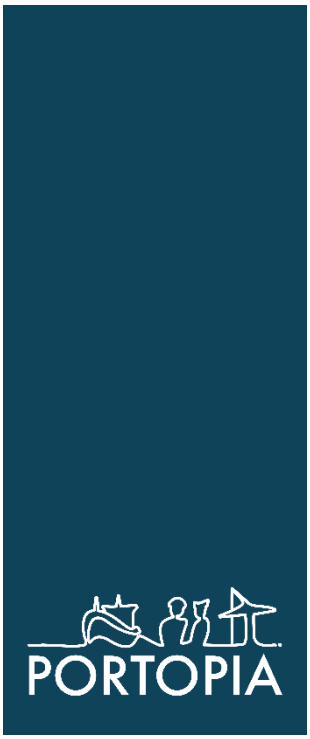


7th Framework Programme
SST.2013.6-2. Towards a competitive and resource efficient port transport system
Collaborative Project
Grant Agreement no. 605176

Deliverable 7.2

Policy linkages, interrelations and benchmarking suggestions (Inland ports performance indicators)

DOCUMENT ID
PORTOPIA|D|7.2|DT|2014.10.29|V|01

DUE DATE OF DELIVERABLE
2016-04-30

ACTUAL SUBMISSION DATE
[Publish Date]

DISSEMINATION LEVEL
CO (Confidential, only for the member of the consortium, including Commission Services)

DELIVERABLE 7.2

Policy linkages, interrelations and benchmarking suggestions (Inland ports performance indicators)

AUTHORSHIP

Author(s)	Klukas, A; Kirsch, D;
Beneficiary Partner	FHG IML,
Issue Date	2016-04-20
Revision	M. Langenus
Status	Final
Contributors	Klukas, A; Kirsch, D;
Pages	33
Figures	6
Tables	1
Annexes	0

SIGNATURES

Author(s)	Klukas, A; Kirsch, D;
Coordinator	M. DOOMS

DELIVERABLE 7.2

Policy linkages, interrelations and benchmarking suggestions (Inland ports performance indicators)

REVISION

Revision Date	Reviewer Name	Reviewer Signature
2016-04-26	M. Langenus	M. Langenus
2016-07-01	A. van den Bosch	A. van den Bosch

HISTORY

Version Date	Version Id	Status	Comment
2015-09-10	V0.0	[DRAFT]	Structure and Responsibilities
2016-01-16	V0.0	[DRAFT]	Draft Version
2016-04-20	V1.0	[FINISH]	Final Version

DELIVERABLE 7.2

Policy linkages, interrelations and benchmarking suggestions (Inland ports performance indicators)

1 CONTENT

DELIVERABLE 7.2

Policy linkages, interrelations and benchmarking suggestions (Inland ports performance indicators)

List of Tables

List of Figures

Deliverable 7.2

Policy linkages, interrelations and benchmarking suggestions (Inland ports performance indicators)

List of Abbreviations

CNG	compressed natural gas
EEC	European Economic Community
EU	European Union
GDP	gross domestic product
km	kilometers
LNG	liquefied natural gas
TEN	Trans-European networks
TEN-T	Trans-European transport networks
tkm	ton kilometers
USD	United States Dollar

1 INTRODUCTION

Deliverable D7.2 comprises a structured overview of the results of task 7.2, which is the second step of work package 7.

This step aims at analysing the linkages of the inland port performance indicators, developed in task 7.1, and current transport policy objectives of the EU (European Union). The focus lies on the followings tasks:

- analysis of interrelations of the indicators developed with other performance indicators and performance in general (between the inland port indicators and also with the seaport indicators)
- analysis of the relation of the governance and financial indicators with policy objectives

The last step of this task is to give a short overview of meaningful benchmarking methods for inland ports.

2 FUNDAMENTALS

2.1 Development of the transport policy of the EU

Traffic and transport are fundamental elements of our economy and society. Mobility is the foundation of efficient domestic markets and has a significant impact on the citizens' quality of life. Transport is a driver of economic growth and creates jobs. However, there are several challenges, such as increasing congestion of the infrastructure and expected decimation of global oil resources, which need to be addressed by a sustainable design of transport and logistics processes. Since traffic and transport are subject to global influences, political action and intensive cooperation at the international level is required.[1]

Transport policy is a specific economic policy, which creates the framework for the transport of persons, goods and information and the required logistics services. It deals with all issues related to materials handling, technology, law and economy.[2]

