime transport, including short-sea shipping is generally considered to be environmentally friendly and contains several competitive advantages over other modes of transportation. Waterborne transport generates decisively less emissions than other ways of transport, with the exception of sulphur dioxide. Furthermore, fuel consumption is far less with vessel transport.\textsuperscript{151}

\textsuperscript{148} Although the road transport sector improved its emission standards since the 1980s through stringent regulation of exhaust emissions value, road transport is still responsible for the highest CO\textsubscript{2}-emission per tkm. Cp. European Commission (2006c: 13).


Moreover, a shift from road to water transport would go in line with the European Union’s commitment to cut down CO$_2$-emissions as stated in the Kyoto-Protocol.

There are several tools available in the internet for calculating energy resource consumption and emissions generated by the different modes of transport on individually chosen routes. Using the following hyperlinks, two exemplary tools can be found:

http://www.ecotransit.org
http://www.ntm.a.se/ntmcalc/Main.asp

The users of ecotransit for instance could directly choose two cities, one being the origin and the other being the destination for the desired freight transport. Also, the weight of the cargo as well as some technical details of the means of transport (e.g. train type: long train, short train) can be chosen.

The use of the tool ‘ecotransit.org’ shall be demonstrated by the following example which shows that the vessel in most cases is the better choice for transporting goods:
Assuming that 14 tons of cargo shall be moved from Rotterdam (origin) to Aalborg (destination), the vessel consumes far less resources than the truck or the train. The same applies for emissions – with the exemption of sulphur dioxide.
Calculation of the environmental effects when transporting goods by the use of Ecotransit.org

14 tons cargo

Rotterdam                       Aalborg
(Origin)                       (Destination)

935.37 km

Further assumptions for calculation:
Truck weight type: 40 tons; emission class: EURO 2
Train type: long train; energy type: electrified
The inland vessel has not been taken into previous considerations. Even though the main focus is on maritime transport, for the sake of completeness inland navigation’s effect on the environment will be briefly included here. Buoyancy forces and the Water’s current are responsible for the lower energy consumption\textsuperscript{152} of the inland vessel compared to other transport modes. In some cases, it is even lower than the sea vessel. This results in relatively low freight rates and makes the transport of bulk commodities by inland vessel an attractive alternative. Furthermore, the creation of emissions and noise are very low and according to accident statistics, inland navigation is considered to be very safe.\textsuperscript{153} But the disadvantages like long transport times and its dependence on the weather (ice drift, high tides, low tides) represent a threat to a reliable delivery.\textsuperscript{154} Furthermore, one of the most distinctive characteristics of inland navigation vessels – their long life-time – is regarded as increasingly problematic. As the ageing process of Europe’s inland navigation fleet continues, the environmentally friendly performance of inland navigation vehicles is being more and more challenged. For instance approximately half of the Dutch fleet was put into service before 1960 and most of the engines in use in 2005 were built before 1980. Nearly the same applies to the other European countries likewise in Germany: the dry cargo fleet’s average age in 2004 was about 50 years and for tank vessels about 30 years. However, if inland navigation wants to keep up with modern and environmentally sound inventions, it has to invest in low-emission fuels and engine techniques and ship owners have to change propulsion engines and other components of the

\textsuperscript{152} Energy or fuel consumption is directly linked to the emission of carbon dioxide, sulphur dioxide and nitrogen oxides. Cp. European Commission (2006c: 13).

\textsuperscript{153} In 2005, inland navigation was responsible for the shipment of about 80% of all dangerous goods being transported in Europe. Cp. European Commission (2006c: 13).

vessel’s system not only when such a substitution is commercially feasible as well as economically justifiable.\footnote{Cp. European Commission (2006c: 12-15).} \footnote{One specific example is the leakage of oil and grease (bilge water). Although modern propeller shaft seals that are completely water tight are available, about 70\% of the European barges still have seals that leak water into the bilge because ship owners do not invest into new equipment if it does not seem to be necessary. Cp. European Commission (2006c: 15).}

Since for the transport from consignor to consignee the so-called ‘last mile’ in most cases cannot be done via vessels, a supply chain needs to be established. If the cargo stays in one and the same transport unit while changing modes and only the unit is being transshipped but not the goods itself are being reloaded, this concept is named intermodal transport. In general, savings in CO$_2$-emissions realized by intermodal transport can be put down to the facts that smaller-sized consignments are being consolidated into larger freight volumes that can be moved with less energy consumption per unit and that a more environmentally friendly alternative to simple road transport is being used. Therefore, intermodal transport is beneficial in reducing the negative effects of the transport system on the environment.\footnote{Cp. Vrenken, Macharis and Wolters (2005: 5).} \footnote{Cp. Lowe (2005: 118).}
2.2. Intermodal transport chains – the way to achieve a shift from roads to environmentally acceptable means of transport

Intermodal transport is the generic term for the movement of goods whereby successively at least two different modes of transport are being used. During the entire transport chain, the consignment stays in one and the same loading unit or vehicle without handling the goods\(^{159}\) in changing modes of transport. A combined transport in this relation means intermodal transport where during the major part of the distance (main haul), the loading unit is being transported by vessel (inland navigation as well as sea) or rail and any initial or final leg, carried out by truck should be kept as short as possible. The most characteristic feature of intermodalism is the use of standardised loading units that could be carried by truck and rail as well as by vessel.\(^{160}\) Since these standard loading units are of vital importance for intermodal transport, chapter 2.2.2. exclusively deals with these units.

Intermodal transport aims at achieving a shift from roads to railways and/or sea or waterways. The reason for a growing focus on intermodal transport is the increased traffic in all singular modes of transport, which often reaches a shortage in capacity. Without any changes to general conditions an intensification of present problems will be inevitable. Arising bottlenecks, especially in economic conurbations of the European Union, cannot be eliminated by the extension of road infrastructure alone. By combining two or more modes of transport such bottlenecks can be avoided. Quite often economic and ecologic advantages result from intermodal transport.\(^{161}\) Because of the use of other more environmentally acceptable modes of transport in the transport chain than road transportation alone, intermodal transport creates

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\(^{159}\) A handling of the goods in changing the transport mode would be called “broken transport”. Cp. Schulz (2003: 55-56).


benefits like reduced consumption of carbon fuels, less exhaust emissions as well as less road congestion. These represent reasons why intermodalism seems to be so appealing to the makers of transport policy. The promotion of intermodal transport is a soft modal shift instrument and therefore the policy of promoting intermodal transport is broadly applied in the European Union. An effective policy to promote intermodal transport must create awareness for its advantages and disadvantages among potential customers, who have so far mainly used European roads.\footnote{Cp. Lowe (2005: 1-2) and Vrenken, Macharis and Wolters (2005: 240)}

The following chapter will provide a deeper insight into intermodal transport.
2.2.1. Further explanation of intermodalism

Intermodal combinations often offer specialised and cheaper services that cannot be realised by single modes of transport. Their intention is to achieve operationally efficient and cost-effective freight delivery in an environmentally sustainable way from consignor to consignee and thus utilize the comparative advantages of the different modes of transport to optimise the transport chain altogether.\(^\text{163}\)

Per definition, intermodal transport involves two or more suitable modes. Therefore, at least two transshipment processes are required. Since nearly all goods being transported begin and end their journey on the back of a truck (pre- and on-carriage), intermodalism principally describes the use of an alternative mode to carry out the main haul of the journey. Usually, the intermodal loading unit must be transshipped from a truck at a railhead or a port terminal for being transported by rail or vessel for the main haul and afterwards, the loading unit must be transshipped back again onto a truck for the on-carriage to the consignee. If there is a missing direct connection between the consignor/consignee and the rail, inland navigation or sea transport system, the road element for collecting or delivering the goods is inevitable. Transshipment processes represent additional cost factors that arise independently from the transport distance and do not accrue on direct road transport. Besides the supplementary costs, the transshipment process needs additional time as well. And occasionally, extended transport distances result from intermodal transport since often roads are the direct connection between loading and unloading point. For this reason intermodalism’s cost-effectiveness starts beyond a minimum transport distance of 300 km. And a particular strength of trains and vessels is their ability to ship large amounts of freight over great distances at relatively low cost.\(^\text{164}\)


But frequently, other considerations than additional costs, time for transshipment or extended transport distances are decisive for the choice of mode. These determining factors are for instance operational practicalities like the availability of special handling facilities as well as the ability to meet particular requirements of freight. According to the nature or the volume of freight it might be appropriate to choose an alternative to single road transport (e.g. inland navigation or shortsea shipping for unwieldy or large amounts of goods). Additionally, security considerations (e.g. inland navigation for dangerous goods), the need to follow corporate environmental policies or to ease a shipper’s social conscience may represent determining factors as well. Regarding the factor ‘time’, not only the time for transshipment needs to be taken into consideration. Sometimes, the whole time of delivery will be extended if using intermodal transport. This derives from less frequent services in railway transport, shortsea shipping or inland navigation or occasionally it simply is the result of a vessel’s slow movement for instance.\(^{165}\)

In the following, actions taken by the European Union to make shortsea shipping as attractive as road transport will be outlined.

2.2.2. Intermodal loading units

Intermodal transport involves the use of at least two modes of transport for the movement of freight from place of consignment to destination while the goods stay in one transport unit during the whole transport chain without being transshipped.\footnote{Cp. Bardi, Coyle and Novack (2006: 211) and Walter (2005: 457ff.).} These transport or loading units are for instance trailers, interchangeable units, or containers – the so-called ‘boxes’. Standardised loading units raise efficiency in handling cargo by making it possible to handle heterogeneous pieces of freight like homogeneous freight when a combination of small consignments is being consolidated into a container.\footnote{Cp. Korf et al. (2005: 609), Schulz (2003: 55-56) and Lowe (2005: 6).}

This concept has the advantage that it saves transshipment and repacking time as well as costs for the latter, and provides higher security against theft for the shipment in transit as well as a reduced risk of being damaged.\footnote{Cp. Lowe (2005: 6) and Bichler, Krohn and Philippi (2005: 33-34).}

Through the development of a standard container that could be interchanged between different modes of transport, intermodalism has been made possible. The ISO\footnote{ISO: International Organization for Standardization. This organisation was established in 1926 and is responsible for the elaboration and introduction of standards which are for instance, standard dimensions, strength parameters or standards for transshipment handling systems. Cp. Bichler, Krohn and Philippi (2005: 86) and Vrenken, Macharis and Wolters (2005: 120).} container is one of the most frequently used intermodal loading units.
The success story of this loading unit has its origins in the invention of the first shipping container – a 30 feet aluminium box that could be stacked two high on barges – designed by Malcolm McLean, a successful truck line owner. His vision was to develop a concept to move freight both highway and waterway without repacking the goods. This was in 1949. Several years later, in 1956, 58 of the further developed aluminium truck bodies were transported aboard the IDEAL-X, an aging tanker ship, from New Jersey to Houston where 58 trucks waited to carry these boxes to their destinations. The increasing volume of freight movements put a lot of pressure on ports and transport operators to optimise their processes in order to reduce the lay days of vessels and enable a handling of higher freight volumes without extending the port infrastructure at that time. This development was of prime importance for the introduction of the standard container.  

Illustration 13: Container site in the port of Hamburg.

Source: Neumann.

Since then, the further developed ISO container – which is basically a big lockable steel box into which freight is loaded – has a proper place in transportation. In mid-2005, 21,074,978 TEU were in use and over 90% of these were built in China.\footnote{Cp. Kummerow (2005: 136) and Foxcroft, Fossey, Evers and Hall (2006: 6).}

In general, ISO maritime containers, which have to be strong enough to be stacked aboard on a container vessel as well as ashore, come in two standard lengths: 20 feet and 40 feet. The following table provides an overview of their dimensions.

Table 4: Dimensions of ISO containers.

<table>
<thead>
<tr>
<th>20 feet</th>
<th>40 feet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TEU = Twenty Feet Equivalent Unit</strong></td>
<td><strong>FEU = Fourty Feet Equivalent Unit</strong></td>
</tr>
<tr>
<td>Outside length: 6.096 m</td>
<td>Outside length: 12.190 m</td>
</tr>
<tr>
<td>Outside width: 2.438 m</td>
<td>Outside Width: 2.438 m</td>
</tr>
<tr>
<td>Outside height: various\footnote{In the period after the introduction of the maritime container, it was only available in two different heights: 8 feet (2.440 m) or 8.5 feet (2.590 m). This can be put down to the fact that it was impossible for trucks to drive through the tunnels on access roads to the port of New York loaded with containers higher than 8.5 feet. Since then, other container heights like 8.6 feet are available as well. Cp. Witthöft (2004: 108-109) and Globalsecurity.org.}</td>
<td>Outside height: various\footnote{Cp. Bardi, Coyle and Novack (2006: 214).}</td>
</tr>
</tbody>
</table>


The transport capacity of container vessels is either quoted on a TEU or a FEU basis.\footnote{Cp. Bardi, Coyle and Novack (2006: 214).}

Within these standard dimensions, different models are available to meet the specific requirements of the freight (e.g. temperature or pressure control as well as tank containers for liquids).\footnote{Cp. Vrenken, Macharis and Wolters (2005: 120).}
Additionally, in 1996 a container of 45 feet (13.72 m) length was introduced under the overall control of the Danish shipping company A.P. Möller-Maersk. Transshipment of such containers is just as expensive as the transshipment of 40 feet containers while increasing the freight volume by 10\%.\textsuperscript{175}

But the chassis needed for the road transport of these 45 feet containers is 7 cm longer than allowed by an EU guideline (96/53, guideline for the determination of maximum size and weight of road vehicles, issued 1996\textsuperscript{176}), with the maximum length allowed being 13.65 m. Due to heavy protests, the European Commission declared that 45 feet containers were allowed to be transported on road in 1996. There was a 10 year interim period for those container transports to be allowed on road. After this interim period ended at the end of 2006, European Commission’s Vice President Jaques Barrot confirmed, that 45 feet containers will not yet be banned from road transport.\textsuperscript{177}

Apart from the international 45 feet container there is a European 45 feet container measuring an outer width of 2550 mm and an inner width of 2448 mm. Its corners are rounded and it equals the measurements of European trailers, thus bearing 33 pallets. This container fulfils all European legal requirements, is planned for standardisation by the CEN TC 119 and is intended to become the new European Intermodal Loading Unit (ILU).

In April 2003 the European Commission published a proposal for regulations on Intermodal Loading Units as a means to promote shortsea shipping. The proposal’s purpose is to reduce the variety of ILUs and to simplify their handling, thus increasing the efficiency of transshipment operations. Moreover, according to the proposal, safety would be ensured and risks to people and

\textsuperscript{175} Cp. Seidelmann (2006: 8).

\textsuperscript{176} The reason for the introduction of this EU guideline was that politicians were monitoring infrastructure and did not want to get involved into vehicles that would have required intensive adjustments of infrastructure. Cp. Seidelmann (2006: 8).

goods be minimised if ILUs were of a uniform design and as long as such equipment is being maintained and inspected on a regular basis.\textsuperscript{178}

Concerning the inside width of the ISO containers, it is regarded disadvantageous that dimensions permit to stow two standard Euro-pallets sideways within. Nevertheless, few suppliers already have pallet-wide containers within the ISO exterior dimensions in their product range, due to the fact that in this line of business nearly everyone is keen on optimising intermodal loading units to make transportation more and more economic.\textsuperscript{179}

In the following, it is sought to give the reader an idea about how containers are unloaded from a container vessel and are transferred to trucks.


Illustration 14: ISO container being unloaded from a container vessel by crane in the port of Hamburg.

Source: Neumann.
Illustration 15: Two ‘boxes’ being lifted from a vessel in the port of Hamburg.

Source: Neumann.
Illustration 16: ‘Boxes’ being carried by so-called Van Carriers.

Source: Neumann.
Illustration 17: Trucks waiting for being loaded with ISO containers for the on-carriage.

Source: Neumann.
2.2.3. Challenges of intermodal transport

Since this e-learning module mainly focuses on maritime transport, in the following only the challenges of intermodal transport regarding sea transport will be considered. Especially the challenges at transshipment junctions\footnote{Transshipment at railheads or in transport and logistics centres will not be taken into account. Only ports will be mentioned.} will be looked at.

Because the costs for the transshipments at pre-, main-, and end-haulage typically add up to more than 50\% of door-to-door transport costs, an intermodal supply chain’s competitiveness mainly depends on the operational efficiency of the ports\footnote{A port “is an intermodal junction in the transportation network, where cargo and/or passengers change modes of transportation (e.g. from a ship to an inland transport mode and vice versa).” Talley (2006: 44).}.\footnote{“A port is also an economic unit that provides a (transfer) service as opposed to producing a physical product. The amount of this transfer service is referred to as the port’s throughput… Users of port services are those that utilize the port as part of the transportation process of moving cargo to and from origin to destination locations.” Cullinane and Talley (2006: 1).} The efficiency with which ports process freight has become more and more important as poorly-performing ports can substantially reduce trade volumes and consequently reduce the attractiveness of intermodal transport. Many factors contribute to port efficiency. These are for instance labour relations, the time to clear customs and transshipment facilities as well as harbour characteristics like channel depth and ocean/tidal movements. Also, the performance of ports depends very much on the hinterland\footnote{Cp. European Commission (2006c: 28).} connection (port access, road, rail and/or inland waterway connection to the traffic network – the goods have to be transported into and out of the ports), the port (esp. transshipment) facilities and the maritime services itself.\footnote{Hinterland means the inland territory behind a port. Cp. Biebig, Althof and Wagener (2004: 290).}
Admittedly, there have to be some improvements in maritime traffic in order to make the vessel a good alternative to the truck. Thus some container ports are regarded as a ‘bottleneck’ because their capacities are nearly utilized and the big container vessels have to lie in queue for some days until they can be unloaded. The additional charge has to be put through to the shipper, which restricts the competitiveness in comparison to the truck. This and resulting delays in delivery have made shippers choose the truck for transportation. In Europe, the Drewry Shipping Consultants identified Antwerp and Rotterdam as the ports with the most serious bottlenecks.\textsuperscript{186} \textsuperscript{187}

Possible solutions are for example the extension of transshipment facilities and rerouting of maritime services to smaller regional ports where construction work would be due as well (improvement of the infrastructure to and from the port site as well as the port facilities, extension of the depth etc.).\textsuperscript{188}

In order to provide help in improving the attractiveness of intermodal transport, the European Union established different projects and initiatives. Some of these will be presented in chapter 2.4.

\textsuperscript{186} Cp. DVZ (2005a: 8) and Internationales Verkehrswesen (2005: 186).

\textsuperscript{187} In Rotterdam for instance inland navigation vessels sometimes have to wait 30 hours for transshipment. Cp. Zapp (2005: 390).

\textsuperscript{188} Cp. DVZ (2005b: 1).
2.3. Key performance indicators: What clients do expect from transport services and what could make them chose an alternative to road transport

Depending on the Incoterms\textsuperscript{189}, in most cases the shipper has an influence on the decision about single modes of transport or entire logistics chains.\textsuperscript{190} There are many criteria that influence the way of how the shipper’s goods are being transported which are listed in the following illustration. Nevertheless, the main interest of the shipper is that the cargo shall be moved in a way that goes well with their production or distribution needs at an appropriate price. Even though this means that the shippers have the power to decide on the mode of transport, many of them do not want to exercise that power because shippers who have outsourced transport services often leave the modal choice to their transport service provider as well.\textsuperscript{191}

\textsuperscript{189} International Commercial Terms.

\textsuperscript{190} Even though the buyer of the goods – the payer of the transport service when the treaty is based on the Incoterm ‘ex works’ or ‘free on board’ – in about 70\% of all cases, the shipper had an influence on the decision of mode of transport. Cp. Pawlik (1999: 102).

\textsuperscript{191} According to some experts, it is implied that logistics service providers who own physical transport assets try to increase their return on investment by optimising the use of their facilities, vehicles and personnel in the first place. Cp. Vrenken, Macharis and Wolters (2005: 53ff.).

Furthermore, referring to common belief, employees in the logistics sector (especially in small and medium-sized enterprises) are often specialised in only one field of the sector and lack the awareness of different modes of transport. Cp. ZLU et al. (2003: 2ff.).

Among all attempts to shift the balance between the modes, there are two very important aspects the European Commission takes into consideration. The first one is the requirement of specific competences employees in the logistics sector must have to organise an intermodal transport chain. The second one is that employees need a special awareness of environmental concerns. Thus, the source to finding an optimal transport solution concerning the transport costs and the environment is well-trained employees, since they make the final decision. Therefore, the European Commission established the job description of the Freight Integrator that was first mentioned in its White Paper. Cp. DVZ (2003: 4) and ZLU (2003: 2ff.). The following excursus provides the reader with more information about the Freight Integrator concept:

- Freight Integrator at a glance (Appendix 1)
But due to a company’s philosophy of being especially environmentally aware like IKEA for instance, some shippers may express preferences regarding particular logistics solutions or are in favour of intermodal transport. However, for the majority of shippers it is simply of particular importance to obtain the best value for their money and thus they are eager to consider all options or alternatives and are open to change, if this will bring any improvements. Therefore, the logistics partners of the shippers have the opportunity to suggest innovative logistics solutions that are designed to either cut costs or enhance performance or both. Furthermore, besides getting the best value for money, customers in most cases prefer one central commercial contact because it facilitates transport matters a lot. This one central commercial contact is called a ‘one stop shop’. One stop shops are being entrusted with the task of organising the whole transport chain from origin to destination and hold a complete overview of the whole transport process. In order to obtain information and intervene at all stages in the transport process if the need arises, one stop shops have the special skills and resources required.\(^\text{192}\)

\(^{192}\) Cp. Vrenken, Macharis and Wolters (2005: 49 and 53ff.).
Illustration 18: Main performance indicators – what could be important to customers of transport services.

Source: Own illustration according to Zachcial (2001: 28).
Table 5: Brief explanation of the main performance indicators.

<table>
<thead>
<tr>
<th>Costs</th>
<th>Costs and additional costs of the whole transport.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer service</td>
<td>Advice for and looking after the client.</td>
</tr>
<tr>
<td>Door-to-door service</td>
<td>Movement of goods from the “door” of the consignor to the “door” of the consignee.</td>
</tr>
<tr>
<td>Environmental impact</td>
<td>Impact of the way the cargo is being transported on the environment. E.g. road transport has a greater negative effect on the environment than waterborne transport with regard to CO$_2$-emissions.</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Way in which the transport services could be designed to meet the specific demands of a customer.</td>
</tr>
<tr>
<td>Frequency of departure</td>
<td>The amount of opportunities to send off cargo; also waiting time for next transport going off.</td>
</tr>
<tr>
<td>Frequency of transshipments</td>
<td>Speed of handling of goods when changing transport modes.</td>
</tr>
<tr>
<td>Information flow</td>
<td>Speed and accuracy of the forwarding of data concerning the transport and the transport chain.</td>
</tr>
<tr>
<td>Kind of goods</td>
<td>Perishable, delicate, dangerous or oversized cargo, for instance, each requires a specific treatment.</td>
</tr>
<tr>
<td>Punctuality</td>
<td>The way in which delivery times are kept.</td>
</tr>
<tr>
<td>Reliability</td>
<td>Ability to keep specific criteria agreed upon, such as date, price, or volume. Or especially concerning the time: The degree to which shipments arrive at their destinations at the specific time stated.</td>
</tr>
<tr>
<td>Safety of goods</td>
<td>Procedures securing that the goods will be transported and remain undamaged.</td>
</tr>
<tr>
<td>Time</td>
<td>The degree of time criticalness of a transport, e.g. minimal or maximal travelling time.</td>
</tr>
<tr>
<td>Transport volume</td>
<td>Smaller volumes of cargo need to be consolidated and greater volumes might need special vehicles to be transported. Thus, the transport volume determines the transport services and the efforts needed for the movement.</td>
</tr>
</tbody>
</table>

Source: Own illustration according to Talley (2006: 48) and Zachcial (2001: 28).
Not only for transport service providers is it crucial to understand which criteria are important to shippers, but to the EU as well, as the understanding of important factors facilitates the creation of new research attempts. Once the customers’ expectations of transport services are known, policies to promote intermodal transport can be better tailored to meet the shippers’ needs, and further training of personnel can be specifically designed to match the logistics market’s requirements.

Illustration 4: Transshipment process in the port of Hamburg.

Source: Neumann.

Since the EU has an interest in staying close to day-to-day practice, funds are raised to obtain expert information on specific lines of business. For example, in an exemplary case study the research project SUTRANET\(^{193}\) carried out expert interviews. Because the Interreg IIIB project of SUTRANET is explicitly concentrating on the North Sea region, during

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\(^{193}\) SUTRANET (Sustainable Transport Research & Development Network in the North Sea Region) is a project within the Interreg IIIB North Sea Programme. The Interreg IIIB Programmes are initiatives of the European Commission “to stimulate the transnational cooperation in the EU... Interreg IIIB Programmes cover larger transnational areas and the North Sea Region comprises areas of Sweden, Denmark, Germany, the Netherlands, the Flemish Region of Belgium, United Kingdom and Norway.” Interregnorthsea.org.

Since these areas of the region often share the same problems and challenges, best results can be attained by working together and sharing knowledge and experiences especially regarding the Interreg objective to secure a sustainable and balanced future. Cp. Interregnorthsea.org.
these expert interviews contacts from Denmark, Germany, Great Britain, the Netherlands, Norway and Sweden were questioned. All six interview partners were stakeholders of the logistics chain and consisted of shippers, forwarders, and carriers. Even though the relatively small number of interviews was not sufficient to claim to be representative, the answers to the questions gave a hint at what is really important to the members of a transport chain. At the same time, the questionnaire examined if environmental reasons were of any importance for choosing intermodality. Furthermore, the importance of environmental issues to the company should be determined. Other questions of the interview were aimed at discovering to which degree companies attach

Of the four North Sea Programme’s priorities, the SUTRANET project is connected with priority 2 “Efficient and sustainable transport and communications and improved access to the information society.” (Interregnorthsea.org). SUTRANET especially addresses measure 2.3 “which concerns the development of spatial integrated strategies on transportation networks and the promotion of intermodal transport systems in the NSR. This measure aims at improving transportation networks with an emphasis on intermodality.” Interregnorthsea.org. The SUTRANET project is beside other issues also involved in the EU objective “from Road to Waterway”. Involved in the SUTRANET project are researchers from Denmark, Germany, Norway, Scotland, Sweden and the Netherlands. SUTRANET is divided into four workpackages complementing each other to bring out the best solutions for a sustainable development in the NSR.

The first WP is engaged with the establishment of a sustainable research and development network. It is also – as a horizontal workpackage – responsible for the specification of the framework conditions and strategies for policies and decisions regarding investments in infrastructure. With the elaboration of the working papers “Regional Development Perspectives and Concepts in the NSR” and “Transport Systems Concepts and Definitions”, WP1 provided the partners as well as the Group of Users with clear definitions and the latest insights, as an example of this WP’s outputs.

The second WP is occupied with the analysis of the major seaports and maritime routes in the NSR. WP2 identifies the importance of the ports for the NSR and provides the logistics sector with an overview of new ferry and SSS concepts. Furthermore, it presents new ideas for Motorways of the North Sea.

The third WP mainly focuses on the development of innovative transport systems and concepts. One activity of this WP is to elaborate case studies on how NSR ports could be developed into integrated and intermodal logistics centres.

The last WP focuses on the problem of the “lack of a European-wide vocational training system, especially regarding any emphasis on intermodal transport…” ZLU et al. (2003: 2) and the development of a best practice catalogue on training and educational efforts in the NSR. Hence the objective of WP4 is to improve the qualifications and skills/competences of SMEs and operational staff in intermodal transport. The elaboration of a training programme curricula and the development of a best practice catalogue are some of the activities of this WP. This WP is occupied with the European Union’s medium-term objective to harmonise the training standards (a problem of the Freight Integrator concept) as well. Cp. Sutranet.org.
importance to offer their employees further training with regards to the impact on the environment of their modes of transport.

The results of the expert interviews showed that intermodal transport is a significant solution for all stakeholders and is used whenever it offers advantages over other forms of transport with regard to price, delivery time and the specific requirements of the cargo. In almost all of the interviews it could be noticed that the price for the transport services was the singular decisive factor. Even though ecological aspects are anchored in a company’s strategy, the majority of the interviewees stated that environmental reasons only take on a minor role, but that they still serve as a marketing instrument whenever intermodal transport is used. Only few interviewees were eager to be as environmentally friendly as they could be at reasonable financial expenditures. Also, the further training of employees concerning environmental issues is only performed in one of the interviewed companies.

A ranking of the importance of the performance indicators mentioned by the interviewees could look like this:

1. costs
2. time
3. reliability
4. kind of goods
5. safety of goods
6. environmental impact

Then again it has to be mentioned that it is an entirely different story if a customer like IKEA is calling for transport services. Depending on a company’s environmental policy the criterion of environmental friendliness and sustainability might as well climb to number one.
2.4. Actions formulated in the White Paper to achieve a modal shift in favour of waterborne transport

The European Commission uses many different tools and measures in order to shift cargo from congested roads to waterways as proposed in the White Paper. Stepping up checks on European truck drivers for instance is regarded to be an effective measure as the following example shows: In 2006 driving hours in Poland started to be increasingly monitored, which according to experts has led to an increase of traffic on the route Rostock-Ventspils. From that, one can conclude, that from the beginning of 2007 shortsea shipping services are benefiting from the new idle times decreed by the EU, assuming that these will be supervised and enforced effectively.

Although the European Union’s Eastern enlargement has led to a growing traffic volume in German ports, the problem of providing sufficient infrastructural capacity has intensified at the same time. Since ports can only be kept fully operational if the hinterland infrastructure is being developed adequately, this means investments into the hinterland connection via road, rail, sea, inland navigation as well as into the general port facilities.

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194 Starting off from Rostock, during the first 6 months of 2006 Scandlines transported 10.5% more trucks then during the same time period of the preceding year. In total, during the first six months of 2006 the company transported 769,079 trucks. Cp. DVZ (2006j: 2).


196 Cp. DVZ (2006g: 2).


198 The extension of the port’s infrastructure is not only of crucial importance for the inner European shortsea shipping, but for global trading as well, as less and less seaports in Europe are able to accommodate the largest vessels of ocean shipping lines, due to limited access, quay size and handling capacity as well as insufficient port depths. Cp. Vrenken, Macharis and Wolters (2005: 9).

199 One example of how crucial the extension of the hinterland connection is can be seen at the port of Hamburg. There, investments into waterside infrastructure are high, but extensions to trucks, rail and inland navigation are neglected. Since these transshipment nodes are already congested, many truck drivers find it increasingly difficult to meet delivery dates. Cp. DVZ (2006e: 2).
For this reason, the European Commission created tools and measures to encourage moving freight off the roads and to introduce financial support to realise necessary investments. For instance there is the Marco Polo Programme that provides grants for Motorways of the Sea if these replenish the Trans-European Network for Transport (TEN-T). But there are many more projects, programmes and action plans that provide (financial) support. This chapter only inspects a few examples.

**Illustration 20:** Roll-on-roll-off vessel which can carry any type of rolling cargo.

Since the European Commission wants to develop or support actions, which are practical, nearly all action plans are based on expert’s reports to which all stakeholders have been invited to contribute. By relying on such reports, the European Commission wants to ensure that its projects will match the needs of every day’s practice and be of assistance in achieving the White Paper’s objectives. Contrariwise, all interventions into the balance of the transport modes and the focussing on the intermodal transport must still go along with the ideas of free competition, free choice of mode, and legal compliance.

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2.4.1. „Motorways of the Sea“- and „shortsea shipping“-initiatives

2.4.1.1. Shortsea shipping

Increasingly, shortsea shipping (SSS) [in a European context] is considered a key alternative to road transport and a solution to the burdens caused by traffic congestion and air pollution in Europe. Developing shortsea shipping is crucial to enhance land-sea intermodality. Strengthening its competitive position compared to road transport helps pursuing environmental and economic benefits, since shortsea shipping reduces several issues, such as pollution, accidents of road transport, congestion of transport networks and investments in road infrastructure.202

Despite many efforts, there are still many ambiguous definitions of shortsea shipping in circulation. The cited examples in the following are generally regarded as the most appropriate ones:

“Short Sea Shipping means the movement of cargo and passengers by sea between ports situated in geographical Europe or between those ports and ports situated in non European countries having a coastline on the enclosed seas bordering Europe. SSS includes domestic and international maritime transport, including feeder services along the coast, to and from the islands, rivers and lakes.”203

“SSS is seaborne goods transport which does not cross oceans.”204

“SSS are seaborne flows of all kinds of freight performed by vessels of any flag, from one EU member county to whichever destination within the territory embracing Europe, the Mediterranean and Black Sea non-European countries.”205


“SSS includes any services which are not considered to be Deep Sea Shipping and SSS refers to relatively short distances. The high number of journeys (of normally less than four days) makes management and organisation costs of shortsea shipping comparatively high...”

In Stopford, the definition is a bit more extensive: “SSS provides transport within regions. It distributes cargo delivered to regional centres such as Hong Kong or Rotterdam by deep sea vessels, and provides a port-to-port service, often in direct competition with land based transport such as rail. This is a very different business from deep sea shipping. The ships are generally smaller than their counterparts in the deep sea trades...Designs place much emphasis on cargo flexibility...Because trips are so short and...visit many more ports in a year than deep sea vessels, trading in this market requires great organizational skills.”

Illustration 21: Vessel near the port of Lübeck.

However, there is nothing completely new about this mode. Freight transport by vessel has a very long history: For centuries, waterborne transport was the dominating way of moving goods in Europe and in the Middle Age, major

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towns were built near the seas, rivers or estuaries. Also, large trade fairs were organised at ports.\textsuperscript{208}

But the novelty about shortsea shipping in Europe is that the European Commission considers it as being a safer and more sustainable alternative to road haulage due to several advantages and thus provides grants to develop adequate port facilities and waterborne services for instance. The shortsea shipping-initiative of the European Commission aims at integrating this way of transporting goods into the logistics chain and improving its links to other modes as well as improving the quality of services which must be closer to the customer's needs.\textsuperscript{209} This may be considered as one of the reasons resulting in an increase of shortsea shipping in Europe.


One of the routes that benefits from the growth in shortsea shipping is the Kiel Canal. In 2005 a total of 88.2 million t of cargo has been transported along the 100 km of water route. This matches an increase of 9.3% compared to 2004. In comparison to 1999, the amount of freight transported through the Kiel Canal has doubled.\textsuperscript{210}

Then again, shortsea shipping is not a universal solution to the issues of transport and environmental sustainability, as the following table shows.

\textsuperscript{210} Cp. DVZ (2006h: 8).
Table 6: Advantages and disadvantages of shortsea shipping in the EU.

<table>
<thead>
<tr>
<th>Advantages of shortsea shipping</th>
<th>Disadvantages of shortsea shipping</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lowering congestion on land transport networks.</td>
<td>• Partial increase of pollution (unlike other emissions, sulphur dioxide emissions are much higher than in other modes).</td>
</tr>
<tr>
<td>• Relatively low energy consumption compared to other modes of transport.</td>
<td>• Increase of other environmental problems (like the ballast water problem).</td>
</tr>
<tr>
<td>• Lower emissions esp. CO₂-emissions than most other modes of transport (SSS helps reaching the CO₂ target under the Kyoto Protocol).</td>
<td>• Congestion in port nodes (investments in ports are needed).</td>
</tr>
<tr>
<td>• Larger economies of scale than road transport (SSS is often the most cost-effective means to shift long-distance traffic off Europe’s roads).</td>
<td>• Lower flexibility in service times due to larger unit capacity and lower frequency of service.</td>
</tr>
<tr>
<td>• Strengthening the cohesion of the European community, facilitating connections between European regions and revitalising peripheral, outlying or isolated regions.</td>
<td>• Lower reliability of scheduled departure and arrival times due to weather conditions or due to port congestion for instance.</td>
</tr>
</tbody>
</table>

Despite being a more sustainable alternative, maritime transport has other advantages, which are considered to be important by the European Commission. This is for instance its ability to reach areas known as peripheral regions that are difficult or even impossible to reach by other modes. Examples of these regions are Ireland, Norway, regions on the Baltic Sea, the Black Sea and the Eastern Mediterranean. Consequently, shortsea shipping is the most appropriate transport mode between Eastern and Western Europe as well as between the countries of the Mediterranean basin.\footnote{Cp. European Conference of Ministers of Transport (2001: 44).}

**Illustration 22:** Van Carriers at work.

Source: Own illustration with photos of Pawlik.

The main generators of shortsea traffic in the Baltic and North Sea Regions are the ports of Rotterdam, Le Havre, Antwerp, Hamburg, Bremen, Felixstowe and London. Generally, on short distances of up to 12 hours travel time, many
services are ferries which are regarded as being extensions of the road network rather than being alternatives to road transport due to their frequency.\textsuperscript{212}

Nevertheless, the competitiveness of shortsea shipping cannot be compared to that of land transport, since transports by truck ignore environmental costs and the higher costs for infrastructure. Strictly speaking, any policy aiming at establishing a fair modal split – rather than simply aiming at the growth of shortsea shipping – must strive to equalise the environmental and fiscal external effects of all modes of transport.\textsuperscript{213} And in the beginning of 2007, there still prevails an insufficient integration in the intermodal transport chain so further supporting actions – like the further development of the shortsea shipping promotion centres – need to be taken.\textsuperscript{214}

Table 7: Shortsea shipping at a glance.

<table>
<thead>
<tr>
<th>Problems this initiative mainly deals with:</th>
<th>Shortsea shipping</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Insufficient infrastructure (e.g. port facilities, hinterland connections)</td>
<td></td>
</tr>
<tr>
<td>- Relatively unattractive services (concerning frequency, flexibility etc.)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall objective:</th>
<th>White Paper objective\textsuperscript{215}: Modal shift “from Road to Waterway” (shifting the balance between modes of transport by promoting transport by sea and inland waterway)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>➢ Creation of favourable conditions for/promotion of shortsea shipping</td>
</tr>
</tbody>
</table>

| Milestones:         | - Creations of favourable conditions for new services - Promotion of SSS - Improvement of the image of SSS - Improvement of the links to other modes of transport - Provision of adequate infrastructure |

<table>
<thead>
<tr>
<th>Eligible actions/measure:</th>
<th>In order to achieve the milestones, the following actions will be taken for instance:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Promotion of shortsea shipping’s reliability and frequency (promoting SSS as a modern element in the logistics chain, characterised by high speed, reliability, flexibility, frequency and cargo safety)</td>
</tr>
<tr>
<td></td>
<td>- Ensuring that its reliability, quality and safety are recognized (for instance by supporting shortsea shipping promotion centres: <a href="http://www.shortsea.info">www.shortsea.info</a>. These centres aim at convincing cargo owners, forwarders and other industries of the benefits of shortsea shipping. They provide information and advise the various players involved in the supply chain.)</td>
</tr>
<tr>
<td></td>
<td>- Integrating SSS more fully in door-to-door freight transport services</td>
</tr>
<tr>
<td></td>
<td>- Administrative simplification of shipping logistics</td>
</tr>
<tr>
<td></td>
<td>- Removing unnecessary costs and delays at ports by investing in infrastructure (improvement of ports to the needs of SSS and implementation of dedicated terminals; in smaller ports there is less risk of congestion but there is a need to further develop port infrastructure)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Finances:</th>
<th>Different sources for financing this initiative, like the Marco Polo Programme</th>
</tr>
</thead>
</table>

Source: Own illustration.

\textsuperscript{215} The mid-term review regarding the White Paper and the advancement to a new main objective called co-modality will be further examined in chapter 5.
2.4.1.2. Motorways of the Sea

Continental shortsea shipping is successfully in use on routes that lack good or frequently used overland alternatives. For this reason industry and Motorways of the Sea (MOS) policies work on a better integration of shortsea shipping into the overland transport system. It is important to note that the Motorways of the Sea concept does not necessarily involve new techniques. It rather utilises a heightened awareness for opportunities, including shortsea shipping, and tries to create conditions that allow for large quantities to be shipped from door-to-door. Motorways of the Sea are intended to concentrate freight traffic on specific sea routes to relieve road congestion and improve the link to peripheral and insular regions. The MOS network contains facilities and infrastructure of at least two ports in two different EU member states. Also, the combined transport of people and goods shall not be excluded, as long as the freight part is dominant.

Illustration 23: Transshipment process 1.

Source: Pawlik.


Furthermore, the concept of MOS defines criteria regarding frequency and quality of shortsea services, international security standards and port infrastructure on which to base a decision of eligibility for financial subsidies.\textsuperscript{218}

Criteria for e.g. port operators or shipping lines to obtain such a funding include having the potential to become a Motorway of the Sea and lead to a concentration of traffic in that specific region, as well as going conform with the TEN-T regulations.\textsuperscript{219}

**Illustration 24:** Transshipment process 2.

Source: Pawlik.


The idea of Motorways of the Sea was first publicized in the White Paper of September 2001, in which the European Commission proposed the development of these as a real competitive alternative to road-only transport with respect to commercial efficiency and sustainability. The overall objective of this concept is to introduce new intermodal maritime-based logistics chains to create a structural change in the transport organisation in order to bring relief to the congested European road network.

**Illustration 25:** Port facilities.

Therefore, fuller use of existing maritime transport resources as well as of rail and inland navigation resources as part of an integrated transport chain will have to be made. To keep up with the increasing amount of cargo, the already existing resources have to be further developed.\(^{220}\) In order to help furthering Motorways of the Sea, the White Paper stated that European funds must be raised and that Motorways of the Sea should be a part of the TEN-T.\(^{221}\)

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\(^{220}\) Besides the establishment of new high quality, frequent services, this encompasses hinterland connections and port facilities as well. This is due to the fact that the success of the MOS concept depends on the actions taken on the landside. The ports of Bremen for instance become more and more important for the MOS concept due to their sophisticated development. At the interface between ocean crossing traffic and shortsea shipping, cargo of the big ocean carriers is being distributed via feeder vessels. Cp. Lutzky (2006: 11).

The revision of the guidelines for the Trans-European Network for Transport (TEN-T) in 2004\textsuperscript{222} consisted of the creation of four corridors of Motorways of the Sea as one of thirty preferential projects, which take up the majority of the EU financial subsidies for TEN-T. With these TEN-T funds, the European Commission supports the elaboration of traffic plans for the creation of Motorways of the Sea in the Baltic Sea, in the Atlantic Ocean and in the Mediterranean Sea. The intention of these investments is the development of a capacious and fully functional network of Motorways of the Sea until 2010.\textsuperscript{223}

\footnotesize
\begin{itemize}
  \item \textsuperscript{223} Cp. European Commission (2006e: 1-4).
\end{itemize}
The four corridors in which Motorways of the Sea projects can be set up are listed in the following.\textsuperscript{224}

- **Motorway of the Baltic Sea**: Linking the Baltic Sea member states with member states in Central and Western Europe, including the route through the Kiel Canal

- **Motorway of the Sea of Western Europe**: Leading from Portugal and Spain via the Atlantic Arc to the North Sea and the Irish Sea

- **Motorway of the Sea of South-East Europe**: Connecting the Adriatic Sea to the Ionian Sea and the Eastern Mediterranean

- **Motorway of South-West Europe**: Western Mediterranean, connecting Spain, France, Italy and Malta and linking with the Motorway of South-East Europe including links to the Black Sea

\textsuperscript{224} European Commission (2004: 4).
Illustration 26: Corridors in which Motorway of the Sea projects can be set up.

Source: Europa.eu/Map of Motorways of the Sea.
Also, Motorway of the North Sea projects are planned.

**Illustration 27:** Map of Motorways of the North Sea.

Source: Sutranet.org.

Further information regarding Motorways of the North Sea are provided by the following documents:

- *Major intermodal ports in the North Sea Region*[^225]
- *Intermodal shipping services at major ports in the North Sea Region*[^226]

[^225]: Sutranet.org/Major intermodal ports. Download: http://www.sutranet.org/pub/DRAFT%201%20FOR%20WP2.pdf

A first Motorway of the Sea was already established in September 2005 between the port of Toulon in Southern France and the port of Civitavecchia close to Rome in Italy. Using this Motorway of the Sea, trucks can bypass the Alps by ship and thus save up to eight hours of travel time. Even though this service was not profitable until mid-2006, the shipping lines involved – Dreyfus (France) and Grimaldi (Italy) – wanted to stick to this water route because the service is deemed to be vital after the start-up finance period exceeded.227

**Illustration 28:** View on the container deck from a crew member’s cabin.

Another Motorway of the Sea – the first government-aided one – is planned along France’s and Spain’s shared Atlantic seaboard and will be in duty from the end of 2007 onwards. Thereby, border traffic is substantially reduced. In 2006, the French-Spanish border crossing-point near Le Perthus close to the Mediterranean coast was passed by an average of 9,000 trucks daily. In

comparison, the border crossing-point near Hendaye close to the Atlantic coast was passed by an average of 8,000 trucks daily. These crossing points could be relieved of a lot of traffic if sea motorways were installed. Proposals for projects transferring cargo from road to sea can be handed in by private companies or governmental institutions. These project proposals for MOS must meet corresponding criteria of the European Commission. The submitted project proposals will be examined according to the volume of traffic these are able to turn off roads and the provided quality of services. The evaluation’s main focus in this case is on the service frequency. Further criteria are, that only those projects will be financially supported which have at least one shipping line as well as one French port and one Spanish port involved. Italy has announced an interest into joining the MOS concept. A shipping route along the Mediterranean coast of these three countries is being contemplated.228 229 230


229 Italy is already the leader in the Mediterranean shortsea shipping but wants to strengthen its seaborne transports even more. In 2005 the turnover of Italy in shortsea shipping amounted to 311 million tons of cargo. In order to keep up with the increasing volume of goods transport a port’s infrastructure would need to be extended. The shortages of port capacity present a serious issue and are a challenge to the MOS concept. Cp. Kloss (2006: 6).

230 One fact being criticised is the lack of projects in the North Sea, while simultaneously there are several projects in the Baltic See and the Mediterranean Sea region. Cp. Findeis and Kloss (2006: 7).
Table 8: Motorways of the Sea at a glance.

<table>
<thead>
<tr>
<th>Problems this initiative mainly deals with:</th>
<th>Motorways of the Sea</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Insufficient infrastructure and port facilities</td>
<td>- Insufficient infrastructure and port facilities</td>
</tr>
<tr>
<td>- Services that don’t represent a reasonable alternative to road transport (due to insufficient flexibility, frequency, regularity, punctuality, costs etc.)</td>
<td>- Services that don’t represent a reasonable alternative to road transport (due to insufficient flexibility, frequency, regularity, punctuality, costs etc.)</td>
</tr>
<tr>
<td>- Poor access to insular or peripheral regions and states</td>
<td>- Poor access to insular or peripheral regions and states</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall objective:</th>
<th>White Paper objective”III”: Modal shift “from Road to Waterway” (shifting the balance between modes of transport by promoting transport by sea and inland waterway)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>➢ Creation of favourable conditions for development of maritime transport to be fully competitive to pure road transport</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Milestones:</th>
<th>- Consolidation and concentration of freight flows</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Establishing new maritime services</td>
</tr>
<tr>
<td></td>
<td>- Creation of port facilities, equipment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eligible actions/measures:</th>
<th>In order to achieve the milestones, the following actions will be taken for instance:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Start-up aid for new services (viability after three years must be proven by expert’s report)</td>
</tr>
<tr>
<td></td>
<td>- Investments in infrastructures such as port infrastructures, hinterland connections</td>
</tr>
<tr>
<td></td>
<td>- Investments in facilities such as electronic logistics management systems, safety, security, administrative and customs facilities, equipment for ice-breaking and dredging operations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Finances:</th>
<th>- TEN-T funding for major infrastructure projects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Marco Polo funding for logistics and services (start-up aid)</td>
</tr>
<tr>
<td></td>
<td>- Regional funds (like Interreg or Cohesion funds) for infrastructure and facilities</td>
</tr>
<tr>
<td></td>
<td>- State aid for infrastructure, facilities and services</td>
</tr>
</tbody>
</table>


Source: Own illustration.