Transport policy has been a solidary policy sector within the EU (at that time European Economic Community) since the Treaty of Rome in 1957 and thus presents one of the first common policy sectors. The focus was approximately the creation of an homogeneous European transport area and the liberalization of domestic transport markets. This objective has been achieved essentially by today, with the exception of the rail transport, whose domestic markets are still segmented extensively. An important aspect, with regard to the liberalization of the domestic markets, is the implementation of fair competitive conditions not only within the various transport modes, but also between them. Thus, the policy aimed at adjusting legal frameworks at national level, including the unification of technological, social and fiscal conditions. Driven by the increasing greenhouse gas emissions in the transport sector, which plays a significant role in the context of the climate protection goals of the EU, a sustainable design of transport and logistics processes has grown in importance in the recent years.[3]

2.2 Transport policy structure of the EU

Within the EU, various government bodies are responsible for the area of transport policy. These include the European Parliament Committee on Transport and Tourism, the Transport, Telecommunications and Energy Council, a special commission for Transport and the Directorate-General for Energy and Transport.[4] In addition to processing separate tasks, the European transport policy correlates with other policy areas, in particular internal market policy and energy and environmental policy.[5] Figure 1 shows the transport policy structure at the European level.

[1] European Commission 2011a, p. 3
[2] Stackelberg and Malina 2012
[3] Thomas 2014
[4] European Commission 2012
[5] Schöller 2007, pp. 145

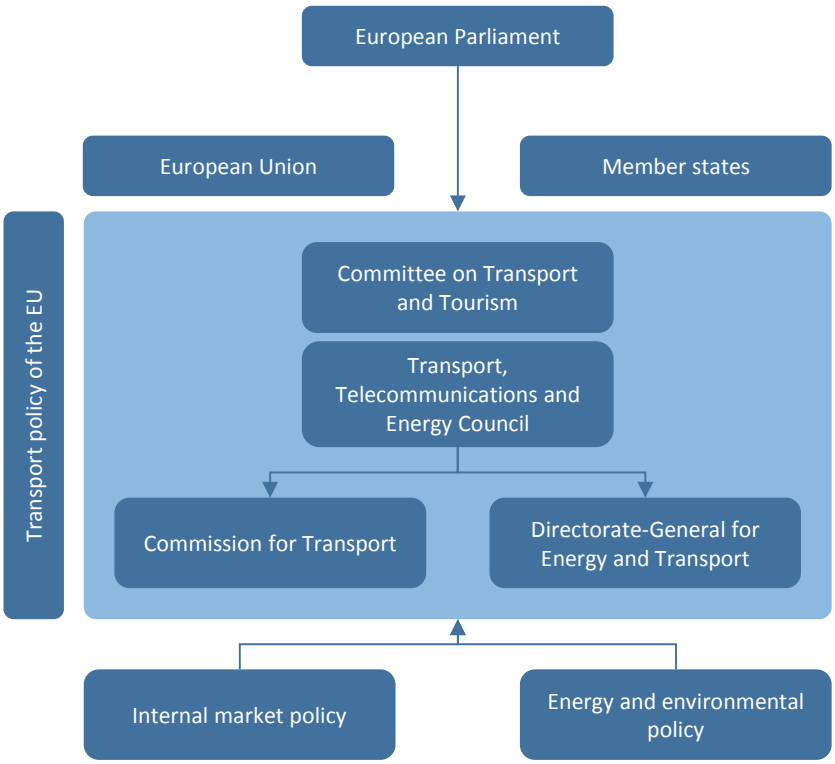


Figure 1: Transport policy structure at the European level[6]

Based on the legal foundation (Article 90 to 100 Treaty on the Functioning of the European Union) the responsibility for transport related issues are allocated on the EU and the Member States. While the political actions of the EU addresses predominantly the transboundary transport, including all transport modes, the national policy focuses on the domestic transport. Among the political issues, there exist distinct interrelations, which require an intensive collaboration of the different political levels.[7]

Since the transport policy is a solidary policy area, the EU obliges the structural framework of designing the transport policy at national level and dictates general requirements and objectives. However, the EU-policy shows diverse interrelations with the transport policy of the Member States and allows them scope for interpretation with regard to the political guidelines. Specific political measures are rather developed and implemented at national level.

2.3 Relevant initiatives

Objectives of the European transport policy are based partially on transnational initiatives and conventions. Especially the trans-European transport networks policy (TEN-T) and the climate and energy package have a decisive impact on the transport policy.

The trans-European networks policy (TEN) is based on the awareness that well developed, largely networked and efficient infrastructures are essential for competitiveness, growth and prosperity. They are a prerequisite for the establishment

[6] Schöller 2007, pp. 145.; Clausen und Geiger 2013, p. 36
[7] Schöller 2007, pp. 145; European Commission 2012

of a strong internal market and are intended make a contribution to achieve geographic, economic and social cohesion within the EU.[8]

The activities and objectives of the trans-European transport networks policy include all transport modes, important traffic hubs as well as relevant services. The focus is on the creation of a homogenous transport area, which increases the added value for users by improved efficiency and sustainability. The main objectives of the current TEN-T-policy are listed below[9]:

- Expanding cohesion
- Increasing efficiency
- Sustainable development
- Increasing the added value and generating benefits for users.