231 The mid-term review regarding the White Paper and the advancement to a new main objective called co-modality will be further examined in chapter 5.
2.4.2. Marco Polo Programme

The Marco Polo funding initiative is a market oriented, demand-driven EU-subsidy programme, that was designed by the European Commission to promote intermodal transport (in order to enable a modal shift), especially shortsea shipping and inland waterway modes, and the Motorways of the Sea concept by providing financial assistance. This provides international consortia with grants for the start-up phase of intermodal services such as the Motorways of the Sea. These allocated grants help investors to compensate their high commercial risks in the early stages on the condition that they can provide evidence that their service will remain viable even after the end of three years when subsidies come to an end. The amount of money granted depends on the tkm of road transport that turns from road to another service.\(^{232}\)

**Illustration 29:** Fixed containers.

Source: Pawlik.

The Marco Polo Programme is the successor programme of PACT (Pilot Actions for Combined Transport), which started in 1992 and provided

monetary aid for the relocation of freight traffic from road onto alternative means of transportation.\textsuperscript{233} \textsuperscript{234}

With a budget of € 100 million from 2003 to 2006 Marco Polo I funded projects that aimed at shifting freight traffic from road to railway and waterway (inland navigation as well as shortsea shipping). The successor Marco Polo Programme II contains a budget of € 400 million for the duration of 2007 to 2013. A new feature to Marco Polo II is the regulation that all projects have to comply with the ideas of SME. For instance, from 2007 on not only the freight’s weight, but also its volume will be taken into consideration. The intensity of the effect of the shift off the road is measured by either tkm or cubic km, whichever unit yields the largest shift.\textsuperscript{235} Additionally, the scope of Marco Polo II has been changed. Apart from the EU, also Russia, the Ukraine, White Russia, the Balkan States and the Mediterranean Sea region are eligible for the programme. Furthermore, not only companies can apply for subsidies but also local authorities and communities that act like companies are allowed to apply for financial aid.\textsuperscript{236}

In the following, the requirements for Marco Polo subsidies are briefly listed:

- Subsidised projects must be of international character. Service provider and freight must cross at least one border.
- Project partners usually have to originate from two different eligible countries, one of which must be a member of the EU.
- Shift or prevention of traffic can refer to existing traffic services or to those that would normally be transacted via road traffic, in case the

\textsuperscript{233} Cp. Dahm (2006b: 3) and Frerich and Müller (2004b: 421).

\textsuperscript{234} The first PACT Programme ran from 1992 to1996, followed by a second from 1997 to 2001. Main focus of both programmes was the modal shift by promotion of intermodal transport, as in the Marco Polo Programme nowadays. CP. Frerich and Müller (2004b: 421-424).

\textsuperscript{235} Cp. Dahm (2006a: 1).

\textsuperscript{236} Dahm (2006b: 3).
submitted project would not exist. Subsidised projects can either be a new invention or a significant extension to an already existing service.

- All submitted projects must be viable even after the subsidies have ended. For the time following the loss-making start-up phase an economically stable perspective is required.

- At the moment of application, the project has to be defined as a specific type of project or action. This decision defines all further modalities.

These types of projects or actions will be explained in the following:
List of types of action that can benefit from financial aids of the Marco Polo Programme:

a) Modal shift actions
b) Catalyst actions
c) Common learning actions
d) Motorways of the Sea\(^{238}\)
e) Traffic-prevention actions\(^{239}\)

a) Modal shift actions: The main aspect of modal shift actions is the relocation of traffic services from the road to alternative modes of transport. The volume of the shifted freight is therefore the deciding assessment criterion.

b) Catalyst actions: This type of action requires real innovation in the sector of transport and logistics to create a shift of traffic. Appendages can be of technical, organisational or structural nature, but have to refer to a market barrier and lead to a breakthrough in this specific sector.

c) Common learning actions: A direct effect of traffic reduction or shift of traffic is not assumed to result from a common learning action type. According to the learning act, the exchange of knowledge and experience and the combined education of personnel indirect effects in compliance with the Marco Polo Programme shall be evoked by the promotion of cooperation. A limitation to a set number of partners or to a regional coverage is not reasonable.


\(^{238}\) New in Marco Polo II.

\(^{239}\) New in Marco Polo II.
d) Motorways of the Sea: The idea of Motorways of the Sea revolves around reliable and regularly used connections of shortsea shipping, integrated into intermodal transport chains. This action therefore includes a seaport’s hinterland and its railroads and inland navigations. Focusing only partially on a high travel speed, this concept’s success relies mostly on a fast transshipment and optimised interfaces of intermodal transport.

e) Traffic-prevention actions: This type of action aims at reducing road traffic in general. Ideas to achieve a reduction of traffic are a higher utilization, optimisation of processes, and a reduction of transport volumes without lowering the value or amount of transported goods.

With all the above mentioned actions, the following criteria have to be considered:

1) Avoidance of unacceptable distortion of competition (both between modes and within modes):
   
   Public promotions must not bias competition.
   
   Services promoted by Marco Polo must not be in direct competition with other services, except road freight traffic.

2) Justification of financial request:

   All occurring costs have to be elaborately justified.

Table 9: The Marco Polo Programme at a glance.

<table>
<thead>
<tr>
<th>Problems this programme mainly deals with:</th>
<th>Marco Polo Programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Insufficient infrastructure (port facilities, hinterland connections etc.)</td>
<td>- Relatively unattractive services (concerning frequency, travel speed etc.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall objective:</th>
<th>White Paper objective[^241]: Modal shift “from Road to Waterway” (shifting the balance between modes of transport by promoting transport by sea and inland waterway)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Creation of favourable conditions for/promotion of intermodal transport</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Milestones:</th>
<th>- Start-up financing for new services (the service’s viability after the subsidies end after three years needs to be proven)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Encouragement of companies to invest into port facilities and provide the financial means</td>
</tr>
<tr>
<td></td>
<td>- Providing financial aid for infrastructure development</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eligible actions/measures:</th>
<th>In order to achieve the milestones, the following actions will be taken for instance:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Modal shift actions</td>
</tr>
<tr>
<td></td>
<td>- Catalyst actions</td>
</tr>
<tr>
<td></td>
<td>- Common learning actions</td>
</tr>
<tr>
<td></td>
<td>- Motorways of the Sea</td>
</tr>
<tr>
<td></td>
<td>- Traffic-prevention actions</td>
</tr>
</tbody>
</table>

| Finances: | Marco Polo I (2003-2006): 100 million € |
|           | Marco Polo II (2007-2013): 400 million € |


Source: Own illustration.

\[^241]\ The mid-term review regarding the White Paper and the advancement to a new main objective called co-modality will be further examined in chapter 5.
Critics are of the opinion that the European Union’s Marco Polo Programme is a good initiative to promote shortsea shipping and intermodal transport. But they agree upon the fact that this programme alone is not sufficient. To achieve the goal of a perceptible modal shift in favour of waterborne transport, an incentive or bonus system has to be established in order to make truck drivers use more ferry services.\footnote{Cp. Hollmann (2006a: 10).} Furthermore, experts consider the application form to get Marco Polo funding to be unnecessarily complicated for companies that are not accustomed to such administrative efforts.\footnote{Cp. Landon (2006: 5).}
2.4.3. NAIADES – revival of inland navigation

For the sake of completeness in order to provide an overview of actions taken by the EU to achieve the “from Road to Waterway”-objective it is regarded appropriate to present the NAIADES-project – although inland navigation only represents a side issue in this e-learning module.

Since concrete measures are needed to put inland navigation in the position to make full use of the market potential while at the same time enhancing its attractiveness, the NAIADES-project was founded. National as well as European actions have to be taken due to the fact that inland navigation often crosses national borders and consequently a standardised European-wide regulatory and economic framework would facilitate transport processes.

Traditionally, inland navigation holds a strong market share in long-distance transport of bulk cargo like iron ore or construction materials. Since the 1980s, in addition to serving traditional markets, inland navigation has expanded into new markets like the hinterland transport of maritime containers (intermodal transport) as well. But up to the year 2005 only 6% of the whole European transport volume was being shipped by inland vessels. And according to the European Commission, new market niches such as the transport of vehicles, of waste, or of heavy or oversized cargo, are only inadequately served by inland navigation. This is the result of some significant omissions. Due to the hard competition inland navigation is facing difficulties in the procurement of capital, and modernisation of the fleet and investments in new liner services have had to be postponed. And because of insufficient public relations and promotions work, inland navigation missed the opportunity to improve its image and to provide shippers with information about services.

The European Commission considers NAIADES as being a suitable instrument to abolish institutional as well as infrastructural bottlenecks and to advance the development of inland navigation with political help.

Table 10: NAIADES at a glance.

<table>
<thead>
<tr>
<th>NAIADES</th>
<th>Navigation And Inland Waterway Action and Development in Europe</th>
</tr>
</thead>
</table>
| **Problems this project mainly deals with:** | - Insufficient infrastructure (inland port facilities, locks etc.)  
- Bad image of inland navigation  
- Aging fleet |
| **Overall objective:** | White Paper objective\(^\text{245}\):  
Modal shift “from Road to Waterway”  
(shifting the balance between modes of transport by promoting transport by sea and inland waterway)  
- Creation of favourable conditions for further development of inland navigation  
- Coordinated development of waterway infrastructure and inland port facilities |
| **Milestones:** | - Creation of favourable conditions for new services  
- Stimulation of fleet modernisation and innovation  
- Promotion of better working conditions and competence development  
- Improvement of the image and cooperation with transport operators  
- Provision of adequate infrastructure |
| **Eligible actions/measures:** | In order to achieve the milestones, the following actions will be taken for instance:  
- Support of liner services for intermodal transport (grants should be given etc.)  
- Facilitate access to finance for SMEs (providing information on funding subjects, funding organizations etc.)  
- Encourage the use of eco-efficient engines and renewable energy sources (such as bio-fuels, catalytic converters etc.)  
- Attract the workforce by improving working and social conditions (encompass e.g. pension insurance, modern accommodation standards on board, attractive working time models)  
- Stimulate life-long learning  
- Promote inland navigation as a reliable and successful partner  
- Encourage the development of port and transshipment facilities  
- Implement River Information Services (effective information exchange could optimize transport operations (e.g. trip scheduling, terminal operation plans) |

\(^{245}\) The mid-term review regarding the White Paper and the advancement to a new main objective called co-modality will be further examined in chapter 5.
Finances: 120 million €
Will approximately be provided in 2008 by the EU and the member states


Source: Own illustration.
3. Maritime transport and its negative effects on the environment

Despite the fact that maritime transport is in most cases more environmentally friendly than other modes of transport, it nevertheless is the origin of several negative external effects. Regarding particulates, CO-, NO\textsubscript{x}-, HC- and CO\textsubscript{2}- emissions, the vessel is the least polluting means of transport. Also, waterborne transport contributes to a reduction of road congestion and thus leads to increased safety on European roads, maintaining of Europe’s competitiveness and less CO\textsubscript{2}-emissions since the truck is one of its main emission sources among modes of transport.

Illustration 30: Container terminal Rotterdam.

In the following, the downside of maritime transport is sought to be portrayed. This is for example the vessel’s emission of sulphur dioxide which is ten times higher than that generated by road transport in grams for tkm. Furthermore, there is the risk of accidents which represents a threat to the environment as well as to society. In most cases, the damage caused by such accidents is often of a far greater dimension than those caused by e.g. land vehicles. For instance, if an oil tanker runs aground and oil leaks out, the damage caused to the environment is worse than any damage done by land vehicles could be. Still, ships are considered to be one of the safest ways of transportation.
Additionally, the introduction of foreign life forms like aquatic microorganisms in the ballast tanks of vessels and the environmentally harmful behaviour of a vessel’s crew or companies that e.g. carry out the cleaning of tanks at sea represent problems to the maritime environment as well. This chapter also deals with the negative external effects of maritime transport caused by toxic coatings and the scrapping of old vessels that were still built with asbestos.

After chapter 1.2. dealt with consequences of traffic on the environment in general, this chapter will explicitly pay attention to the consequences of maritime transport on the environment.
3.1. **Negative effects caused by operating a vessel**

The negative effects on the environment due to maritime traffic could be subdivided into negative effects that have its cause in a vessel’s operation on the one hand and negative effects that emerge in principle without moving the vessel at all on the other hand. Chapter 3.1. deals with the different problems to the environment arising while operating a vessel such as polluting the atmosphere by creating noxious emissions.

**Illustration 31:** Container terminal Rotterdam – Container vessel.

Source: Pawlik.
3.1.1. Emissions

In most cases, ship engines use heavy oil as fuel, which puts them on par with incinerating plants for hazardous waste.\textsuperscript{246} Emissions from vessels contain air pollutants, greenhouse gases, as well as ozone-depleting substances entailing risks for both – human health and the environment. Sulphur dioxide (SO\textsubscript{2}) and nitrogen oxide (NO\textsubscript{x}) emissions cause acid deposition which represents a threat to the environment, and particulate matter which are harmful to human health. Moreover, NO\textsubscript{x}-emissions add to environmentally damaging eutrophication. Compared to other modes of transport like the truck or the train, the vessel creates the most SO\textsubscript{2} in grams for tkm. Furthermore, seagoing ships create Nitrogen oxide (NO\textsubscript{x}) and volatile organic compound (VOC) emissions which contribute to ground-level ozone which poses a risk to health and is harmful to the environment. Additionally, vessels in operation create CO\textsubscript{2}. The emission of that vapour is less than by any other means of transport such as the truck or railway.\textsuperscript{247} Although created in comparatively small amounts, CO\textsubscript{2} evokes repercussions on the environment, most notably enhancing the climate change. The climate change is responsible for several effects that in turn effect sea shipping itself, such as heavy weather conditions, hurricanes, melting polar caps, or extremely low or high tides.\textsuperscript{248} The concentration of carbon dioxide in the atmosphere has risen significantly since 2002. With a value of 380 ppm\textsuperscript{249} the concentration is about 100 ppm higher than in pre-industrialization time. It is deemed proven that the atmosphere’s CO\textsubscript{2} concentration has reached a peak for the last 600,000 years. Estimates for future energy consumption go as high as an increase of 50\% until 2030, which will heighten today’s value even more as most energy will result from fossil energy sources. As a result of the climate


change and from a rising water temperature, maritime environment starts to suffer, as for example coral reefs react delicately towards environmental changes. Another consequence of rising water temperature is the solubility of carbon dioxide in the ocean. Even though binding CO\textsubscript{2} from the atmosphere in the ocean and thus relieving atmospheric issues, their effects on maritime ecosystems are severe. For instance, plankton loses its ability to produce lime which in turn threatens to eliminate the very first step in the food chain. Obviously, in order to preserve the maritime balance, the emission of CO\textsubscript{2} needs to be reduced. Comparing emissions of different vehicles, the ship’s benefits become apparent. An aircraft creates 540 grams of CO\textsubscript{2} per tkm, and a lorry 50 grams per tkm, as opposed to a cargo vessel of 8,000 grt\textsuperscript{250} upwards, which only creates 15 grams per tkm. This clearly shows that any amount of cargo shifted from road or air to sea helps reducing the emission of greenhouse gasses on the one hand.\textsuperscript{251} On the other hand, the pure propulsion of a ship causes a lot of emissions, as a ship’s engine runs on bunker oil, which is the most polluted of all kinds of oil.

**Illustration 32:** Reefer container en detail.

Being almost undistinguishable from refinery waste products, it is so dense that it needs to be heated to liquidize it. Although a lot of efforts have been undertaken to reduce truck emissions, ship engines have long been neglected. As a consequence, a single ship can release as much air pollution as 350,000 cars in an hour. This has been addressed in the Annex VI of MARPOL and put into effect in May 2005 wherein the sulphur content of heavy ship fuel oil has been limited to 4.5%.\textsuperscript{252}

\textsuperscript{250} Gross registered tons.

\textsuperscript{251} Cp. Osler (2006: 1).

Then again, CO$_2$ not only results from the operation of a vessel, but also from the usage of the cooling equipment for perishable cargo or of air-conditioning. To reduce emissions, the IMO has forbidden the installation of devices that produce ozone depleting substances into new ships. This was announced in the above mentioned Annex VI to MARPOL as well. However, devices using hydrochlorofluorocarbon are allowed to be installed, as they only have an ozone depletion potential of three to six percent. For this reason, these elements are allowed for installation until 2020. Within EU borders, this permission is only valid until 2015.$^{253}$ Some improvements on CO$_2$-emission have been done, however. But most technical innovations concerning engines and propulsion were not achieved with sustainability in mind, but for mere economical reasons, such as running a ship even more cost-effective. Using the cheapest and dirtiest oil available obviously creates the most pollution, and unless the shipping industry spends a higher proportion of its revenues on new more environmentally friendly technology to achieve real sustainable maritime transport, the emission of ozone-depleting gasses will still run strong.$^{254}$

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3.1.2. Risk of accidents at sea

The European Union’s economic development depends very much on maritime transport/inland navigation due to its history, geographical reasons and the increasing globalisation. The following figures illustrate this fact:

In 2005, the European Commission found out that almost 90% of foreign trade and about 40% of Europe’s domestic trade is being processed by using a vessel. In the same year, the European Commission announced that approximately 1 billion\textsuperscript{255} tons of crude oil are being shipped on European territorial waters and transshipped in ports of the European Union on a yearly basis.\textsuperscript{256}

Concerning the aim of reducing CO\textsubscript{2}-emissions and road congestion, it is worth striving for shifting as much cargo from road to waterway as possible. But increasing maritime transport represents an increasing risk of accidents. Therefore, the European Union is required to develop policies that minimise the probability of accidents to happen or at least minimise the environmentally harmful consequences of accidents. This issue will be explained in chapter 4.

But beforehand, the reader should be provided with more detailed information about accidents at sea since some of the most devastating accidents gave the first impetus to the regulations in effect – like the regulations for the transport of noxious chemicals concerning the requirements for ships in terms of construction standards (e.g. double hull tanker vessels).

According to Talley, a vessel accident is defined as an unintended incident that can either be a collision, grounding, a fire or explosion or a material/equipment failure.\textsuperscript{257}

\textsuperscript{255} All numbers are presented in modern English notification, also referred to as Short Scale. Therefore 1 billion corresponds to 10\textsuperscript{9} (1,000,000,000).

\textsuperscript{256} Cp. European Commission (2005d: 3-5).

Table 11: Types of vessel accidents.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collision</td>
<td>Vessels striking either other vessels or stationary objects.</td>
</tr>
<tr>
<td>Grounding</td>
<td>Vessels contacting with the sea bottom, a bottom obstacle or an object on the sea floor.</td>
</tr>
<tr>
<td>Fire/Explosion</td>
<td>Fire and explosion accidents contain all fire damages except those that origin from a hull or machinery failure.</td>
</tr>
<tr>
<td>Material/Equipment failure</td>
<td>Include all accidents caused by hull, machinery or equipment failure.</td>
</tr>
</tbody>
</table>

Source: Own illustration according to Talley (2002: 426-428).

Vessel accidents can be attributed to environmental reasons, human error or vessel causes. However, in most cases accidents do not have only one unambiguous reason but a sequence of causes. This could be the combination of heavy weather as the initial (environmental) cause and cargo shift as a secondary cause of a vessel’s accident for example. But due to expert’s estimates, in nearly 80% of all vessel accidents the initial cause is human error – human action or omission.

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258 Environmental causes are for instance adverse or heavy weather, high wind speed, presence of fog, lightning, adverse current or bad sea condition.

259 Human error comprises error in judgement, lack of knowledge, stress, fatigue, improper mooring/towing, carelessness, improper cargo stowage, inadequate supervision or intoxication.


To better display the consequences of waterborne accidents a few case studies will be presented in the following sector.

But first the consequences of oil spilling accidents on animal life shall be demonstrated. Even a small patch of oil of the size of a € 2 coin on a sea bird’s feathers means a huge loss of body heat, since now the cold water can penetrate the feathers and reach the bird’s skin. With feathers sticky with oil and soaked with water, a bird has to struggle not to drown. For this reason, birds immediately start cleaning themselves, swallowing oil by accident. Soon after, the bird is poisoned by oil and dies within days from cold, hunger, drowning, or poisoning.260

Illustration 33: Seagull.

Source: Neumann.

In January 2007, the 180 m long bulk carrier SERVER broke apart near the Norwegian west coast because the ballast tanks were not sufficiently filled and thus the northerly course could not be maintained in the heavy weather. The strong westerly wind caused a drift towards the coast. North of Bergen, the SERVER was pushed to shore and broke apart. The SERVER, built in 1985, had a total cargo of 585 tons of fuel oil and 72 tons of diesel fuel on board. Of these, 285 tons leaked out during the accident due to the break-up. The

remaining 372 tons were stored in the front part of the vessel which stayed above water and could be retrieved.  

Still, this may seem as a minor accident when compared to more serious oil catastrophes. Nevertheless, even a comparably small amount of oil leaked into the ocean can severely harm the ecological balance of the affected region. One of these big accidents happened in March 1989 when the tanker vessel EXXON VALDEZ ran aground near the coast of Alaska. Nearly 40,000 tons of crude oil spilled out of the wreck into the Prince William Sound. This oil spill led to a long-lasting disturbance of the ecosystem as well as to fish mortality. The consequences following the destruction of the environment in that area were major losses in fisheries and thus wages to fishermen and business firms. The ship owner Exxon as the responsible party for this accident, had spent 2.2 billion $ on the cleaning of the oil-polluted water and shores, 1 billion $ on settling state and federal lawsuits, and 300 million $ on the loss of income of the 11,000 fishermen and business firms. Furthermore, in 1994 an Alaskan court awarded 5.3 billion $ in punitive and compensatory damages to those who had come to any harm due to the accident. 

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261 THB (2007c: 13).

However, the determination of an appropriate compensation for damages to the environment represents a big problem to international laws. Awarding damages for polluting the environment is far more difficult than awarding damages for pain and suffering. In comparison to a typical automobile accident, the EXXON VALDEZ, ERIKA or PRESTIGE\textsuperscript{263} incidents had more extensive and more serious ramifications to a greater number of stakeholders (human beings as well as flora and fauna in that area).\textsuperscript{264}

**Illustration 34:** View from the bridge of a container vessel.

Oil and hazardous substance spills arising out of tanker vessel accidents have been at record low levels in 2006. This is attributed to regulations aiming at the prevention of the spillage of noxious liquid substances. One of these regulations that will be explained in chapter 4 stipulates the transition from single- to double-hull tankers. Approximately 65\% of the global tanker fleet are double-hull tanker vessels by the end of 2006 – but still 35\% of the tanker fleet represent a higher threat to the environment.\textsuperscript{265} Nevertheless, a fundamental problem of the European Union is that Europe’s territorial waters are passed through by vessels of serious conditions. In 2005, the European Commission published data according to which 10\% to 15\% of the world fleet (comprising all kinds of


\textsuperscript{264} Cp. Lloyd’s List (2006b: 6).

vessels – not only tanker vessels) do not correspond with international safety standards.\textsuperscript{266}

Besides the issue of the spillage of noxious liquid substances, there are other accidental incidents endangering the environment in maritime transport such as the loss of boxes.

There was for example the 698 TEU container vessel JRS CANIS that lost 10 ISO containers in January 2007 in the North Sea near Helgoland on its way from Bremerhaven to St. Petersburg. According to the coastguard services the reason for this accident were three successive waves of 8 m height at a wind speed of 90 kmh.\(^{267}\)

Other examples of vessels which lost larger numbers of containers\(^{268}\) in February 2007 alone are:

P&O Nedlloyd’s MONDRIAN that lost 58 containers near the Dutch coast;

CMA CGM’s VERDI that lost 80 containers near Cap Finisterre;

CMA CGM’s OTELLO that lost 48 containers in the Bay of Biskaya.

In the Bay of Biskaya current weather conditions were extremely heavy and the waves were about 10 m high.\(^{269}\)\(^{270}\)

The aforementioned examples demonstrate that again and again a great number of containers are lost to the sea. And even though many of these lost containers are being salvaged, there is still a high number of containers remaining in the oceans.

Even for those who know the sector very well it is hardly possible to make a guess about the number of containers that go overboard in heavy weather worldwide every year. It is still estimated, that roughly 2,500 to 10,000 containers are lost in the oceans per year.\(^{271}\)

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\(^{268}\) Larger losses of containers regularly occur in the transpacific area, where ships often are confronted with suddenly changing weather conditions and hurricanes. Cp. THB (2006a: 15).

\(^{269}\) Adverse weather condition is the main reason that a container go overboard.

\(^{270}\) Cp. THB (2007a: 15).

\(^{271}\) Cp. THB (2007a: 15).
In case any of these containers are filled with hazardous material, serious damage to the environment can be the result, as the case of the SHERBRO demonstrated in chapter 1.2.

As containers on modern supersize containerships are stacked in up to eight tiers, wind and weather find a broad front to push against, which can lead to entire stacks of containers going overboard.\textsuperscript{272} Furthermore it is criticised, that items such as Calciumhypochloride or Ferrosilicone are not being marked as dangerous materials and as such are stored on the ship in a flawed way.

Similar sources of danger are presented by fireworks. An estimated 57\% of Chinese fireworks do not meet international quality- and safety-standards, as the example of the explosion accident onboard the HYUNDAI FORTUNE has shown. 7 containers of fireworks en route from China to Le Havre detonated in March 2006 and caused serious explosions onboard the 5,551 TEU container vessel.\textsuperscript{273}

\textsuperscript{272} The loss of large numbers of containers not only presents an issue to the environment, it also causes high costs. In 1998 the APL CHINA lost 300 Containers in a pacific hurricane, and 700 more were heavily damaged. The estimated value of the lost cargo is 100 million $, and cargo values are at a rising. It is being estimated that the average cargo value in 2006 will be 80,000 to 100,000 $ per TEU. Cp. THB (2007a: 15).

\textsuperscript{273} Cp. THB (2007a: 15).
The increasing size of the vessels and thereby the increasing dimension of accident scenarios is a big concern to experts. As a rule of thumb, the bigger the vessel, the greater the risk, since larger container vessels create a larger potential for high losses and risk accumulation. And various industry experts suggest that there are no insurmountable technical barriers to the increase in the size of container vessels. Concept designs for container vessels up to 18,000 TEU already existed in 2001.\textsuperscript{274}

One example of the trend towards creating larger vessels is the EMMA MAERSK, which was launched in 2006. According to specifications, the ship can carry 11,000 TEU as its width of 56.40 m allows for 22 rows of containers to be placed adjacent. However, ship builders believe that the vessel’s true cargo space is at 13,500 TEU. At full load, the ship has draft of 16 m. Then again, insuring the vessel and its entire cargo might lead to catastrophic losses in case of an accident.\textsuperscript{275}

The only boundaries that might limit the vessel growth will be market-determined.\textsuperscript{276} The intention of determining the optimal ship size is to reduce the total transport costs, residing from travelling costs of the ship and handling costs of goods at the terminals. While the costs per ton transported declines with an increasing ship size (Economies of Scale), time needed for goods handling at the terminals and in the ports rises with increasing ship capacities since the loading and unloading of more cargo consumes more time (Diseconomies of Scale).

\textsuperscript{274} The recent development of shipsizes was as follows: 
Since 1960 container vessel up to 1,000 TEU; 
Since 1970 container vessel up to 2,000 TEU; 
Since 1972 container vessel up to 4,000 TEU; 
Since 1992 container vessel up to 6,000 TEU. 


The costs of a voyage consist of variable costs and capital costs. Variable costs contain costs of the crew, the fuel, and the ship maintenance, while the capital costs refer to depreciation.\textsuperscript{277} Obviously, large container vessels have a cost advantage since transport costs per container declines with increasing ship size. However there are more criteria that effect the choice of optimal ship size. One of these criteria is usually the maximum size a ship may have in order to enter a port or pass a canal. For example, the Kiel Canal may only be passed by ships of a certain maximum height, since otherwise they could not pass underneath the railroad bridge near Rendsburg. Likewise, such size limits apply to all ports and canals worldwide.\textsuperscript{278 279}

**Illustration 35:** Container handling.

![Container handling](image)

Source: Pawlik.

In the competitive environment vessel operators are under pressure to be as profitable as possible and to cut down all costs to a minimum. One attempt e.g.


\textsuperscript{279} A shipping company’s decision on which port a vessel of a specific size can approach mainly depends on a port’s hinterland connection and its proximity to delivery destinations. This is one of Rotterdam’s and Antwerp’s main competitive strengths. Their proximity to highly populated areas with industrial concentrations along Rhine and Ruhr guarantees for a high amount of goods handling. Cp. Fritsch, Leybold and Matthes (2006: 538).
is to try to reduce the time a vessel cannot be used for transport since it is in maintenance. Another option is to cut down on operating personnel aboard a ship. Then again, shrinking crew sizes while vessel sizes increase are a safety concern (e.g. the EMMA MAERSK only needs a crew of 13 to be fully operational) since fewer crew members can share watch duties which leads to increased fatigue from longer working hours. Fatigue is being regarded as one of the main reasons that led to the accident of the EXXON VALDEZ. This clearly shows, that a crew size which is shrunk below a certain level required to safely operate a vessel, will eventually compromise the safety and in the end may lead to accidents.\footnote{Cp. Talley (2002: 428).} But once again, it helps cutting the costs.
3.1.3. Ballast water

Ballast water is seawater taken up at a port or during a journey to reach a specific weight needed to stabilise the vessel during an empty run. The water is being pumped into tanks and dumped into the sea again once the loading of the ship with freight has begun. It further helps to balance out the buoyancy of the ship and its inertia when getting into difficult weather conditions.

As mentioned in chapter 1.2.8. one problematic aspect of ballast water is the fact that foreign life forms are transported into areas they do not originally inhabit. With the absence of natural enemies to control the population’s growth, the environmental balance is at stake. The IMO has recognised the introduction of foreign life forms as a major concern regarding maritime ecosystems, and has thus started a convention on the issue of ballast water unloading regulations on February 13th, 2004. Additionally, ballast water not only contains above mentioned life forms, but more often than not is also contaminated with polluting substances. This derives from the fact that ships which do not possess dedicated clean ballast tanks usually use their liquid cargo tanks to take up ballast water. When dumping water from their cargo tanks again, remains of the last cargo get washed out and are flushed into the sea. These cargo residues can be of any liquid kind of cargo, depending on which kind of substances the vessel is suitable to transport.

---

For the handling of ballast water, three major approaches can be distinguished:

Chemical methods of decontaminating ballast water involve using chemicals to deaden all life forms in the tank and to degenerate remains of non-water residues. Due to the large amounts of chemicals needed and the need to deal with chemical remains, this option tends to be very expensive.

Mechanical methods include the separation of life forms from either the ballast water or from the ship altogether. This might be done by running the contaminated water through filters, or to change ballast water in the open sea, at a distance big enough not to threaten coastal ecosystems. This would increase the transport time however, as the ship would need to slow down for the exchange process to be executed. Or the vessel might make use of a port’s reception facilities to dispose of the ballast water into special tanks, where the further treatment will take place. While mechanical methods of dealing with ballast water may be the most cost-efficient, they are also regarded to be the least effective ones.

Physical methods of handling ballast water are for example the use of ultra violet radiation, supersonic sounds or the heating of ballast water to kill life forms within. Still, these ideas remain experimental and have yet to be proven functional on a scale required for application on a ship’s tanks.
Going beyond the issues of ballast water, similar problems arise with other liquids, such as oil, sludge water, bilge water, sewage, and liquid chemical cargo.

Apart from unintended accidents, oil contamination of water can happen for several reasons. One source could be the usage of main liquid tanks for ballast water on empty runs. When dumping the ballast again, crude oil residues may get washed out and flushed into the sea. It is also possible that, although a ship is equipped with clean ballast tanks (CBT), weather conditions require an extra stability and inertia, which forces the crew to fill empty cargo tanks with seawater. Lastly, water used for washing and cleaning the ship or the ship’s tanks might accidentally or purposely be dumped into the sea. According to the OECD, the biggest single source of oil pollution is the operational discharge of oil at sea. This has led to several routines being developed to reduce the amount of oil leaking into sea each year.

Following the sinking of the single-hulled EXXON VALDEZ in 1989 and the sinking of the tanker ERICA in 1999, the IMO regulated that until 2015 all the single-hulled tankers of the world’s fleet shall be replaced by double-hulled vessels. Furthermore, ships are required to either provide clean ballast tanks (CBT) or segregated ballast tanks (SBT) to prevent oil residues in ballast water from entering the sea. Ships being already in existence are demanded to be refitted to meet this requirement.

Sludge remains when heavy oil is burnt as fuel by ship engines. Approximately 1.5 to 2% of the so-called bunker-c-oil remains as sludge, which needs to be discharged into a specific port waste reception facility in case it cannot be burnt onboard by using either an incinerator or by homogenising and burning it along with other fuel.
Bilge water results from water entering the ship's hull and engines. During the voyage, bilge water mixes up with the residues of oil used for engine maintenance, remains of fuel burning, and dirt, and turns into an oily-watery substance. This polluted water needs to be pumped out by so-called bilge-pumps.

Sewage, also referred to as ‘black water’ is human, animal, and/or medical waste, which used to be freely dumped into the sea in former times. The MARPOL Annex IV, which came into force in 2005, stated that the legality of discharge of sewage depends on the level of pre-treatment. If the mentioned requirements cannot be met, the discharge is marked illegal and vessels have to unload their ‘black water’ at a port’s waste reception facility.

**Table 12:** Annex IV Sewage discharge requirements.

<table>
<thead>
<tr>
<th>Annex IV. Sewage discharge requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>• Sewage must be retained in holding tanks and</td>
</tr>
<tr>
<td>• Discharge must take place at least 12 nautical miles from the nearest land, and</td>
</tr>
<tr>
<td>• The discharge rate must be approved by the Flag State, and</td>
</tr>
<tr>
<td>• The ship is proceeding en route at a minimum speed of four knots.</td>
</tr>
</tbody>
</table>


Chemicals, or noxious liquid substances, are transported in specialised liquid cargo tanks. Ships need a certification that they are fitted with the equipment
that is needed for a safe handling of a set non-oil liquid cargo. Most pollution cases happen while loading or unloading the cargo, or while cleaning the cargo tanks prior to loading them with different liquids. The cleaning water needs to be unloaded at a port’s waste facility, but after the cleaning a ship’s crew may conduct a second tank cleaning. This so-called rinse water does not need to be discharged into specialised facilities but may be dumped into the sea instead, as long as a certain concentration of chemicals is not exceeded. The exact concentration depends on the noxious liquid. Still, residues remain in the cleaning water and enter the sea through the dumping of the rinse water.

Table 13: Discharge requirements for chemicals.

<table>
<thead>
<tr>
<th>Category</th>
<th>Hazard to human health and/or marine ecosystems</th>
<th>Harm to amenities or other legitimate uses of the sea</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Major hazard</td>
<td>Serious Harm</td>
</tr>
<tr>
<td>B</td>
<td>Hazard</td>
<td>Harm</td>
</tr>
<tr>
<td>C</td>
<td>Minor hazard</td>
<td>Minor Harm</td>
</tr>
<tr>
<td>D</td>
<td>Recognisable hazard</td>
<td>Minimal Harm</td>
</tr>
</tbody>
</table>

Table 14: Discharge requirements.

<table>
<thead>
<tr>
<th>Noxious substance category</th>
<th>Annex II. Discharge requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In all areas</td>
</tr>
<tr>
<td>A, B, C</td>
<td>• The ship must be en route, and</td>
</tr>
<tr>
<td></td>
<td>• The vessel must be operating at a minimum speed of 7 knots (self-propelled) or 4 knots (not self-propelled), and</td>
</tr>
<tr>
<td></td>
<td>• The vessel must be located at least 12 nautical miles from the nearest land, and</td>
</tr>
<tr>
<td></td>
<td>• Discharge must take place below the water line, and</td>
</tr>
<tr>
<td></td>
<td>• Discharge must take place in water at least 25 metres deep (except for category D substances).</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outside Annex II Special Areas</td>
</tr>
<tr>
<td></td>
<td>Within Annex II Special Areas</td>
</tr>
<tr>
<td>A</td>
<td>• Maximum concentration of effluent after port tank washing is (0.1) % by weight.</td>
</tr>
<tr>
<td></td>
<td>• Maximum concentration of effluent after port tank washing is (0.05) percent by weight.</td>
</tr>
<tr>
<td>B</td>
<td>• Maximum 1 m(^3) or 1/3000 of the tank’s capacity in m(^3) can be discharged per tank</td>
</tr>
<tr>
<td></td>
<td>• Concentration in the wake astern of the ship is no more than 1 ppm.</td>
</tr>
<tr>
<td></td>
<td>• The tank must be pre-cleaned and the washings stored onboard and/or discharged to a waste reception facility</td>
</tr>
<tr>
<td></td>
<td>• Concentration in the wake astern of the ship is no more than 1 ppm.</td>
</tr>
<tr>
<td>C</td>
<td>• Maximum 3 m(^3) or 1/1000 of the tank’s capacity in m(^3) can be discharged per tank</td>
</tr>
<tr>
<td></td>
<td>• Concentration in the wake astern of the ship is no more than 10 ppm.</td>
</tr>
<tr>
<td></td>
<td>• Maximum 1 m(^3) or 1/3000 of the tank’s capacity in m(^3) can be discharged per tank</td>
</tr>
<tr>
<td></td>
<td>• Concentration in the wake eastern of the ship is no more than 1 ppm.</td>
</tr>
<tr>
<td>D</td>
<td>• Maximum one in 10 part dilution of the substance in water.</td>
</tr>
<tr>
<td></td>
<td>• Maximum one in 10 dilution of the substance in water.</td>
</tr>
</tbody>
</table>

The Annex II special areas are: The Mediterranean Sea, the Baltic Sea, the Black Sea, the Red Sea, the “Gulfs”, the Antarctic, the Caribbean, and the Northwest European Waters.
3.1.4. Environmentally harmful behaviour of crew and companies

According to the Organisation for Economic Co-operation and Development (OECD), one major environmental impact of shipping is the disposal of a vessel’s garbage overboard. Traditionally, vessels had relatively simple garbage streams consisting of the galley’s food wastes and packaging materials which were in general dumped at sea. But just as land-side waste streams, garbage flows from ship-board operations have diversified and increased extensively since the 1970s as well. Since then, garbage flows include for instance food as well as food packaging materials, medical wastes, packaging for cleaning and maintenance compounds, metal, plastic, glass and paper. If these wastes are thrown over board, in most cases they end up at coastlines where they interfere with marine life. Plastic waste for instance represents a deadly threat to marine creatures and sea birds as they could get caught in it or mistake it for food.282

The following table provides an overview of only a few examples about the duration of the disintegration of garbage to make the reader understand how long waste pollutes the seas.

Table 15: **Duration of garbage to disintegrate at sea.**

<table>
<thead>
<tr>
<th>Garbage Type</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rope</td>
<td>3-14 months</td>
</tr>
<tr>
<td>Woollen cloth</td>
<td>1 year</td>
</tr>
<tr>
<td>Tin can</td>
<td>100 years</td>
</tr>
<tr>
<td>Aluminium can</td>
<td>200-500 years</td>
</tr>
<tr>
<td>Plastic bottle</td>
<td>450 years</td>
</tr>
</tbody>
</table>

Source: Own illustration according to IMO.org/Environment.

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In order to prevent the continuing pollution of the seas and its impact on marine and coastal ecosystems, MARPOL Annex V was introduced. Among others, this annex requires that all garbage movements off the vessel must be recorded into a so-called Garbage Record Book to prove that plastic waste disposal e.g. did not happen by simply throwing the rubbish overboard. Also, this annex determines disposal requirements displayed in the following table, as well as special areas worthy of protection.

These special areas are\textsuperscript{283}:

Mediterranean Sea
Baltic Sea
Black Sea
Red Sea
The “Gulfs”
Antarctic
Caribbean
Northwest European Waters

Table 16: Disposal requirements.

<table>
<thead>
<tr>
<th>Types of garbage</th>
<th>Disposal requirements inside special areas</th>
<th>Outside of special areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastics</td>
<td>Disposal at sea prohibited in all areas</td>
<td></td>
</tr>
<tr>
<td>(includes synthetic ropes, fishing nets, plastic containers, plastic bags, biodegradable plastics, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cargo packing waste</td>
<td>Disposal at sea prohibited</td>
<td>Disposal at sea permitted at least 25 nautical miles from nearest land</td>
</tr>
<tr>
<td>(includes floating dunnage, lining and packing materials)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food wastes</td>
<td>Disposal at sea permitted at least 12 nautical miles from nearest land</td>
<td>Disposal at sea permitted at least 12 nautical miles from nearest land</td>
</tr>
<tr>
<td>Other garbage</td>
<td>Disposal at sea prohibited</td>
<td>Disposal at sea permitted at least 12 nautical miles from nearest land</td>
</tr>
<tr>
<td>(includes rags, paper, glass, metal, crockery, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comminuted/ground food or other wastes</td>
<td>Disposal at sea prohibited (unless only food and then at least 12 nautical miles from nearest land)</td>
<td>Disposal at sea permitted at least 3 nautical miles from nearest land</td>
</tr>
<tr>
<td>Incininator Ash</td>
<td>Disposal at sea prohibited</td>
<td>Disposal at sea prohibited unless ash is free of toxic heavy metal compounds and/or plastic residue and then at least 3 nautical miles from nearest land</td>
</tr>
</tbody>
</table>

Another big problem for a maritime ecosystem is the washing of oil tankers at sea, when oil-polluted water runs into the sea.\textsuperscript{284} Chapter 4 will take up on the regulations of garbage disposal and other environmental concerns of the IMO.

\textsuperscript{284} Cp. Aktionskonferenz Nordsee e.V. (1998b: 1).
3.2. **Negative effects due to ship elements**

In contrast to the negative effects emerging while operating a vessel – such as sulphur dioxide emissions – there are negative effects on the environment coming from the vessel itself without travelling a single nautical mile. This is for instance the problem of hull coatings containing TBT or the scrapping of vessels that are made of materials endangering the environment if not disposed of properly, like asbestos.

**Illustration 36**: Container vessels in the port of Rotterdam.

Source: Pawlik.
3.2.1. Scrapping

At the end of a ship’s life cycle, its usefulness is reduced to the raw materials it is made of. As with any other items produced, even ships are considered 'waste' after their owners decide to decommission them. And although up to 99% of a ship’s materials can be reused, the discarding and dismantling of the vessel’s hull and equipment make it be regarded as waste, which implies that the basic ideas of environmentally friendly disposal of waste need to be applied. That is, hazardous materials need to be dismantled and stored separately, and not be exported from the European Union to non-OECD member countries.

Until the 1970s these work and wage intensive jobs were often done in Europe. With rising environmental regulations and labour costs, the scrapping business more and more shifted towards Asian countries. A center of wracking business is Alang in India.

At the world’s largest ship scrapyard, 3,500 workers on 184 beachfront plots are employed to dismantle ships. Along with other ship scrapyards, the Third World accounts for 90% of the world’s ship recycling industry. But business is running low in recent years due to several reasons. One of the main reasons is a heightened awareness of environmental pollution caused by ship scrapping, another important reason is that the transport business is at a rising and capacities are needed, leading to a prolonged lifetime of a ship and thus to postponed decommissions.

The idea behind scrapping ships is that in order to dispose them, they can be sold to generate a last source of income, while the scrapyard owner takes the

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285 Usually, a ship is being dismantled after approximately 30 years.


ship as an investment and sells the recycled raw materials. Thus, both sides of the deal and the environment take profit of such deals.\textsuperscript{290}

The impact of environmental groups such as Greenpeace for instance can be seen in the case of the ship NORWAY, formerly known as the SS FRANCE or the BLUE LADY. The Norwegian cruiseship NORWAY was sold to Bangladesh for scrapping, but has been anchored in Malaysia for a year, as Bangladesh denied entry into territorial waters since Greenpeace claimed that the ship still contained an estimated 900 tons of asbestos and various other toxic materials, such as the carcinogenic polychlorinated biphenyls. As a consequence, Greenpeace listed the NORWAY on its ‘black list’ of 50 of the most toxic and contaminated ships worldwide. Eventually, Bangladesh resold the NORWAY to India for final dismantlement.\textsuperscript{291}

Similarly, the former French aircraft carrier LE CLEMENCEAU has been recalled from decommission by French President Jacques Chirac because the ship still contained toxic materials. According to the Green Paper, hazardous wastes should not be exported from the European Union.\textsuperscript{292} Furthermore, in 2006 India announced that it is not yet able to fully break a ship in a clean way, which demonstrates the need for specialized ship scrapyards that can extract hazardous and toxic materials and decontaminate the vessel prior to scrap-selling ships to Third World parties that might not be able to make sure the dismantlement will be executed without polluting the environment.\textsuperscript{293}

It is important to take note, that the process of scrapping a ship not only deteriorates environment, but also endangers the scrap workers’ health, as cancerous materials are set free and are being inhaled. Due to the hazardous work on a scrapyard, workers are constantly exposed to extreme conditions, such as working in 15-minutes-shifts in areas with an air temperature of more

\textsuperscript{290} Cp. Nadkarni (2006a: 5).
\textsuperscript{291} Cp. Nadkarni (2006a: 5).
\textsuperscript{292} Cp. O’Mahony (2006: 3).
\textsuperscript{293} Cp. Nadkarni (2006a: 5) and Nadkarni (2006b: 3).
than 50°C, dumping large pieces of scrap metal on the beach, or working in compartments that require oxygen tanks and full body suits to survive.\textsuperscript{294} For that reason, in 1999 the German shipping company Hamburg-Süd was searching for a scrapyard that would not only dismantle ships in a sustainable manner, but also pay their workers appropriate and take care of their safety. The choice not to opt for Alang was made after Greenpeace reproached the company for exporting illegal hazardous material. This happened due to the selling of the container ship COLUMBUS NEW ZEALAND, which a broker bought and re-sold to a scrapping company in Alang. There, the ship was scrapped under inhuman conditions. For the dismantlement of two identical containertships – the COLUMBUS AUSTRALIA and the COLUMBUS AMERICA – Hamburg-Süd chose a Chinese scrapping company near Shanghai, since there working conditions were on a good level and proper equipment for an environmentally friendly dismantlement were present.\textsuperscript{295} The rising demand for sea transport has induced ship owners to run their vessels longer than expected, which in turn means less ships for scrapping and less work for ship scrapyards.\textsuperscript{296} While in 1998 to 1999, the peak of 361 ships scrapped per year has been reached, during the fiscal year 2005 to 2006\textsuperscript{297} only 97 ships have been dismantled in Alang, clearly demonstrating the prolonged lifetimes of ships. Nevertheless, within the next couple of years the demand for scrapping services will rise significantly. Until 2015 roughly 1,300 single hull tankers and a lot of passenger ships built in the 1960s and 1970s containing asbestos, as well as decommissioned warships will be due for scrapping.\textsuperscript{298} This demonstrates that waste disposal regulations need to be applied to vessels and that regulations need to be put into effect. Although commitments by the

\textsuperscript{294} Cp. Nadkarni (2006a: 5).
\textsuperscript{295} Cp. DVZ (1999: 1).
\textsuperscript{296} Cp. Nadkarni (2006a: 5).
\textsuperscript{297} In Alang, the fiscal year ends on March 31st. Cp. Nadkarni (2006a: 5).
\textsuperscript{298} Cp. O’Mahony (2006: 3).
industry are welcome and might turn out to be the most cost-effective way of decontaminating ships, the sufficiency of such measures remains to be proven. As a consequence, the International Maritime Organization (IMO) has launched an international convention contemplating sharper legislation on ship disposal. New rules would apply to all ships of 500 grt (gross registered tons) upwards, except for national vessels and warships. According to the convention, all new ships are required to provide an inventory list of hazardous materials, and ships being already in service would be required to provide one within five years of the legislation coming into effect.\textsuperscript{299}

The aspect facing the most criticism is the IMO’s time estimations. It is not expected that the convention will be done prior to 2008 or 2009, commonly needing an additional six years for ratification.\textsuperscript{300} As a result, the European Commission has started a study to inspect the IMO convention’s ideas and find any gaps in the regulations. Contrariwise, putting up regulations for European vessels would not work out in a globalized context, as many ships would simply re-flag. A more detailed analysis of legal requirements, rules and regulations will be done in chapter 4.1.

\textsuperscript{299} Cp. THB (2007d: 1-2).

\textsuperscript{300} Cp. O’Mahony (2006: 3).
3.2.2. Toxic coatings

Toxic coating, also referred to as protective coating or anti-fouling coating, is a layer of lacquer applied to a ship’s hull. The coating’s objective is to poison and kill all maritime life forms that might attach themselves to the hull on a submarine level, such as algae and mussels. These life forms would increase frictional resistance and thus decrease voyage speed and efficiency and force the vessel to use up more fuel. As a result, toxic coatings are intended as an efficiency-saving means of hull protection. This kind of protection comes at a cost, however, as these coatings contain volatile organic components which can cause breathing difficulties and contribute to ozone depletion.\textsuperscript{301} As these chemicals over time dissolve into the ocean, yet unknown harm is done to the maritime environment.\textsuperscript{302} Even though toxic coatings are in broad use, volatile organic components (VOCs) are furthermore contained within several solvents such as paints, thinners, and paint stripping fluids.\textsuperscript{303} 80\% of the world wide production of Tribultyin Oxide (TBT) is being used for ship hull coating. This led to an interdiction to use TBT containing lacquers on ships shorter than 25 meters in 1990 by the Marine Environment Protection Committee.\textsuperscript{304}

\textsuperscript{301} Cp. Lloyd’s List (2006d: 11).

\textsuperscript{302} A known consequence of tin-containing vessel-coatings is the hormonal disturbance of embryos, larvae and infant animals (e.g. fishes, common seals or crayfishes), which lead to mutations and infertility. Cp. Aktionskonferenz e.V. (1998d: 2).

\textsuperscript{303} Cp. Lloyd’s List (2006d: 11).

\textsuperscript{304} Cp. IMO.org/Toxic.
On October 5, 2001, the International Convention on the Control of Harmful Anti-fouling Systems on Ships prohibited the appliance or re-appliance of organotins as TBT from January 1, 2003 on. Due to a lack of ratifications, the entry into force has been postponed until 25 members with a summarized 25% of the world’s merchant shipping tonnage have ratified the convention. As per June 2006, only 16 member states representing 17.27% of the world’s merchant shipping tonnage had given their ratification.³⁰⁵

To further the idea of sustainable transport, the European Commission has issued two regulations to counter the hazardous effects of toxic coating on the environment that are expected to be put into force in 2007: REACH (registration, evaluation, and authorisation of chemicals) and the Solvent Emissions Directive.

The REACH directive demands that producers of chemicals provide detailed information about the compounds being used. The amount of information required for a concession by the European Commission is dependent on the total amount produced of a specific solvent. Thus, the more of a solvent is in use, the more urgent is the need for information concerning risks when using this chemical. To enforce that no heavily hazardous lacquer will come into use, the right for permission remains with the European Commission instead of its

³⁰⁵ Cp. IMO.org/Toxic.
member states. The REACH directive has been issued on December 30, 2006, and will be put into force on June 1, 2007.\textsuperscript{306}

The Solvent Emissions Directive establishes emission limits for volatile organic compounds in waste gases for instance.\textsuperscript{307}

However, it is yet unknown how these directives will be enforced once they are put into force. Member states are reluctant to police if and how ships adapt to the new regulations. Without a clear statement of how EU directives will be put into national legislation and how these laws will be enforced, industries involved in ship building, repairing, or outfitting will find themselves in a blurry legal position.

\textsuperscript{306} Cp. Reach.info.

4. **Possibilities to minimise the negative effects of maritime transport on the environment**

After the preceding chapter showed some of the negative effects of maritime transport on the environment and the balance of ecosystems, such as emissions, ballast water, or toxic lacquers of vessels, chapter four is about how these repercussions can be minimised. Three different approaches can be distinguished – improving legislation to force all participating stakeholders to keep waterborne transport clean; actions taken by companies to reduce their footprint on the environment (this affects an entire fleet, an entire port, etc. or is company-focused); or technical possibilities to refit vessels to operate more environmentally friendly (this affects only single vessels or is vessel-focused).
4.1. Legal requirements – rules and regulations set by institutions for environmental protection in shipping

Global merchant shipping is widely known as one of the most heavily regulated industries and also was among the first to evaluate broadly implemented international safety standards.

Generally, international standards can be divided into three categories. These are economic, social, and safety and environment standards. Economic standards basically deal with good commercial practices. Social standards primarily concentrate on the working conditions of a vessel’s crew, while safety and environment standards are concerned with technical or operational issues of a vessel or a shipping company. Usually, standards are subject to specific rules and regulations.

The objective of implementing safety and environmental regulations is to achieve a balance between the economic system’s aims on the one hand, and the social, safety and environment system’s aims on the other and, further aiming at achieving a balance between the needs of current and future generations.

Since shipping is inherently international, it is necessary that regulations are developed at a global level so that shipping is subject to uniform regulations regarding issues such as construction standards, navigational rules or crew training.\(^\text{308}\)

Rules and regulations are rather developed by national or international governmental organisations than by shipping and aligned industries themselves.\[309\] There are numerous intergovernmental organisations involved in formulating regulations concerning the protection of the maritime environment.\[310\]

This chapter will present briefly two of the most important institutions and the rules and regulations implemented by them.\[311\]

\[309\] The “own” or “internal” regulatory system of the shipping industry – the Classification Society - arose from the efforts of insurers to make sure that the vessels which they were insuring were sound. In the middle of the eighteenth century, the first Classification Society was formed by insurers. Since then, Classification Societies have become an essential part of the maritime regulatory scene. These organisations develop vast and complex rules for safe ship construction and its maintenance and issue a so-called ‘Class Certificate’ – the Classification Society’s mainstay – to reflect compliance. This certificate is issued when the ship is built and it is updated after regular inspections throughout the whole life of a vessel. Without such a Class Certificate a vessel cannot obtain insurance and has only little commercial value and in some instances, governments may require a vessel to be classed. However, the importance of the certificate goes beyond insurance. Thus, the main objective of the Classification Societies is to enhance the safety of life and property at sea by ensuring high technical standards of design, manufacture, construction and maintenance of merchant and non-merchant vessels. Even if for many flags Classification Certificates are not mandatory, shipowners keep their vessels safe due to considerable commercial pressures. Cf. Stopford (2006: 423, 425, 453) and Alderton and Leggate (2005: 253).


\[311\] Furthermore, there are institutions as the International Labour Organization (ILO), which is one of the oldest inter-governmental agencies. Originally established in 1919, the ILO became the first specialised agency of the United Nations in 1946. The ILO principally deals with maritime labour problems and thus has been involved in developing several conventions about working conditions on board of vessels. These conventions include for instance provisions on manning, working hours, pensions, vacations, and minimum wages. The ILO’s work is a particularly important factor in ship operating economics since crewing costs account for a high proportion of the total ship operating costs. Cf. Ewert (2006: 80-81) and Stopford (2006: 448). Since organisations like the ILO are not involved in the protection of the environment, these will not be presented in the following. Furthermore, organisations with less importance for global merchant shipping than the IMO or the EMSA will not be mentioned as well.
The most important international organisation concerned with maritime matters is the **International Maritime Organization (IMO)**.

The Inter-governmental Maritime Consultative Organization (IMCO; IMO’s predecessor organisation) has been established by the United Nations in Geneva on March 6, 1948. By the time the IMCO came into operation in 1958, several important international conventions such as the SOLAS (Convention for the Safety of Life at Sea) or the OILPOL (Convention for the Prevention of Pollution at Sea by Oil) had already been developed. For instance, the SOLAS – the first international convention on maritime safety – was the result of the first International Conference on Safety at Sea in 1913-1914 which had been carried out in the aftermath of the loss of the TITANIC in 1912 when 1,489 people died and the world began to realize that maritime safety cannot be achieved without international cooperation.

The IMCO were given responsibility for ensuring that these conventions were kept up to date and that new conventions were developed as and when the need arose. In 1982, the IMCO changed its name to the International Maritime Organization (IMO) but its purposes remained unchanged. Next to the task of being a custodian of numerous international conventions, the IMO is also responsible for adopting legislation on matters related to maritime safety and the prevention of marine pollution on a world-wide basis.\(^{312}\) According to Article 1 (a) of the IMO Convention, its main purposes are “to provide machinery for cooperation among Governments in the field of governmental regulation and practices relating to technical matters of all kinds affecting shipping engaged in international trade; to encourage and facilitate the general adoption of the highest practicable standards in matters concerning maritime safety, efficiency of navigation and prevention and control of marine pollution

from ships.” Additionally, the IMO is empowered to deal with administrative and legal issues related to these purposes mentioned above.\footnote{Cp. IMO.org/SOLAS.}

In 2007, the London-headquartered IMO considers the interests of 167 member states and adopted until then about 55 different conventions and protocols. Some of the most important conventions have been acknowledged by countries whose combined merchant fleets make up approximately 98% of the world total in 2006.\footnote{Cp. Ewert (2006: 80), Biebig, Althof and Wagener (2004: 46), Alderton and Leggate (2005: 250), Li and Wonham (2005: 277), Stopford (2006: 443) and IMO.org/SOLAS.}

In the following, the organisational structure is presented in order to show how the IMO works.
Illustration 38: Organisation chart of the IMO.\textsuperscript{315}

Source: Own illustration according to Stopford (2006: 443-444) and IMO.org/SOLAS.

As mentioned above, the IMO adopted about 55 different conventions and protocols until the beginning of 2007. Two of the most important conventions the IMO adopted and updates regularly are SOLAS and MARPOL which will be presented briefly in the following.

\textsuperscript{315} Work, either of technical or legal nature is being accomplished by five specialised committees. These committees are displayed in the illustration above.

The Sub-Committees deal with a broad range of issues including for instance safety of navigation; radio communications and life-saving; life-saving appliances and arrangements (e.g. rescue boats and jackets); search and rescue; standards of training and watchkeeping; carriage of dangerous goods (e.g. classification, marking, stowage); ship design and equipment. Cp. Ewert (2006: 83) and Stopford (2006: 443).
The first version of the SOLAS Convention was the result of the first International Conference on Safety at Sea in 1913-1914 which had been carried out in the aftermath of the loss of the TITANIC in 1912. This version was adopted in 1914. After the IMO’s founding, its first major task was to adopt the 1960 SOLAS Convention which came into force in 1965 and covered various measures designed to improve the safety of shipping. Updated in 1974, it entered into force in 1980 replacing the earlier versions of the SOLAS Convention. Since the 1990s, the IMO has taken steps e.g. to regulate the standards of the shipping industry’s management because of the growing recognition that fatalities at sea and environmental pollution are very much influenced by the way companies manage their fleets.

Main objectives

Main objective is the specification of minimum standards for the construction, equipment and operation of vessels, compatible with their safety in order to prevent accidents at sea and therefore help protecting the maritime environment.

The SOLAS Convention contains general obligations concerning:
- General provisions (includes e.g. regulations for the inspection of vessels in ports of other contracting governments)
- Construction – subdivision and stability, machinery and electrical installations
- Fire protection, fire detection and fire extinction
- Life-saving appliances and arrangements (including e.g. requirements for rescue boats according to vessel type)
- Radio communications
- Carriage of cargoes (includes requirements for stowage and securing of cargo or cargo units)
- Carriage of dangerous goods
- Nuclear ships
- Management for the safe operation of ships (making mandatory the International Safety Management [ISM] Code, which requires a safety management system to be established)
- Safety measures for high-speed craft
- Special measures to enhance maritime safety (referring to authorisation of recognised organisations, port state control)
- Special measures to enhance maritime security (making mandatory the International Ship and Port Facilities Security [ISPS] Code, which is concerned with several security precautions in order to prevent terrorist attacks)
- Additional measures for bulk carriers

<table>
<thead>
<tr>
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</tbody>
</table>

Table 17: SOLAS at a glance.
Flag states are responsible for ensuring that vessels flying their flag comply with the convention’s requirements and several certificates are prescribed in order to prove observance with the required standards. Furthermore, control provisions allow contracting governments to inspect vessels of other contracting states in case of having a suspicion for believing that the vessel and its equipment do not fulfill the requirements of the SOLAS Convention. This procedure is called “port state control”\(^{316}\).

316 Regulations in terms of maritime safety and environment are developed at national and international levels. Individual countries set their own rules and standards related to the various technical aspects of vessels and navigation in order to enhance safety and environment standards. Countries regulating vessels under its registration are so-called flag states. The ship as well as its owner become subject to the laws of that particular country. The registration makes the vessel an extension of national territory while being at sea.

In general, there are 4 main consequences of choosing to register in a particular country:

1. **Tax, company law and financial law:** Since companies that have registered their vessels in a particular country become subject to that country’s commercial laws, and these laws determine for instance the company’s liability to pay tax and may impose regulations in such areas as employment of staff or auditing of accounts, the choice of a register very much affects the economics of the business.

2. **Compliance with maritime safety conventions:** The registration under a country that has ratified the SOLAS Convention and strictly enforces it makes shipowners maintain high standards in vessel operation while a country that has not ratified SOLAS may allow shipowners savings on equipment and maintenance.

3. **Crewing and terms of employment:** Some flag states that insist on the employment of nationals and thus cutting the shipowner’s freedom of decision-making in terms of crewing.

4. **Naval protection:** A country’s navy is responsible for the protection of the vessels flying its flag. Although this is less important nowadays, during the war between Iran and Iraq in the 1980s shipowners decided to fly the flag of the USA to be under the protection of their naval forces in the Gulf.

According to the United Nations Convention on the Law of the Sea (UNCLOS), the flag state is responsible and obliged to exercise its jurisdiction and control concerning administrative, technical and social matters over vessels flying the country’s flag. This means to maintain a register of vessels, their masters, officers, and crews, and to take all steps necessary to ensure safety at sea, including regular inspections. Flag states have to ensure that vessels flying their flag comply with international rules and standards, through adoption of the legislation and effective enforcement without regard to where the violation occurred. Cp. Ma (2002: 405) and Stopford (2006: 428, 431-432).

In contrast to the flag states, **port states** are countries in whose ports vessels (regardless of their flags) are calling. Many international conventions such as SOLAS require surveys to be carried out by the port state’s authorised officers in order to verify that the necessary certificates and documentation are on board, complete and valid. These officers have the power to prevent a vessel from leaving the port, whenever there is a reasonable suspicion that the certificates or the documentation are incomplete or invalid or the vessel’s conditions or its equipment are inadequate according to the certificates and documentation. The port state is responsible for preventing the vessel from sailing until it can operate without endangering persons, property or the environment. This is called port state control. Cp. Ma (2002: 405).


Source: Own illustration.
Table 18: **MARPOL at a glance.**

<table>
<thead>
<tr>
<th>MARPOL</th>
<th>Convention for the Prevention of Pollution from Ships</th>
</tr>
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<tbody>
<tr>
<td><strong>Brief history</strong></td>
<td><em>In the first half of the 20th century, oil pollution of the marine environment was recognised as a problem which has induced various countries to introduce national regulations in order to control oil discharge within their territorial waters. The process of developing legislation at an international level started with a conference on oil pollution organised by the United Kingdom in 1952, which resulted in the adoption of the International Convention for the Prevention of Pollution of the Sea by Oil (OILPOL) in 1954 and entered into force in 1958. The convention primarily addressed the problem of oil tankers carrying ballast water in their cargo tanks which they then discharge to reload cargo, it inevitably contains a certain amount of oil, which pollutes the marine environment. This pollution resulting from routine operations and additionally from the discharge of oily wastes from machinery spaces was regarded as the major causes of oil pollution from ships. In order to prevent coastal areas from oil pollution, the convention established so-called prohibited zones extending at least 50 miles from the nearest land. During the 1960s, as the pressure on marine environment increased due to a rise in the carriage of large quantities of toxic materials by sea, the need was seen for a more broadly based convention on marine pollution. And after the tanker TORREY CANYON ran aground in the English Channel in 1967, spilling her entire cargo of 120,000 tons of crude oil into the sea, the IMO started negotiations about the International Convention for the Prevention of Pollution from Ships (MARPOL) besides the already existing OILPOL. In 1973, the MARPOL Convention finally was adopted but since it did not achieve the necessary majority of ratifying parties, its contents have been absorbed by the protocol of 1978. Thus, the MARPOL Convention is a combination of these two treaties and is known as MARPOL 73/78. The MARPOL Convention prescribes for instance that tankers must be fitted with oil discharge and monitoring equipment, and that they must have slop tanks.</em></td>
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</tbody>
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The main objectives of the MARPOL Convention is the prevention of pollution from oil, bulk chemicals, dangerous goods, sewage, garbage and atmospheric pollution, and the development of provisions such as those which require oil tankers to have a double-hull or an oil record book.

The MARPOL Convention’s regulations aim at preventing and minimising the pollution of the marine environment by vessels that may be caused both accidentally and in the course of routine operations (Annexes I & II must be accepted by states parties while the others are voluntary):

- **Annex I.** Regulations for the prevention of pollution by oil
- **Annex II.** Regulations for the control of pollution by noxious liquid substances in bulk
- **Annex III.** Prevention of pollution by harmful substances carried by sea in packaged form
- **Annex IV.** Prevention of pollution by sewage from ships
- **Annex V.** Prevention of pollution by garbage from ships
- **Annex VI.** Prevention of air pollution from ships

Statistics (2004) indicate that over 99.98% of all oil carried by vessels reaches its destinations without any incident and casualty rates are lower compared to those of other modes of transport. Despite these facts, there is an increasing worldwide intolerance of vessel accidents due to the great impact on the environment. In order to respond to this intolerance, the MARPOL Convention’s Annex I includes two regulations adopted in 1992, concerning new tanker’s construction standards and concerning the upgrading of safety standards of existing tankers. These regulations require for instance, that tankers ordered after July 1993 must have a double-hull or an equivalent design.

According to a study carried out in 1997, double-hull tankers are expected to reduce oil spills in the event of an accident by 40% to 70% depending on the vessel size.


Source: Own illustration.
Table 19: Overview of the MARPOL Annexes and their dates of entry into force.

<table>
<thead>
<tr>
<th>Annex</th>
<th>Entry into force</th>
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<tbody>
<tr>
<td>Annex I: Regulations for the prevention of pollution by oil</td>
<td>Entry into force: 2 October 1983</td>
</tr>
<tr>
<td></td>
<td>Revised Annex I: 1 January 2007</td>
</tr>
<tr>
<td>Annex II: Regulations for the control of pollution by noxious liquid substances in bulk</td>
<td>Entry into force: 6 April 1987</td>
</tr>
<tr>
<td></td>
<td>Revised Annex II: 1 January 2007</td>
</tr>
<tr>
<td>Annex III: Prevention of pollution by harmful substances carried by sea in packaged form</td>
<td>Entry into force: 1 July 1992</td>
</tr>
<tr>
<td>Annex IV: Prevention of pollution by sewage from ships</td>
<td>Entry into force: 27 September 2003</td>
</tr>
<tr>
<td>Annex V: Prevention of pollution by garbage from ships</td>
<td>Entry into force: 31 December 1988</td>
</tr>
<tr>
<td>Annex VI: Prevention of air pollution from ships</td>
<td>Entry into force: 19 May 2005</td>
</tr>
</tbody>
</table>

Source: Own illustration according to IMO.org/MARPOL.
Some experts are of the opinion that governments seldom act without being spurred on by media attention and public outrage at some current catastrophe and thus the history of governmental and international commitment to safety is in most cases the history of maritime tragedies. And since the regulatory process is to some extent one of reaction to a problem, many modern rules and regulations on safety can be traced back to the TITANIC tragedy. This exactly is what critics reproach the IMO for. Examining the IMO’s decision-making process, it is obvious that its regulations are usually developed as reactions to specific events rather than as a result of systematic examinations and analysis. Additionally, some experts say that a disaster with many casualties which maybe occurs only once in a long period of time, has frequently taken priority over multiple incidents involving few casualties which may in total add up to a greater number of fatalities over the same length of time. Furthermore, critics blame the IMO for often being dedicated to what is regarded important to please public opinion.\textsuperscript{317}

\textsuperscript{317} Cp. Alderton and Leggate (2005: 250) and Li and Wonham (2005: 282).
The next organisation of great importance for merchant shipping is the **European Maritime Safety Agency (EMSA)**. This agency was created in 2002, in the aftermath of the ERIKA and PRESTIGE oil tanker accidents in order to contribute to the enhancement of the overall maritime safety system in the European Union. Generally, the EMSA aims at providing technical and scientific advice to the European Commission and member states of the European Union in terms of maritime safety and the prevention of pollution of the marine environment by vessels and thus protecting EU’s member state’s coastal areas. This includes continuous updating and developing of new legislation, monitoring its implementation as well as evaluating the effectiveness of these rules and regulations. EMSA officials cooperate closely with maritime services of the European Union’s member states and works on the improvement of the cooperation between the individual member states in all key areas. Some of these key areas the EMSA is involved are for instance the strengthening of the port state control regime, the establishment of a Community vessel traffic monitoring and information system, auditing of Classification Societies recognised by the EU or the development of a common methodology for the investigation of maritime accidents.\(^{318}\)

However, the founding of the EMSA has not gone without criticism. Since the IMO is an internationally recognised authority in terms of global shipping issues and is constantly working on improving existing safety standards, according to some experts it is to be feared that the initiative of the European Union could lead to conflicts between the IMO and the EMSA. The same experts are of the opinion that these two organisations should establish a closer cooperation or even reject the idea of having an individual European authority, because it might complicate shipping when shipowners have to adapt to

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different codes and regulations for different countries instead of adapting to only one valid guideline.\textsuperscript{319}

Illustration 39: Organisation Chart of the EMSA.

Source: Own illustration according to EMSA.europa.eu/Organisation.

For further information go to:
http://www.emsa.europa.eu/
4.2. Independent actions taken by companies to facilitate sustainable behaviour

As the demand for transport services has risen, so has the demand for maritime services in general. According to some experts, this development resulted in a demand-induced increase of shipping services supply, produced by an increase of the worlds’ total fleet number, which in turn led to tightened competition among shipping companies trying to achieve or defend a cost-leadership position. On the cost side of doing business, savings are often achieved by reducing or neglecting technical maintenance of vessels, or cutting down on crew sizes, enlarging the risk of technical failure or human misbehaviour and thus ultimately increasing the risk of accidents, harming crew members and causing pollution.

In spite of this development, companies have started to follow a differentiation strategy rather than a cost-leadership position by running their business in a more environmentally friendly manner. Being aware of the fact that a socially and environmentally responsible way of conducting business not only presents higher costs, but also produces benefits like a positive reputation, an easy adaptation to coming legislation, or the attraction of customers and suppliers, some companies have begun taking voluntary steps towards maritime transport service.

This is for the reason, that compliance to rules and regulations set by the various institutions is not sufficient to achieve sustainability, as they basically require no more than mimimal efforts to operate on a legal level. And apart from shipping companies, the environmental performance of all participants in a logistics chain, such as shippers, ports, suppliers etc. has to be looked at, as their influence on the success of sustainable transport is as big as that of shipping companies. The following illustration provides an overview of shipping and its business environment.\[320\]

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Illustration 40: Shipping and its business environment.

The market calls for a more proactive and transparent approach to handling environmental issues.


Many parties of the transport chain are becoming aware of their responsibility towards society, and start to correspond to this by implementing a management principle called Corporate Social Responsibility. While the implementation of such a principle portrays a positive and logical extension of the awareness of a company’s responsibility, it is also considered to be a yardstick of good management.

The idea of Corporate Social Responsibility can be divided up into three segments: Social Responsibility, Social Responsiveness, and Social Obligation. Social Obligation is the very minimum of fulfillment of legal and social requirements, obeying laws and self-limiting one’s social duty to its stakeholders. Going any further beyond economical or legal standards and requirements is not the intention of Social Obligation.
Going one step further and adding an ethical component to decisions leads a company to Social Responsibility. Business-related decisions are not only founded on the principle of economic sense but also on the moral aspect of if the company’s activities are ‘the right things to do’. Social Responsibility is a long-term decision framework and a state of being.

Complementing the Social Responsibility is the Social Responsiveness, which rather focuses on mid- to long-term decisions and is a constant process of adaptation to changing social conditions. Guided by social norms, decisions made by the management help a firm to stay responsible by constantly responding to changes of the social environment.321

**Illustration 41:** Levels of social involvement.


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In the following, a few examples of socially responsible companies will be given. In the case of IKEA, the company states the presence of an environmental policy and the date of the last Environmental Action Plan later than February 1, 2006, a prerequisite for shipping companies when asking for transport services. Ericsson requires its business partners to have an Environmental Management System (EMS)\(^\text{322}\) equalling ISO 14001 implemented. Having that EMS certified is not required, but highly favoured. BP, and several other energy companies, contemplated an extension to the industry-wide supplier database towards information concerning that supplier’s commitment to safety, health, and environment protection.\(^\text{323}\)

But the requirement of environmentally friendly behaviour apart from regulations is no invention of modern days. Voluntary environmental regulations between companies, trade associations and regulators date back to the late 1980s, when a steadily growing interest in environmental issues could be recognised.\(^\text{324}\)

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\(^{322}\) The corporate environmental management takes into consideration the aim of environmental protection in all areas of planning, realisation, and controlling of economic activity with the focus on reducing or preventing environment pollution and on a long-term protection of business objectives.

Some of these environmental protection actions are taken in order to meet existing law while other actions are taken voluntarily. In the following, a main focus is on the voluntary actions.

Environmental management standards shall support organisations with the introduction of EMS and appropriate instruments, with the aim of thereby making a contribution to sustainable development on a voluntary basis. The constant adherence to standards should therefore lead to more environment protection than legislation demands. Cp. Gastl (2005: 28).


4.2.1. Environmental Management Systems

According to empirical studies companies are more willing to join voluntary environmental programmes, such as ISO 14000 – which is considered being the most widely recognized programme worldwide – when they are for instance in closer contact with the end-consumer or when they are concerned about their image.

Furthermore, when companies experience strong competitive pressure, are subject to pressure from their stakeholders or have poor environmental records, they are more engaged in taking voluntary environmental actions than others.\(^{325}\) Prakash and Potoski are of the opinion that voluntary environmental programmes are like green clubs and companies joining these clubs gain exclusive, reputational benefits from their stakeholders (including regulators, customers, and environmental groups) due to the fact that such a club membership signals that its members take progressive environmental action. Thus, companies could build trust and enhance their standing with stakeholders and particularly with government officials enforcing regulations.\(^{326}\)

The difference between environmental actions taken due to a regulatory framework and environmental actions taken voluntarily is outlined in the following: “While command and control regulations seek to persuade firms to adopt such policies via the stick of mandatory enforcement, green clubs seek to

\(^{325}\) Admittedly, these voluntary actions sometimes are not that voluntary as it may seem. Because end-users for instance may demand more environmental protection of companies from which they buy their goods and may appreciate the establishment of an Environmental Management System. And the decision to buy a product or not very much depends on the impression a consumer has of a company. Additionally, it is to mention that more and more consumers are willing to pay more for products which are manufactured in a sustainable way. Furthermore, some companies only want to cooperate with others that join green clubs as well due to their standing with stakeholders (e.g. IKEA). Cp. Prakash and Potoski (2006: 137) and DVZ (2006p: 18).

do so via the carrot of enhancing a firms’ reputation through their membership in the club.”

But a company’s standing can only be enhanced if the green club carries a positive brand reputation among the stakeholders of the club members. A positive brand image can be attained by both demanding standards, which are the policies and programmes green club members have to adopt, and strict enforcement rules by which clubs make sure that its members adhere to these club standards. The ISO 14000 standards, for instance, define how members have to organise internal operations with regard to the environment. Within these standards, ISO 14000 requires its members to establish policies, structures and systems which make sure that a company complies with the law while encouraging them to exceed the requirements of the law. These policies, structures and systems are known as an environmental management system or EMS. For joining ISO 14000, companies have to subject their EMS to third-party audits in order to confirm that their facilities have met the required standards. These audits have to be carried out because of the ISO 14000’s enforcement rules which define a system of external audits and certifications (this also includes re-audits and re-certifications after a specified period of time). The aim of these enforcement rules is to identify and exclude members who fail adhere to the club standards. Furthermore, it has to be mentioned, that a green club’s reputational benefit is likely to be deemed higher by companies if the club fits well within the context of the environmental policy. And thus makes it more attractive for companies to join such clubs.


328 Generally, a management system refers to what an organisation does in order to manage its processes or activities to make their products or services meet the company’s objectives such as satisfying the customer’s requirements regarding quality and service or meeting environmental objectives. Cp. ISO.org and Engelfried (2004: 84).

The following paragraph gives a brief overview of the benefits for companies establishing an EMS or joining a green club while the disadvantages will be mentioned later on in chapter 4.2.1.1. and 4.2.1.2.

Illustration 42: Advantages of establishing an EMS.


According to common literature, there are even more advantages (such as increased credibility or avoidance of liability claims) of establishing an EMS. But since these resemble the above listed advantages, the given examples will be sufficient.
Admittedly, various surveys about the real economic benefits of implementing an EMS uncovered that some high hopes in positive external effects such as improved relationships to customers, public authorities, banks and insurance companies or competitive advantages were mostly disappointed. But regarding advantages like transparency of tasks, employee motivation, environmental awareness, cost reductions and increasing efficiency a company’s expectations were nearly completely fulfilled.\footnote{Cp. Becke (2004: 34) and Düsseldorff, Lohre, Wuppermann and Dobischat (2002: 188).}
4.2.1.1. ISO 14000

The Geneva-based International Organization for Standardization (ISO) is a non-governmental organisation that was created 1947 as a merging of its two predecessors, the International Federation of the National Standardizing Associations (IFNSA, founded in 1926 to develop standards in the upcoming branch of mechanical engineering) and the United Nations Standards Coordination Committee (UNSCC, founded in 1946 to help allied war efforts and aid in reconstruction after the Second World War ended). The main objective of the ISO is to facilitate international trade and commerce by developing voluntary common international standards and codes for products, materials, and processes. Since varying standards across countries create transaction costs that undermine trade, the ISO’s work is globally appreciated. Until 2006, the ISO has produced about 14,000 standards. In order to develop these standards, the ISO consults key participants, including companies, regulators, and other relevant stakeholders, through technical working groups comprising experts coming from all over the world.\(^{331}\)

In 1996, the ISO launched the ISO 14000 family of standards that were developed to meet the needs of business, industry, governments and consumers in the field of environment. This compilation is a series of standards which are based on principles similar to those of ISO 9000\(^{332}\). They consist of a certification standard (ISO 14001), and eighteen guideline standards governing environmental labelling (14020 and 14021), environmental performance evaluations (14031), and life-cycle assessment (14040-43, 14048-49).\(^{333}\) This ISO 14000 family provides management tools for organisations in order to help


\(^{332}\) The ISO 9000 family of standards (quality management system) “represents an international consensus on good management practices with the aim of ensuring that the organisation can time and time again deliver the product or services that meet the customer’s quality requirements, and applicable regulatory requirements, while aiming to enhance customer satisfaction, and achieve continual improvement of its performance in pursuit of these objectives.” ISO.org.

them controlling the environmental impact of its activities, products or services and improving their environmental performance continually and thus, minimising the harmful effects on the environment caused by the organisations’ activities. According to the International Organization for Standardisation, these tools can provide tangible economic benefits such as reduced raw material/resource use, reduced water generation and disposal costs as well as reduced energy consumption. For obtaining the ISO 14001 certification, the International Organization for Standardization requires companies to implement an environmental management system which makes possible a structured approach to setting environmental targets, to achieving these and finally to demonstrating that these have been achieved.334

The certification itself is not given by the ISO, but rather by accredited bodies that specialised on the certification of companies of a specific branch. These accreditation bodies in turn have to be certificated by the ISO in the first place. Furthermore, accreditation bodies conduct audits and assessments of companies in order to verify that these companies implemented the management system in conformity with the requirements of the standards prior to granting certificates.335

The reasons for striving for an ISO 14001 certificate are the benefits mentioned in chapter 4.2.1.

Disadvantages of the ISO 14000 standards are for example that these standards are presented too much in the abstract and provide only little information about the way a company can measure, assess or present its environmental performance. Additionally, the implementation of an environmental


335 Cp. ISO.org.
management system which is a prerequisite to get an ISO 14001 certificate consumes financial means\textsuperscript{336} and keeps employees occupied.\textsuperscript{337}

Further information about the ISO 14000 family of standards and the implementation process for instance is provided by the ISO home page:

\textit{http://www.iso.org}

\textsuperscript{336} The cost of ISO certification can range from approximately 23,000 € to 91,000 € (or even more) per facility. Thus, for a company with twenty facilities, these costs could add up to 1,820,000 € (or even more). Cp. Prakash and Potoski (2006: 27).

4.2.1.2. **EMAS**

The Eco-Management and Audit Scheme (EMAS) was first introduced in 1993 as an environmental policy tool that was devised by the European Commission, in a step towards achieving the Commission’s objective\(^{338}\) of sustainable development. Since 1995, EMAS was open for voluntary participation by companies and its scope restricted participation to companies in industrial sectors only. A new EMAS regulation that came into effect in 2001 constituted an extension of the scope to all economic sectors including public and private services. The voluntary EMAS registration of public and private organisations is only available for organisations operating in the European Union, in candidate countries awaiting their accession to the EU or in the European Economic Area (EEA), which additionally includes Iceland, Liechtenstein, and Norway. EMAS is considered to be a new form of reflexive or indirect regulation in European environmental policy because its registration requires an organisation to adopt an environmental policy that contains commitments to comply with all relevant environmental legislation as well as commitments to achieve continuous improvements in the organisation’s environmental performance. The thing about EMAS is that it is based on the main principle of controlled self-responsibility of organisations – EMAS combines market-based incentives with the self-regulation of companies in environmental matters with external controls carried out by independent environmental verifiers. The registration process of EMAS is briefly described in the following.\(^{339}\)

\(^{338}\) The overall objective of the European Union regarding the environment as defined in the Maastricht Treaty is the promotion of “harmonious and balanced development of economic activities, sustainable and non-inflationary growth respecting the environment…the raising of standards of living and quality of life.” To attain the European Union’s objective of sustainable development a wide range of instruments for environmental policy needs to be established. These instruments shall for instance give the right incentives for environmental improvements for economic activities. Cp. Europa.eu/EMAS/FAQ.

Firstly an organisation has to do an initial environmental review in order to uncover its interactions with the environment. Afterwards, the organisation has to develop an environmental policy in which its environmental goals are defined. The formulation of an environmental policy that is reflecting the organisation’s commitment to continuous improvement in environmental performance within the legal framework is the first visible step of the process. Based on these general aims of the environmental policy and on the results of the review, an effective environmental management system aiming at improving the environmental performance has to be established. The environmental management system contains for instance the organisational structure of the environmental management, its responsibilities as well as the resources for the goal attainment. In the next step, an environmental audit is carried out by a third party to provide external credibility to the environmental management system. Furthermore, this third party has to verify an environmental statement containing environmental performance data which has to be published.\textsuperscript{340}

\textsuperscript{340} Cp. Becke (2004: 21) and Europa.eu/EMAS/FAQ.
The reasons for striving for an EMAS registration are the benefits mentioned in chapter 4.2.1.

The disadvantages of EMAS are similar to those of the ISO 14000 family. There are for instance the relatively high costs\(^{341}\) including expenditure on personnel, costs for registration fees, environmental verifiers and often – due to a lack of know-how – costs for environmental consultancy. Furthermore, since EMAS goes one step ahead of the ISO 14000 family it requires companies to make more of an effort which might be the reason that less than 1% of the companies existing in the European Union are registered under EMAS. Some companies for example shrink from publishing their environmental performance data.\(^{342}\)

Although ISO 14000 and EMAS basically have the same goals, there are some differences which will be outlined in the following table.

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\(^{341}\) The average entire costs of EMAS participation for companies with less than 20 employees amount approximately 34,500 €. Cp. Becke (2004: 37).

Table 20: Comparison between EMAS and ISO 14000.

<table>
<thead>
<tr>
<th>Comparative features</th>
<th>EMAS</th>
<th>ISO 14000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coverage</td>
<td>European Union, candidate countries and EEA</td>
<td>worldwide</td>
</tr>
<tr>
<td>Involvement of public authorities</td>
<td>In the process of registration</td>
<td>No</td>
</tr>
<tr>
<td>Legal compliance</td>
<td>It is a prerequisite for registration also involving public authorities</td>
<td>Less tight than EMAS – legal requirements should be met</td>
</tr>
<tr>
<td>Preliminary environmental review</td>
<td>Verified initial review</td>
<td>No</td>
</tr>
<tr>
<td>External communication and verification</td>
<td>Publication of environmental policy, environmental management system, environmental programme, environmental performance</td>
<td>Environmental policy has to be made accessible to public</td>
</tr>
<tr>
<td>Audits</td>
<td>Audits refer to the EMS as well as to the environmental performance; frequency of audits: intervals of no longer than 3 years; annual updating of the environmental performance to demonstrate continuous improvement</td>
<td>Audits refer to the EMS; no specification of frequency and methodology</td>
</tr>
<tr>
<td>Commitments and requirements</td>
<td>Employee involvement, continuous improvement of environmental performance, compliance with environmental legislation</td>
<td>Commitment of continuous improvement of the environmental management system rather than continuous improvement of environmental performance</td>
</tr>
</tbody>
</table>

4.2.2. Clean Cargo Group

The ‘Clean Cargo Group’ is a working group of the non-governmental ‘Business for Social Responsibility’ group and focuses on making the entire transport business more sustainable. This vision has been extended to social responsibility towards employees and communities and is being pursued on a business-to-business co-operative platform. Among the member companies are:

| - APL                  | - Yang Ming Marine Transport Corporation |
| - CMA-CGM             | - Wal-Mart Stores, Inc. |
| - Gap, Inc.           | - Chiquita Brands, Inc. & Great White Fleet, Ltd. |
| - Hapag-Lloyd         | - Cosco Container Lines |
| - IKEA                | - Hanjin Shipping co. Ltd. |
| - « K » Line          | - Hyundai Merchant Marine |
| - Maersk Line         | - Nordstrom, Inc. |
| - NIKE, Inc.          | - Starbucks Coffee Company |
| - NYK Line            | - The Coca-Cola Company |
| - OOCL                | - The Home Depot, Inc. |
| - UPS                 | - Toyota Motor Europe |
| - Timberland          | - Wallenius Wilhelmsen Logistics |
| - Schenker AG         | |

The group’s main approach to achieving sustainable transport and social responsible work is to develop management guidelines that help other companies to monitor and improve their transports’ performance, with the aim to merge the mere product ‘transport’ into the general corporate supply chain management.

343 Carriers and shippers of cargo.
It is acknowledged that maritime transport, although being the most overall sustainable form of transport, is the largest emitter of sulphur emissions within the transport sector. Then again, each mode of transport has its own set of drawbacks, for instance road transport is an important factor in the congestion of roads and the pollution of urban areas. Ocean ships present a danger for maritime ecosystems by threatening to bring alien species into local waters, whereas airplane transport features the highest fuel consumption per tonne and amplifies its emission of ozone-depleting gases by emitting them in high altitude.

On the contrary, the Clean Cargo Group not only means responsibilities, but benefits as well. Those can be distinguished between benefits for business and benefits for communities and the environment.

Benefits for business include increased trust through working on mutual interests; enhanced brand recognition by both investors and consumers, as the public becomes more and more aware of and contented with the concept of sustainability; increased efficiency as the cooperation of companies helps reduce interface slots and thus increases overall performance; and competitive advantages by attaining first-mover advantages due to early preparation and implementation of environmental impact-reducing equipment and thus taking pro-active measures when a new regulation comes into force and implies investments into refitting vessels.

Benefits for the community and the environment include abating global warming by reducing emissions; healthier cities by relocating transport away from heavily-populated areas and thus reducing transport’s impact on peoples’ health; improved stakeholder relations, as environmentally sustainable policies present a position of strength when negotiating with stakeholders of the industrial and non-industrial sectors; enhanced labour conditions by increasing awareness for safety issues and improving working conditions for employees; and root-cause improvements by being in advance of national and international
legislation and having first-hand experience of the origin of environmental concerns.344
4.2.3. Examples of selected individual actions taken in the maritime sector

The German ship owner Rörd Braren refitted some of his vessels with environmentally friendly equipment, even though that meant higher investment costs as well as higher costs for maintenance, leading to more expenses over time. For instance, Braren had catalytic converters be installed into some of his vessels, and opted for using low sulphur fuel. These changes resulted in a reduction of NO\textsubscript{X} of 90%, as well as of SO\textsubscript{2} of 33%\textsuperscript{345}. He stated that in Europe incentives for enhancing sustainability were varying from country to country. Promising approaches are the IMO conventions that make double-hull tankers mandatory and a Swedish programme giving significant incentives to refit vessels with more environmentally friendly equipment. Taking one of his vessels as an example, he calculated all costs for installing and maintaining mandatory equipment and subtracted all incentives, financial aids, and discontinuations of fees and discovered that the instalment and annual net outlay for a single 4,250 grt vessel is 83,312 €\textsuperscript{346}. Nevertheless, he outfitted three of his four vessels with catalytic converters to promote the idea of environmentally friendly and sustainable transport\textsuperscript{347}.

The shipping company Evergreen Marine contributed to environmental protection with the construction of their new S-type container vessel. Trying to combine cheap shipping prizes with the minimisation of environmental impact of marine transport, the 7,024 TEU-vessel features double-hulls, oily water separators, bilge separators and bilge oil tanks, sewage tanks, carbon dioxide emissions-reducing engines, and electric deck machinery to replace hydraulic devices, which further reduce oil pollution\textsuperscript{348}. These features have cost the company 5 million $ per ship, with an additional 400,000 $ per year and ship

\textsuperscript{345} Cp. O’Mahony (2006b: 3).
\textsuperscript{346} Cp. O’Mahony (2006b: 3).
\textsuperscript{348} Cp. Lloyd’s List (2006f: 11).
as maintenance. With an estimated lifetime of 20 to 30 years, this makes a total of 13 million $ to 17 million $ per vessel. These figures apply to all ten S-type vessels delivered or in production. Explaining the company’s philosophy, founder Dr. Chang said that Evergreen Marine would not wait until legislation would be put into force, but use the latest technologies available to meet environmental issues. As a proof of rising awareness of environmental aspects of seaborne transport, the British government reacted to this devotion and awarded Chang the title of ‘Commander of the British Empire’.

Hapag-Lloyd takes efforts to increase sustainability of sea transports by repainting ships with tin-free silicone-based hull coatings. Such lacquers resign the usage of tin which might leach into the sea. Utilizing International Marine Coating’s Intersleek coating, vessels can save up to 6% fuel, adding economical to environmental benefits. The Intersleek coating is a low friction and slippery when wet surface painting, that greatly reduces the ability of fouling organisms to attach themselves to a ship’s hull and thereby reduce its speed and over time increase its fuel consumption. Those that are still able to do so are easily removed, either automatically by travelling at higher speed, or manually by washing when the ship is scheduled for maintenance at dry docks.\textsuperscript{349}

On the land side of transport, the ports of Los Angeles and Long Beach are examples of landside efforts for the reduction of the emission of ozone-depleting gases, which may serve as exemplars for European ports. In 2006, a Clean Air Action Plan (CAAP) has been announced, reducing emissions in both ports.\textsuperscript{350} In 2002, much of the cargo-handling equipment in the port has been reequipped or replaced by newer models, including electrical

\textsuperscript{349} Cp. O’Mahony (2006c).
\textsuperscript{350} Cp. PortOfLosAngeles.org/air.
Furthermore, port management and shipping companies agreed on voluntarily not going faster than 20 knots within 20 nautical miles of the port. These measures have reduced the emission of NO\textsubscript{X} by 14\% and of particulate matter by 60\%. Furthermore, the port of Los Angeles offers vessels a land based power supply (the so-called cold ironing). With electrical power available, the need for running engines and burning fuel without moving in order to create the power needed for operating the ship’s system is removed. It is estimated that use of the port’s electrical power supplies saves a ton of NO\textsubscript{X} and half a ton of SO\textsubscript{X} per ship per day.\footnote{Cp. PortOfLosAngeles.org/environment.}

Another approach to reducing a company’s environmental footprint is the use of low emission loading trucks on the landside. For instance, Wallenius Wilhelmsen ordered 11 low emission tractors and 13 low emission trucks from Kalmar to further reduce air pollution in its shipping business. These trucks feature catalytic exhaust purifiers and electronically controlled diesel engines and thus help reducing onboard emissions. Also using low emission ro-ro trucks, the Stena Line has been awarded the classification society Det Norske Veritas.\footnote{Cp. Lloyd’s List (2006g: 15).}
4.3. Technical possibilities

After demonstrating in the previous sections that regulations set by the IMO and EMSA as well as company policies facilitate environmental friendliness, this chapter will focus on technical possibilities to minimise the environmental disturbance of each single vessel. These possibilities can be divided into two sections, firstly economising the consumption of resources, and secondly optimising resources and affiliated technologies themselves.

Illustration 43: Vessel in the Kiel Canal.

Source: Neumann.
4.3.1. Economising resources

This part of technical possibilities deals with a reduction of environmental pollution by reducing the total amount of resources consumed, rather than an improvement of efficiency. Two main approaches are known for the reduction of fuel consumption on a voyage. These are a reduced speed during the voyage, which increases voyage time, but reduces the emission of ozone-depleting gases, and the concept of Skysails, which aims at lowering fuel consumption without lengthening voyage times by adding an alternative source of propulsion to a vessel.
4.3.1.1. Cutting the Speed

One effective means of reducing environmentally harmful emissions is to reduce speed, since fuel consumption correlates exponentially to the voyage speed. Several shipping companies have taken up this idea and reduced the operational speed of their vessels by 4 knots, saving around 30% of fuel.\textsuperscript{355} Yet this is done mostly for economical rather than ecological reasons. Calculated with a 8,200-TEU-vessel, a speed reduction from 26 to 22 knots and an oil price of $ 300 per tonne, the shipping company would save $ 24,000 per day.\textsuperscript{356}

Then again, regarding the output of emissions it hardly matters whether the reason for a reduced speed is of economical or ecological nature. On the contrary, going at a lower speed means taking a longer time for a run. Shipping companies counter this effect by deploying additional vessels to a route, claiming that this will result in an increased punctuality as well as in net savings even though more vessels are in duty.\textsuperscript{357} The last advantage is that less vessels remain unused in ports, which takes tonnage out of the market.\textsuperscript{358} Thus, by adding one more vessel to a route, several benefits can be created: net savings of fuel costs, reduction of emissions, increased punctuality, and less tonnage being unused.

But one has to take into consideration that a reduced speed can result in the deployment of additional vessels to a route which can set off the achieved benefits of reduced emissions and fuel consumption by these additional vessels.


\textsuperscript{356} Cp. DVZ (2006k: 8).

\textsuperscript{357} Cp. Porter (2006: 1).

\textsuperscript{358} Cp. DVZ (2006l: 9).
4.3.1.2. **SkySails**

SkySails, invented by the Hamburg-based company SkySails GmbH in 2005, is a large kite, similar to a paragliding kite that is being fixed to a ship’s bow. Fitted with an automatic steering unit, its 160 square metres catch enough wind force to drive a ship at low speed without any further sort of propulsion.\(^{359}\)

**Illustration 44:** SkySails 1.

![SkySails 1](source: SkySails)

Although its performance peaks at smaller vessels with a speed of up to 15 knots, larger ships will be targeted once the SkySail concept is ready to go into production.\(^{360}\) For example, the ‘Beaufort’ reached a speed of 5 knots using only low wind power as propulsion source.\(^{361}\)

As pointed out in chapter 2.3, the voyage cost is the most decisive criterion for the choice of mode of transport. Under optimum wind conditions fuel

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\(^{359}\) Cp. DVZ (2006m: 1).

\(^{360}\) Cp. DVZ (2006m: 1) and DVZ (2006n: 1).

consumption could be reduced by 50%,\textsuperscript{362} and by 10 to 35% under normal wind conditions.\textsuperscript{363}

As oil prices are on the rise, any means of cost saving is appreciated by carriers. With an estimated required investment of € 500,000 amortisation periods will be approximately three years. Moreover, the use of skysails and thus the saving of fuel would significantly reduce the emission of sulphur dioxide (SO\textsubscript{2}) and carbon dioxide (CO\textsubscript{2}).\textsuperscript{364}

Due to the proven cost savings, SkySails GmbH aims at refitting 3.5% of the relevant merchant vessels and up to 360 super yachts until 2015.\textsuperscript{365}

\textbf{Illustration 45:} SkySails 2.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{sksails.png}
\caption{SkySails 2.}
\end{figure}

\begin{center}
\textit{Source: SkySails.}
\end{center}

\begin{enumerate}
\item \textsuperscript{362} Cp. Berkenkopf (2006: 12).
\item \textsuperscript{363} Cp. DVZ (2006m: 1).
\item \textsuperscript{364} Cp. DVZ (2006n: 1) and DVZ (2006m: 1).
\item \textsuperscript{365} Cp. Berkenkopf (2006: 12).
\end{enumerate}
4.3.2. Optimising resources and techniques – inventions that minimise the negative effects on the environment

As the preceding section exclusively dealt with the reduction of fuel consumption, this section will focus on other means of organising voyages more environmentally friendly. This can be achieved by either the use of liquid natural gas, by low sulphur fuel, or by non-ballast ships for example. Each of the three approaches will be explained in the following.
4.3.2.1. **Liquefied natural gas (LNG)**

Liquefied natural gas (LNG) is the result of a cooling process of compressed natural gas (CNG). CNG can be found on most oil fields as the conditions for the deposit of oil and CNG are very similar. In liquid form, natural gas consumes far less space than in gaseous form. Then again in order to transport CNG as LNG, cooling and re-gasification facilities are required, and CNG looses some of its energy storage potential while changing its condition of aggregation.\(^{366, 367}\)

Recently, ship owners have begun recognising LNG as a viable alternative energy source to diesel or bunker fuel. With the implementation of Sulphur Emission Control Areas (SECAs) and stricter regulations on emissions by the IMO Annex VI, ship owners have to deal with the upcoming need to reduce emissions and operate in a more environmentally friendly manner.\(^{368}\) One possibility would be the use of low sulphur fuel, which will be dealt with in the next section. The other option is the use of LNG. The next step in reduced-emission propulsion would be the fuel cell driven vessel, as already tested by Eidesvik Offshore.\(^{369}\) Vessels equipped with such an engine can operate up to 50% more efficiently than diesel engines and simultaneously allow further improvements.

Emissions of fuel cells would only contain heat and water; if being fuelled by carbon-containing gases, CO\(_2\) would be emitted, but emissions would be around 50% lower than compared to diesel or bunker burning engines.\(^{370}\) Further advantages of a fuel cell are the silent and vibration-free operation as well as simplified maintenance. Although the installation costs of cell fuel

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\(^{367}\) Apart from liquid natural gas and compressed natural gas there is also liquefied petroleum gas that serves as a fossil energy source. Cp. Fairplay Solutions (2006b: 18-20).

\(^{368}\) CP. MARPOL Annex VI in OECD (2003: 20ff.).


engines would be much higher than for comparable diesel engines (estimated costs are six times higher), these costs will decline in the coming years, and stricter regulations will increase costs on emissions-heavy vessels, leading fuel cell vessels becoming competitive within the next years.\textsuperscript{371}

4.3.2.2. Low Sulphur Fuel

While it is costly to refit vessels with new engines to reduce emissions, switching to a different type of fuel is easily done. MARPOL Annex VI demands that the sulphur contents of SO\textsubscript{X}-emissions do not exceed 4.5% in general and 1.5% in special areas, so-called Sulphur Emission Control Areas (SECA). The world average of SO\textsubscript{X}-emission is 2.7%.\textsuperscript{372} The first two of these areas are installed in the Baltic Sea and the North Sea, with several further areas being planned. In case the USA installed a SECA, demand for low sulphur fuel could double by 2010.\textsuperscript{373} Especially oil from the Amazon basin is in high demand, as it is low on sulphur by nature. However, not every port is going to offer 1.5% sulphur oil for ships to refuel within the next years, and prices per tonne may range from $23 to $60.\textsuperscript{374} Still, in order to be able to comply with the new IMO regulations, some ship owners plan on using 4.5% as well as 1.5% sulphur fuel, though. The type of fuel used depends on the area the ship is passing, e.g. SECAs require the use of 1.5% sulphur fuel. In other areas the cheaper 4.5% sulphur fuel could be used.\textsuperscript{375} Even though there are possibilities to reduce SO\textsubscript{X}-emissions by using 1.5% sulphur fuel, it is only used in areas where this is made mandatory. Thus, an extension of these areas would mean a greater advantage to the environment.

4.3.2.3. Non-ballast water ships (NOBS)

Non-ballast water ships (NOBS) have been developed by the Japanese Shipbuilding Research Centre in 2006. According to the centre, the building of non-ballast water ships will cost more, but will generate advantages due to operating more economically and due to being free of the IMO’s convention regarding the limiting the environmental damage caused by the discharge of ballast water and by operating more economical.

Although the research of the Japanese Shipbuilding Research Centre firstly focused on very large tankers such as suezmaxes and the largest of crude oil carriers, the concept of NOBS has been extended to bulk carriers, ore carriers and container ships as well. The improvement of existing vessel designs was achieved by adopting a broader beam and by using a raked bottom. Three main objectives were to be achieved during the invention of NOBS:

When not loaded with any ballast water, the NOBS vessel must guarantee safe operation under normal conditions, with a 3 metres draught forward and a complete immersion of the propeller, thus providing the same conditions as any conventional vessel that has loaded ballast water. The draft necessary for safe operation even in “very rough” weather conditions should be maintained with only one-quarter of the ballast water a comparable vessel would need for safe operation. An energy saving rate of at least 5% shall be achieved when compared to a conventional vessel of the same deadweight.

The main deciding factor when opting for NOBS vessels will obviously be the costs. For instance, a suezmax vessel’s construction cost will on average be $5.2 million higher than a conventional ship of the same size, due to design requirements, the broader beam and the added hull weight.

In contrast to the higher purchase price, power savings of more than 6% have been detected. These savings will over time amortise the investment via the improved propulsion performance.\textsuperscript{376}

5. **Complications for the EU at achieving the modal shift goal – advancement to co-modality**

A great challenge for the European Union is to design policies, measures and action plans for a continuously changing living environment. Since it is important for the European Union to cover the current market developments, these policies, measures and action plans have to be tested for relevance and to be adjusted continuously to match the changing framework conditions should the need arise.

**Illustration 46:** Flag of the European Union.

This could be examined at the European Union’s 2006 transport policy. Although the overall objectives of Europe’s transport policy have remained stable since its formulation in the Transport White Paper\(^377\) 2001, it became necessary for the existing transport policy to evolve in order to keep up with the changing circumstances. The main focus of the initial Transport White Paper policy – among others – has been on creating an internal European transport market, sustainable development as well as solving Europe’s environmental problems that are related to the increasing demand for transport services. The problems of rising levels of congestion of the TEN-T, pollution, CO\(_2\)-emissions and an imbalance of the modal split have been addressed by the policies. A modal

shift “from Road to Waterway” has been considered being the best alternative with regard to the environment, the congested roads and human health.\textsuperscript{378}

**Illustration 47:** Harald on the Orkney Islands.

In 2006, the White Paper’s objectives, actions and measures had to undergo a mid-term review to find out to what extent set aims have been achieved. Furthermore, it was also reviewed which objectives were still reasonable and if the chosen actions were still working towards achieving these aims. It was realised, that the measures that were created in order to achieve the “shifting the balance between modes of transport”- and the “modal shift”-objectives from road to rail or waterway were not as successful as they were intended to be.\textsuperscript{379} It was time that the transport policy had to be adjusted to meet reality – the fact that the transport mode of choice is primarily the truck. The European Union does not deem itself in the position to regulate which modes of transport are to be used. Since Europe needs all modes of transport (rail, road, air, and waterborne) in order to cope with the ever rising demand of transport services,


\textsuperscript{379} According to Berndt, one reason for this is that some member states of the European Union did not strive for reaching the ‘modal shift off the roads’-objective or that they did not support them entirely. Cp. Berndt (2006: 4).
the shift of transport is no longer regarded as being an overall aim, but rather a
regional one in places where a change of mode of transport can contribute to
improvements. Therefore the shift from road to other, more environmentally
friendly modes of transport will be pursued in sensitive areas, on long distances
and on heavily congested corridors.\footnote{Cp. European Commission (2006m: 19) and Berndt (2006: 4).}
The new main objective is called “co-modality“. “Co-modality” is the efficient utilization of every single mode of transport while optimising interface slots between them at the same time. The performance of every single mode of transport is to be strengthened as much as possible, and thereby organised more environmentally friendly, safer, and more energy efficient. Each mode of transport is to become an optimal and sustainable utilization of resources, both alone and in combination with other modes of transport.\(^{381}\)

The European Commission stated in its mid-term review of the White Paper that all modes of transport “need to be efficient, well integrated and complement each other in order to ensure seamless transport routes and well integrated transport networks, in full co-modality […] Infrastructures are the backbone of European transport systems. While the existing networks should be used as efficiently as possible with the help of new technologies, further investments are needed…”\(^{382}\)

Industry has taken up the challenge to remodel existing infrastructures and modes of transport more efficiently by optimising logistics chains. Sophisticated information and communication–technology allow for such chains to be implemented and serve as a basis for the utilization of intelligent logistics. This trend towards integrated logistics has to be complemented by a policy that sets the premises for an optimal use and linking (“co-modality”) of each of the different modes of transport. An example of such policy is the removal of regulatory barriers that hinder the linking of mode of transport, the support of education and Europe-wide exchange of experience, the advancement of standardisation and interoperability as well as investments into transport and logistics centres. The adjustment of the physical dimensions of containers and transport vehicles to meet the demands of intelligent logistics is also part of the contemplations.\(^{383}\)


\(^{382}\) European Commission (2006h: 5).

Jacques Barrot, Commission Vice President in charge of transport, commented on this issue: “The EU will continue to boost rail and waterways for long distance connections. We also need to step up our efforts to make road transport and aviation more efficient and greener. That is why I want to focus on logistics, green propulsion and intelligent transport systems which use the latest technologies.”384

According to the mid-term review, changes to the overall situation have led the European Union to the decision to remodel the transport policy from “rebalancing the transport modes” to “co-modality”:\textsuperscript{385}

• \textit{Enlargement of the European Union:}
  The enlargement to 27 member states has provided the European Union with a continental dimension\textsuperscript{386} and thus it became more diverse. While pollution, land use and congestion are main problems of the densely populated, industrialised “Middle West”, accessibility to the European market represents a main concern in other regions. Furthermore, the enlargement of the European Union increased the heterogeneity of the existing transport systems which has several consequences on the transport industry. Due to this diversity in the transport environment, certain policy areas require more differentiated solutions, which have to adapt to local, regional, and national requirements, while ensuring the development of the Europe-wide transport market.

• \textit{Evolving transport industry:}
  The profile of the transport industry went through changes since 2001. One of these changes is that more and more consolidation – especially in aviation and maritime transport – is taking place. Furthermore, the globalisation effect led to the creation of large worldwide operating logistics companies.


\textsuperscript{386} The enlargement from EU-15 to EU-25 in 2004 has already added a new dimension to Europe – the size of the Union has expanded by almost a quarter. Cp. European Commission (2006i: 26).
More than ever the transport policy has to strengthen the competitiveness of these internationally operating logistics companies and try to prevent or remove congestions and weaknesses in the logistics chain and thus contribute to making multimodal transport solutions more attractive.

- **Innovation, new solutions:**
  Transport itself has become a high-technology industry which cannot be further developed without extensive research. Therefore, the creation of new innovations receives stronger financial aids by the seventh European Supporting Programme for Research and Development (2007-2013). Some of the Supporting Programme’s topics are for instance the improvement of environmental friendliness of the land- and seaborne transport, the relief of European traffic corridors, intermodality, interoperability, intelligent logistics solutions, the development of new propulsion technologies for improved fuel efficiency, and the promotion of using alternative sources of energy.

- **Environmental commitments (e.g. Kyoto-Protocol):**
  International environmental commitments such as those under the Kyoto-Protocol have to be integrated more into the European transport policy in order to further reduce environmental damages – even though a reduction of polluting emissions could have been achieved since 1996. A major challenge represents the implementation of the objective to cut down the CO\textsubscript{2}-emissions, the noise pollution, and land use.

- **Dependency on expensive foreign oil:**
  Transport accounts for a share of 30% of the whole European Union’s energy consumption. With a high dependency on oil (about 98%), increasing oil prices have a strong influence on the transport industry.
Hence, these high oil prices work as an incentive for the development of innovative technologies that allow more efficient energy use.

• *Changed international context (e.g. terrorism, globalisation):*
  Due to the constant threat from terrorism and the economic globalisation affecting trade flows and increasing demand for international transport services, since 2001 the international context of transport has changed significantly as well and thus requires an adapted transport policy.

Finally, European governance changed as well since the basic internal market legal framework is mostly in place since the development of the White Paper in 2001.
The European Union needs more, and more flexible, means to influence traffic and national traffic legislation to reach the goal of co-modality. Therefore, the mid-term review of the European Commission’s 2001 White Paper on transport outlined a working strategy for the time after 2006. This working strategy encompasses various activities, such as for example:

- Continued consultation of stakeholders and industries
- More extensive economic analysis and assessment of impact
- Tailoring a legislation suited to the needs of the European economy

6. Conclusion

In the first chapter the reader was provided with some specific knowledge about the necessity of freight transport in order for an economy to flourish and its consequences on the environment as well as on human’s health. Furthermore the first chapter presented the European Commission’s 2001 White Paper transport policy and the 2006 Green Paper maritime policy\textsuperscript{388}.

The succeeding, second chapter’s aim was to give some information on the White Paper objective “from Road to Waterway” and to examine what is really important for customers of transport services and what could make them chose a special logistics solution. According to the expert interviews carried out by the Interreg IIIB North Sea Region project “Sutranet”, in most cases the price was the decisive factor for choosing a means of transport or a special transport solution – regardless if waterborne transport – which is deemed to be relatively environmentally friendly – is part of this transport solution or not.

In order to help improve the competitiveness of waterborne transport when compared to road transport, the European Union

\textbf{Illustration 48:} Sutranet – a project within the Interreg IIIB North Sea Region Programme.

\includegraphics[width=0.5\textwidth]{Illustration48.png}

Source: Interregnorthsea.org.

\textsuperscript{388} Some of the ideas put forward in the Green Paper generated questions and perplexities among maritime and shipping circles, but according to the European Commission, this exactly is the objective of a Green Paper because this makes all involved parties discuss appropriate policy measures. Cp. Lloyd’s List (2006e: 1).
established several programmes and projects. Some important ones, such as the “Motorways of the Sea”-initiative or the Marco Polo Programme, were presented in chapter two.

Despite all efforts of the European Union to establish projects that support transport by vessel, there still is room for improvement. This for instance is the case with the implementation of the Motorways of the Sea which are described in the European Commission’s White Paper as shipping services that are fully integrated into the European transport network from door-to-door and which are offering high frequency as well as high quality transport links. The main objectives of these Motorways of the Sea are the unblocking of land motorways on major road corridors and enhancing Europe’s economic as well as social cohesion. But without an active involvement of the whole maritime industry as well as the shippers, the freight forwarders and the transport operators, a proper implementation of Motorways of the Sea is rather unlikely. The European Commission can provide financial aid through several of its programmes for building port or hinterland infrastructures or for launching new services, but it is up to public as well as private sectors to make use of these opportunities.\(^{389}\) The involvement of all parties mentioned above needs further improvements.

The third chapter has sought to present to the reader that – even though regarded environmentally friendly – maritime transport has negative external effects on the environment as well. After providing the reader with information on the threats of maritime transport on the environment and society, in chapter four it is sought to provide the reader with several possibilities to minimise the negative effects.\(^{390}\) Initially, there are legal requirements that ship owners and


\(^{390}\) After the beginning of the elaboration of the White Paper’s mid-term review in 2005 the Commission began to develop a concept of a “register that would make European shipping more competitive, promote re-flagging and re-establishment of shipping companies in Europe, and thereby promote quality shipping.” Lloyd’s List (2006e: 1). This could help minimise the risk of accidents of vessels which are operated by inadequately trained crews.
crews have to recognise and follow while conducting their business. In chapter four, some of the most important rules and regulations set by IMO and EMSA are discussed. But compliance to the rules merely means to do the absolute required minimum to operate on a legal level which for some companies is not enough. These companies respond to environmental and social needs beyond what is mandatory by, for instance, the establishment of Environmental Management Systems (EMS) such as ISO 14001. Admittedly, this sometimes is done due to the pressure of customers who expect their transport service provider to have an Environmental Management System. IKEA for instance puts a lot of pressure on their suppliers as well as on their transport service provider to have such an EMS, otherwise IKEA would refuse to do business with them.\footnote{It is significant to bear in mind the power consumers have with their decision to buy a product or to boycott it. And since there is an increasing environmental consciousness noticeable among consumers, showing environmentally friendly behaviour is of importance for companies that sell their products to end-users. Cp. DVZ (2006p: 18).} But of course, there are companies which really voluntarily take action in order to be more environmentally friendly and which are strongly engaged in sustainable management. In the last section of chapter four, a small selection of technical possibilities to minimise the negative effects of maritime transport on the environment is briefly presented. But one needs to add that often these possibilities are not utilised to the full extent due to a lack of political incentives.
Even though policy makers took great efforts to develop actions to support sustainable development, after all, much work still remains to be done since environmental concerns have not diminished. The main objective therefore is to ensure efficient mobility without having the negative side effects. In order to keep up with future growth in transport demand, it is important to optimise the use of each mode of transport. Especially road transport which is still the predominant means of transport within the European Union, will not be able to accommodate most of the expected growth of 50% in freight transport by 2020 without severely impacting on the environment, the well-being of European citizens, the transport safety or public finances to extend the congested European road infrastructure.\(^{392}\)\(^ {393}\) Hence, a sustainable European mobility policy needs to build on a broader range of policy tools in order to achieve shifts to more environmentally friendly modes of transport where it is appropriate, especially on long distances, in sensitive areas as well as on congested corridors; while at the same time each mode of transport must be optimised. According to the European Commission, all modes of transport must become more environmentally friendly, safe and energy efficient. By adapting the 2001 White Paper’s instruments to the new context of e.g. an enlarged Europe, rising petrol prices, environmental commitments and globalisation, an advancement of the Commission’s objective from “modal shift” to “co-modality” was the result. This is what the fifth chapter is about. The term co-modality describes the efficient use of different modes on their own and their combined use resulting in an optimal and sustainable utilisation of resources. This approach is considered to be a good solution to achieve a high level of both mobility and environmental protection.\(^ {394}\)

\(^{392}\) Cp. Lloyd’s List (2006e: 1).

\(^{393}\) Smart road charging for instance contributes to a more rational use of infrastructure as the following example shows: Since Germany levies a toll, empty runs of trucks decreased by 15%. Cp. DVZ (2006o: 1) and European Commission (2006l: 1).

The development of new technologies that improve energy efficiency or reduce emissions and the use of alternative fuels will be supported to a greater extent by the adjusted transport policy. Furthermore, after the White Paper’s mid-term review the Commission aims at the creation of better synergies between road, rail and river, and a better integration of the various transport modes in logistics chains. Also, from 2007 onwards European policy will place an increased emphasis on landward connections when developing Motorways of the Sea. And since maritime transport still is subject to excessive administrative procedures, the European Union is eager to simplify these.

However, the most important aspect in shaping a European Union transport policy is to listen to the contributions of the main stakeholders involved in transport industry in order to meet the needs of companies as well as those of the environment and the society. Concerning this, there still is room for improvement.

Besides all legislation and efforts by the EU, the true power to effectively change things lies in the hands of the customers. They can put pressure on manufacturers and shippers by preferring and solely buying goods that have been created and transported in a sustainable way. This would force companies to adapt to environmentally friendly ways of conducting business. And a rising awareness of environmental issues on the customer side can be seen. This rising awareness will be more effective and more demanding than any laws, regulations or financial incentives set by national or international governments or institutions could ever be. The one thing that can truly revolutionise the

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396 Thanks to some of these new technologies, catalytic converters and particle filters, harmful emissions such as NO\textsubscript{X} and particle-emissions have been minimised considerably despite an increase in road traffic since 1991. Cp. European Commission (2006k: 6-15).


transports and logistics sector is the appreciation of nature as such, and a step back from regarding nature as a supplier of resources that can be turned into profit. This change of mind has to come to all customers, starting a chain of reaction and ultimately leading to a more environmentally friendly way of transporting goods. And remember: We all are customers!
7. **Excursus: Transport and Logistics Centres**

7.1. **The need for structured and sustainable solutions within the transport sector**

Generally there has been an exponential freight traffic growth all over Europe. Due to this the European freight transport sector faces considerable problems and challenges and therefore new solutions are necessary. On the one hand, handling these problems requires strong initiatives including traditional solutions, i.e. increasing investment in road, rail network, etc. On the other hand, these solutions are highly funded and time consuming. Because of this, new types of solutions, aiming at a more efficient use of the existing infrastructure, arise. Because of the widespread diversification of the Logistics Centre concept it is important to clarify the concept of a Logistics Centre. This concept has many names and meanings throughout Europe, some of the used names are: Transport Centre, Freight Village, Intermodal Hub, Logistic Platform, GüterVerkehrs Zentren (GVZ), Logistic Node, Intermodal Terminal, Interporto etc. Consequently this report will describe the concept using the term Logistics Centre(s).

**Illustration 49:** Transport and Logistics Centres in respectively Hoeje Taastrup and Aalborg, Denmark.
7.2. Definition of a Logistics Centre

The definition of a Logistics Centre is:

A Logistics Centre is a centre in a defined area within which all activities relating to transport, logistics and the distribution of goods - both for national and international transit, are carried out by various operators on a commercial basis. The operators can either be owners or tenants of buildings and facilities (warehouses, distribution centres, storage areas, offices, truck services, etc.), which have been built there. In order to comply with free competition rules, a Logistics Centre must be open to allow access to all companies involved in the activities set out above.

A Logistics Centre must also be equipped with all the public facilities to carry out the mentioned operations. If possible, it should include public services for the staff and equipment of the users. In order to encourage intermodal transport for the handling of goods, a Logistics Centre should preferably be served by a multiplicity of transport modes (road, rail, deep sea, inland waterway, air).

To ensure synergy and commercial cooperation, it is important that a Logistics Centre is managed in a single and neutral legal body (preferably by a Public-Private-Partnership). Finally, a Logistics Centre must comply with European standards and quality performance to provide the framework for commercial and sustainable transport solutions.
The most common characteristics of a Logistics Centre are:

The usual Logistics Centres are built on private-public partnership basis, initiated by national and / or local authorities. The reason for that is that experience shows that the Logistics Centres make a significant contribution to the territorial and economic development of the area they are located;

The Logistics Centres are often established by and in interaction with Municipalities, Ministries of Transport, EUROPLATFORMS E.E.I.G association, domestic and foreign private investors and financial institutions;

The Logistics Centres unite all the activities related with the transport and logistics;

Based on competition principles the Logistics Centres are open for private and public transport as well as enterprises and companies;

Consolidation of different companies serving and/or using transport services through synergy effect increase the economical and productive performance of the companies and at the same time increase their economy of scale;

The Logistics Centres supply users with the most advanced IT infrastructure and solutions, which usually are exorbitant barriers for the individual company.

The Logistics Centres constitute intelligent transport systems, where services are provided based on advanced technologies, i.e. EDI, communication and information systems;

Normally the Logistics Centres are located in a 100-150 ha territory, however, depending on the activities the size can reach 4-500 ha;

An important feature is the Logistics Centres’ tendency to co-operate nationally and internationally and hereby create efficient transport chains and network solutions for optimal cargo flow and distribution.
The first initiatives for the development of Logistics Centres in Europe did already start in the sixties and seventies, particular in France, Italy and Spain. Some of the main driving factors were – despite of the differences between the nations:

Lack of warehousing space in the periphery of urban areas;
Start of intermodality with hinterland transport by rail of sea containers (ISO) as first standardised loading units (demand for inland transhipment facilities);
Increasing conflicts generated by delivery lorries in city centres;
Later on, during the eighties, three additional factors gained importance:
Capacity restrictions in seaports with the demand for the development of “external” handling and storage facilities (either in the port environment or in the hinterland);
Significant growth in freight transport with road freight being the main beneficiary of the increase in transport volumes;
Initiatives on the national railways to stop the decrease of the market share of rail freight by promoting intermodal solutions.

In recent years Logistics Centre developers faced the following main challenges:
To establish alternative investment and operation concepts for the Logistics Centres intermodal terminals and to integrate them into existing transport networks;
To react on the ongoing process of restructuring of the transport and logistics industry leading to a higher degree of concentration and internationalisation (tendency for bigger companies with own logistics networks, partly outside the Logistics Centres network);
To react on the fact that the logistics industry as key Logistics Centres target group is changing from traditional transport and warehousing business towards complex supply chain management (SCM).
There are established several Logistics Centres in Europe, that on present stage are in the process of working as a network. The general strategy-characteristics in these Logistics Centres are:
To create physical integration of transport by road, rail, inland waterways and sea (and in the best case – air);
To achieve economies of scale through co-operation internally and co-operation with other Logistics Centres;
To create a freight concentration by providing the basis for establishing efficient international transport links;
To create a development environment for the transport sector;
To replace part of the fixed capital in the transport enterprises with a floating capital base.

For the transport and logistics companies the existence of a close co-operation within organised Logistics Centres will increase the opportunities of planning international transports and optimising the usage of transport equipment and resources. Thereby Logistics Centres obtain a rationalisation profit. The Logistics Centre concept implies that a long distance international transport is planned in a competitive, but close co-operation between the transport and logistics companies. Nevertheless, it secures that the transport equipment is optimally utilised and the final distribution of goods is taken care of locally. Transport and Logistics Centres from twelve different countries have joined the EUROPLATFORMS co-operation, which is the only European association of freight villages.
Illustration 50: Logistics Centres in Europe, which have joined EUROPLATFORMS.
7.3. **Why establish a Logistics Centre in a specific area**

A Logistics Centre is often established in order to meet the market demand for new, commercial transport and logistics solutions, which at the same time can meet the increasing political demands to the transport and the logistics sector, e.g. concerning environment and utilization of capacity.

Today there is an increasing political understanding and support of the role of the Logistics Centres e.g. in connection with:

- The peripheral regions’ access to the main European corridors.
- Improve sustainable freight mobility.
- Improved use of existing infrastructure.
- Reduce empty loads by consolidation of freight.
- City distribution concepts and solutions.
- Improvement of the whole transport chain.
- Strengthen the SME’s. Increased use of telecommunication.

Improved business opportunities
For the transport and logistics companies the existence of a close co-operation within organised Logistics Centres will increase the opportunities of planning international transports and optimising the usage of transport equipment and resources. Thereby Logistics Centres obtain a rationalisation profit. The Logistics Centre concept implies that a long distance international transport is planned in a competitive, but close co-operation between the transport and logistics companies. Nevertheless, it secures that the transport equipment is optimally utilised and the final distribution of goods is taken care of locally.
At present, there is no standard of the Logistics Centre features, however analysis has shown some vital characteristics necessary for the successful function and performance, such as:

*Multimodal*: Linkage of different transport modes for quick transhipment;

*Openness*: open for public and private companies to locate in and/or utilise the centre’s facilities;

*Multifunctional*: All functions included in transport and logistics are represented through: carriers, forwarders, agents, stevedores, brokers, custom brokers, Authorities (port, custom).

*Handling freight*: A wide variety of facilities for freight handling, i.e. distribution, container combi- and cold storage terminal; storage hotels, etc.;

*Handling electronic information (IT)*: Access to telematics systems related to the transport, administration and supply chain;

*Intersectional*: Intersectional through close and integrated relations to the business sectors, which are serviced with transport and logistics solutions;

*Cost sharing*: sharing storage facilities, IT-systems, service development and knowledge;

*Services*: Filling stations, washing facilities, packaging, customs clearance, research activities.

A very crucial factor for the development of Logistics Centre is that the management of the centre is separated from transport, logistics and other service operators. Locating several enterprises in a Logistics Centre leads from one hand to higher extent of the cost sharing and reduction of the expenses reduced as well as more differentiation within the services and more effectively utilisation. Moreover, such a co-operation between companies located in a number of commercially and geographically well-placed Logistics Centres can create a smooth functioning logistics chain.
7.4. Logistics Centre experiences

In order for a Logistics Centre to function most satisfactorily it is important that the Logistics Centre is:

- placed on the TEN-T,
- has a clear legal entity,
- with active co-operation between private and public,
- with a strong focus on innovation, intermodality and business orientation,
- that at the same time meets the increasing political demands to the sector.

By following these advises the main foundation for an efficiently functioning Logistics Centre should be present. The Logistics Centre should also be an integrated part of the spatial planning in the given area. Therefore the following characteristics are important in relation to the spatial planning perspective:

- Integrate LC’s in transport infrastructure policy and planning,
- Priority of LC’s in transport infrastructure investments,
- Increase the return of transport infrastructure investments with LC’s,
- Use LC’s as framework for new business opportunities and commercial growth.
7.5. **Stages of Logistics Centre development**

The time perspective in Logistics Centres is important due to the constant development that Logistics Centres are undergoing. Therefore – in most cases – the Logistics Centres described should be seen as situated on a certain development stage. In the very early phases the Logistics Centres are sometimes based on virtual or lose cooperation structures. This creates a profound basis for the later stages and the physical centre in operation. In these early stages some of the below mentioned characteristics are present, but some of these young Logistics Centres are not possible to fit fully into the categorisation per se.

The Logistics Centre development can traditionally be understood as in the following figure:

**Illustration 51**: Logistics Centre development.
Traditional transport areas (incl. also intermodal terminals and ports) develop into physical Logistics Centres – sometimes via a stage of Virtual Logistics Centre. When established as a physical Logistics Centre the centre should start developing into a Networking Logistics Centre.

**Illustration 52:** Cooperation between Logistics Centres.

The increased focus on concepts like Motorways of the Sea and globalisation have enhanced the need for networking between Logistics Centres within each region, but also between the different regions. In order to gain a better capacity use, the networking logistics centres are cooperating as larger units and hereby obtain a competitive advantage in the supply chain.
7.6. Ten steps to develop new Logistics Centres

When developing a new Logistics Centre the following 10 steps is a guide for, how to handle the development most appropriate:

1. Identification of the key partners in the Logistics Centre (LC)
2. Transfer and adapt knowledge and experiences from successful Logistics Centres in Europe
3. Activities (test and demonstrations) to create understanding and commercial support for development of a Logistics Centre
4. Analyse transport corridors relevant for the LC
5. Detail planning of the Logistics Centre concept and services
6. Creation of European compatible Logistics Centre company entity
7. Establishment of land rights to the LC
8. International marketing of the LC to potential customers and investors
9. Establishment of business networking between the new LC and other relevant Logistics Centres that are already established

Physical implementation e.g. building and reservation of terminals and infrastructure
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Appendix 1: Freight Integrator at a glance

The official definition for Freight Integrators is quoted as follows:

“Freight Integrators are transport service providers who arrange full load, door-to-door transportation by selecting and combining without prejudice the most sustainable and efficient mode(s) of transportation.”

The following illustration shows problems of the Freight Integrator concept the EU tries to solve.

Illustration 1: Problems of the Freight Integrator concept.

Source: Own figure according to ZLU et al. (2003: 2ff.).

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399 Cp. ZLU et al. (2003: 1).

400 “The best compliance with this definition is found in the freight forwarder without own assets.” ZLU et al. (2003: 4).

Full load describes that cargo exclusively is transported in one transport unit from door-to-door. Door-to-door transportation describes a transport service that encompasses the transportation from shipper to consignee. To combine transport modes without prejudice is regarded complicated because of a lacking neutrality of some potential Freight Integrators due to capacity utilization rate goals of own assets (trucks for instance). Cp. Seeck and Smekal (2004: 483) and ZLU et al. (2003: 4).
Glossary

ASEAN: Association of Southeast Asian Nations. Member states are Malaysia, Indonesia, Philippines, Singapore, Thailand, Brunei Darussalam, Vietnam, Myanmar, Laos and Cambodia. Objectives of this agreement are for instance the acceleration of economic growth, social progress and cultural development.¹

**Combined transport:** This term describes a system in which a number of different modes of transport are combined in order to provide the most efficient transport of goods. Most commonly, the pre- and on-carriage (should be kept as short as possible) is carried out by truck, the main haul (the longer distance) by vessel or rail.²

**Co-modality:** This term describes the efficient use of different modes of transport on their own and in combination with each other. According to the European Commission, this will result in an optimal and sustainable utilization of resources, a well integrated transport network and in seamless transport routes.³³

**Congestion:** “Where the road system cannot accommodate the numbers of vehicles trying to use it at key (i.e. peak) times.”⁴⁴

**Consignee:** Recipient of the goods.

**Consignor:** Company or person who sends goods.

**Container terminal:** “Part of a port where containers are loaded on to, and discharged from, containerships.”⁵⁵
EC: European Commission. “It represents and upholds the interests of Europe as a whole and is independent of national governments. It drafts proposals for new European laws, which it presents to the European Parliament and the Council. It manages the day-to-day business of implementing EU policies and spending EU funds.”

EMAS: “The EU Eco-Management and Audit Scheme (EMAS) is a management tool for companies and other organisations to evaluate, report and improve their environmental performance.”

EMSA: European Maritime Safety Agency. The EMSA was created in the aftermath of the ERIKA accident (the tanker sank near the French coast in 1999, after breaking in half in the course of a storm) by the European Union. The main objective of the European Maritime Safety Agency is “to provide technical and scientific assistance to the European Commission and the member states in the proper development and implementation of EU legislation on maritime safety, pollution by ships and security on board ships.” Further information is provided by the home page of the European Maritime Safety Agency: www.emsa.europa.eu

EU: European Union.

EU-15: Abbreviation for the 15 member states of the EU before the enlargement in 2004 (Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, the Netherlands, Austria, Portugal, Finland, Sweden, United Kingdom).

EU-25: Abbreviation for the 25 member states since May 2004 (EU-15 plus Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia).
EU-27: Abbreviation for the 27 member states since January 2007 (EU-25 plus Romania and Bulgaria).

External effects: Uncompensated impacts on third parties due to economic activities such as production or consumption.¹⁰

FEU: Forty feet equivalent unit.

Globalsourcing: Globalsourcing describes the extension of procurement from domestic to worldwide markets.¹¹

GDP: Gross Domestic Product. GNP minus the balance of income transactions with foreign countries. Alternatively: The total value of all goods and services produced by a country in one year.¹¹

GNP: Gross National Product. The GNP represents the value of all goods and services that are produced in a specific period of time in one region (country) minus advance concessions. Alternatively: The total value of all goods and services produced by a country in one year including the total income from foreign countries.¹¹

Greenhouse effect: “Basically, the greenhouse effect is the physical process by which solar energy passes through the atmosphere relatively freely, while heat radiating from the earth is partially blocked or absorbed by particular gases in the atmosphere that is released by human activities such as transportation.”¹³ Because of this, temperatures are rising. And as a result of rising temperatures, in the long term the sea levels will rise due to the melting polar ice caps. Increasingly, mankind must be prepared for all kinds of extreme weathers like storms, droughts or floods. Mainly responsible for the rising temperatures is carbon dioxide, which is emitted during every combustion process of engines.¹⁴
**Hinterland:** The area behind a port.\textsuperscript{xv}

**ILO:** The International Labour Organization is one of the oldest intergovernmental agencies. Originally established in 1919, the ILO became the first specialised agency of the United Nations in 1946. The ILO principally deals with maritime labour problems and thus has been involved in developing several conventions about working conditions on board of vessels. These conventions include for instance provisions on manning, working hours, pensions, vacations, and minimum wages. The ILO’s work is a particularly important factor in ship operating economics since crewing costs account for a high proportion of the total ship operating costs.\textsuperscript{xvi}

**IMO:** “The International Maritime Organization is a specialized agency of the United Nations which is responsible for measures to improve the safety and security of international shipping and to prevent marine pollution from ships. It is also involved in legal matters, including liability and compensation issues and the facilitation of international maritime traffic. It was established by means of a Convention adopted under the auspices of the United Nations in Geneva on 17 March 1948 and met for the first time in January 1959.”\textsuperscript{xvii}

Further information is provided by the home page of the International Maritime Organization: www.imo.org

**Incoterms:** International Commercial Terms. Incoterms are standard terms such as DDP (Delivered Duty Paid) or EXW (Ex Works) that are established by the International Chamber of Commerce to facilitate international trade.\textsuperscript{xviii}

**Intermodal transport:** Intermodal transport means that goods stay in one transport unit (container, interchangeable container, truck or trailer etc.) during the whole transport chain (involved in this chain are at least two modes of transport \(\rightarrow\) multimodal transport). A transshipment of the goods does not happen.\textsuperscript{xix}
Intermodal loading unit: Intermodal loading units are for instance interchangeable units, trailers or containers – the so-called ‘boxes’.

ISO: International Organization for Standardization. This organisation was established in 1926 and is responsible for the elaboration and introduction of standards which are for instance standard dimensions, strength parameters or standards for transshipment handling systems.xx

ISO 9000: ISO 9000 consists of “standards and guidelines relating to management systems, and related supporting standards on terminology and specific tools, such as auditing (the checking that the management system conforms to the standard)...ISO 9000 is concerned with quality management...Quality management means what the organisation does to ensure that its products or services satisfy the customer’s quality requirements and comply with any regulations applicable to those products or services.”xxi

ISO 14000: ISO 14000 consists of “standards and guidelines relating to management systems, and related supporting standards on terminology and specific tools, such as auditing (the checking that the management system conforms to the standard)...ISO 14000 is concerned with environmental management...environmental management means what the organisation does to minimise harmful effects on the environment caused by its activities.”xxii

Knots: Vessel speed; 1 knot = 1,852 km/h.

Kyoto-Protocol: “The Kyoto-Protocol is a framework agreement of the United Nations signed by 141 countries, which commits the signatories to cut down their emissions. On the 16th of February 2005 the Kyoto-Protocol went into effect.”xxiii
**Logistics:** “Logistics is the process of planning, implementing, and controlling procedures for the efficient and effective transportation and storage of goods including services, and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements. This definition includes inbound, outbound, internal, and external movements.”

**Marco Polo Programme:** The Marco Polo Programme is a programme established by the European Union “…which aims (through the provision of grant aid) to reduce road congestion and improve the environmental performance of freight transport within the Community and to enhance intermodality, thereby contributing to an efficient and sustainable transport system.”

**MARPOL:** “The MARPOL Convention is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes [this includes pollution by oil, chemicals, harmful substances in packaged form, sewage and garbage]. It is a combination of two treaties adopted [at IMO] in 1973 and 1978 respectively and updated by amendments through the years.”

**MERCOSUR:** Mercado Común del Sur. MERCOSUR is an international agreement to enhance free goods traffic as well as service transactions and to reduce trade barriers. Member states are Brazil, Paraguay, Uruguay and Venezuela.

**Modal split:** Describes the entire transportation of freight split up into the different modes of transportation.

**Multimodal transport:** Involved in the transport of goods are at least two different modes of transport.
**NAFTA:** North American Free Trade Agreement. NAFTA is an agreement between Canada, the United Mexican States as well as the United States of America. The objectives of this agreement are for instance the elimination of barriers to trade and the simplification of cross-border movement of goods and services as well as the implementation of effective and adequate protection of intellectual property rights. xxviii

**NAIADDES:** Navigation And Inland Waterway Action and Development in Europe. NAIADDES is a special project that was established by the European Commission to create favourable conditions for further development of inland navigation and to coordinate the development of waterway infrastructure and inland port facilities. xxx

**Nautical mile:** 1 nm = 1,852 km.

**Port:** A port “is an intermodal node in the transportation network, where cargo and/or passengers change modes of transportation (e.g. from a ship to an inland transport mode and vice versa).” xxx

“A port is also an economic unit that provides a (transfer) service as opposed to producing a physical product. The amount of this transfer service is referred to as the port’s throughput… Users of port services are those that utilize the port as part of the transportation process of moving cargo to and from origin to destination locations.” xxxi

**Roll-on-roll-off vessel:** Vessel which can carry any type of rolling cargo.

**Shipper:** “Person/firm who consigns goods for despatch.” xxxii
Shortsea shipping: “Shortsea shipping provides transport within regions. It distributes cargo delivered to regional centres such as Hong Kong or Rotterdam by deep sea vessels, and provides a port-to-port service, often in direct competition with land based transport such as rail. This is a very different business from deep sea shipping. The ships are generally smaller than their counterparts in the deep sea trades…Designs place much emphasis on cargo flexibility…Because trips are so short and …visit many more ports in a year than deep sea vessels, trading in this market requires great organizational skills.”

SME: Small and medium-sized enterprises are characterized by quantitative criteria like the number of employees and financial performance figures. According to a definition of the European Union, companies classified under this term have a number of employees of less than 250, an annual turnover of no more than 50 million € or a balance-sheet total of under 43 million €. Roughly 99% of all companies registered in the EU are SMEs. These companies provide about 67% of EU’s workplaces and represent an important part of the EU economy. In many SMEs there are ethically motivated policy makers who approve of environmental friendliness, but due to larger personnel and financial resources, large-scale enterprises are dominating in respect of sustainable behaviour. Therefore the EU considers supporting SMEs as an especially crucial task and has established several EU-funded projects. According to more general definitions, companies classified under the term SME have a number of employees of less than 500 and an annual turnover of no more than 50 million €.
**SOLAS:** Safety Of Life At Sea. “The SOLAS Convention…is generally regarded as the most important of all international treaties concerning the safety of merchant ships. The first version was adopted in 1914, in response to the Titanic disaster, the second in 1929, the third in 1948, and the fourth in 1960. The 1960 Convention - which was adopted on 17 June 1960 and entered into force on 26 May 1965 - was the first major task for IMO after the Organization's creation and it represented a considerable step forward in modernizing regulations and in keeping pace with technical developments in the shipping industry. The main objective of the SOLAS Convention is to specify minimum standards for the construction, equipment and operation of ships, compatible with their safety.”³⁶vi

**Sustainability:** The idea behind sustainability is the responsible use of limited resources to ensure future developments. Sustainable development aims at the satisfaction of today’s generation’s demands without risking that future generations cannot satisfy their demands. ‘Sustainable transport’ can be understood as ‘environmental sustainability’. Basically, sustainability has three dimensions: Society, economy and environment. From this follows that sustainable transport has to be environmentally friendly, economically efficient and socially fair.³⁷vii
**TEN-T**: Trans-European Network for Transport. “In 1996, the EU Member States agreed on guidelines for the Trans-European Network for Transport (TEN-T). TEN-T consists of road, rail, and inland waterway infrastructure, seaports, airports and inland ports and traffic management systems. A highly efficient European transport network is vital for the success of the internal market and for the competitiveness of the European Union.”

This network also makes a contribution to the cohesion between the different European regions by providing connections between the peripheral and central regions. The total investment value of the TEN-T network extension is estimated at €600 billion to be completed by 2020.

“These amounts far exceed the EU and national budgets. In order to raise more funds and speed up infrastructure development, the private sector is increasingly encouraged to take a stake in the financing process.”

In 2020 the TEN-T will encompass:

- 89,500 km road network
- 94,000 km rail network (including 20,000 km high speed rail lines)
- 11,250 km inland waterway network
- 210 inland ports
- 294 seaports
- 366 airports

**TEU**: Twenty feet equivalent unit.

**Tkm**: Tonne kilometres is “the unit by which the movement of freight is measured (i.e. tonnes lifted multiplied by the distance it is carried)”.

**Traffic**: Describes the movement of passengers and/or goods as well as empty runs.

**Trailer**: “A wheeled load-carrying vehicle drawn by a motor vehicle to form a drawbar combination”
**Transshipment:** Means the transfer of goods from one transport mode to another. The transfer of cargo from one ship to another, for instance, “…may be direct or it may be necessary to discharge the goods on to the quay prior to loading them on to the second ship, or on to vehicles should the second ship be loading at a different berth.”

**Transport:** Describes the movement of passengers and/or goods, excluding empty runs.

**WTO:** World Trade Organisation. The WTO was established in 1995, is located in Geneva (Switzerland) and has 150 members. Among others, it monitors national trade policies and provides technical assistance as well as training for developing countries. “The WTO is the only global international organisation dealing with the rules of trade between nations…its goal is to help producers of goods and services, exporters, and importers conduct their business.”

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\(^{i}\) Cp. Asean.org.


\(^{iv}\) Lowe (2005: 251).


\(^{vi}\) Europa.eu/ABC.

\(^{vii}\) Europa.eu/EMAS.

\(^{viii}\) Emsa.europa.eu.


\(^{xi}\) Cp. Hennies (2003: 50ff.).

\(^{xii}\) Cp. Hennies (2003: 50ff.).

\(^{xiii}\) Cp. Walter (2005: 457ff.).
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