The TEN-T-policy represents the long-term infrastructure policy of the EU. Thus, it is essential to the transport policy objective of developing the infrastructure inside the EU.

The climate and energy package is the first extensive international formulation of environmental and energy goals at regional level. It was adopted in 2008 and covers an implementation period from 2009 to 2020.[10] The climate and energy package contains the following superordinate objectives: the greenhouse gas emissions are to be reduced by 20 % in the period from 1990 to 2020. If other industrial nations, e.g. USA, admit to comparable objectives and emerging countries make a contribution as well, this value may be increased to 30 %.[11] This optional increase aims at creating incentives for other industrial nations to follow these ambitious objectives.[12] Additional goals of the climate and energy package are the enhancement of the percentage of renewable energies to 20 % as well as the improvement of energy efficiency by 20 % compared to a development without efficiency-raising measures. These objectives present targets, which have to be implemented into the domestic legislation by the Member States.[13]

The climate and energy package serves as the basis for the greenhouse gas emission reduction goals of the EU. Thus, it influences the corresponding transport policy objectives.

[8] European Commission 2013a
[9] European Parliament 2013, p. 8
[10] cf. Aachener Stiftung Kathy Beys 2009
[11] European Commission 2015a
[12] Aachener Stiftung Kathy Beys 2009
[13] European Commission 2015a

3 TRANSPORT POLICY OBJECTIVES

Sustainable transport policy has to be aiming at accomplishing infrastructural conditions and traffic systems that meet economic and ecological, as well as social requirements of today's society. Powerful and efficient traffic systems are vital for the wealth of Europe and have a large impact on economic growth and social and economic developments. The transport sector, taken in isolation, represents an important industry and also contributes to the functionality of the whole European economy. The transport sector already represents an important industry, but additionally contributes to the functionality of the whole European economy.[14] The main transport policy objectives are listed subsequently, structured into three areas: environmental performance, homogeneous European transport area and social compatibility.

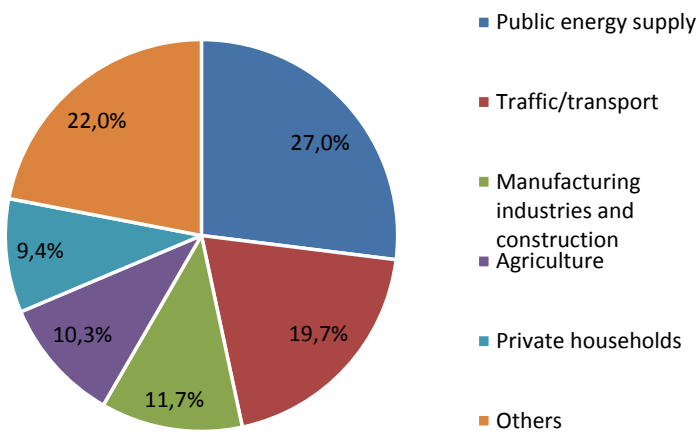
3.1 Environmental performance

According to the guiding principle of sustainable traffic, one of the most important goals is to increase the environmental performance. This goal is based on different sub-goals, including the establishment of ecologically friendly technologies, the reduction of energy consumption and increasing the efficiency of performance and organization of the traffic system. The following specific objectives can be derived:

3.1.1 Reduction of greenhouse gas emissions

Transport is responsible for a significant proportion of greenhouse gas emissions. Within the EU the share increased from 14% to 20% between 1990 and 2012 and has stayed almost constant since 2012.[15] Figure 2**Error! Reference source not found.Fehler! Verweisquelle konnte nicht gefunden werden.** shows the distribution of greenhouse gas emissions in the EU in 2012.

Figure 2: Distribution of greenhouse gas emissions in the EU in 2012



Source: European Environment Agency, 2012

[14] European Commission 2006, p. 3
[15] European Environment Agency 2012; Eurostat 2012

The figure illustrates that apart from public energy supply (27%), traffic and transport is the largest emitter of greenhouse gas emissions. Due to this high share, the reduction of traffic-related emissions is essential for achieving the climate objectives within the EU.

Traffic and transport will represent a significant and growing source of greenhouse gas emissions until 2050. Although there are greater possibilities to reduce emissions in other sectors, the EU aims at reducing the traffic- and transport-related emissions at least by 60% by 2050 compared to 1990 and by 70% compared to 2008. This goal is to be achieved gradually over the coming decades. The intermediate goal put forth is to reduce these emissions by 20% between 2008 and 2030. Despite these goals, it is important not to compromise traffic growth or the performance of the transport system and to avoid the limitation of mobility.[16]

There are different ways of reducing greenhouse gas emissions. Since inland ports constitute interfaces between transport modes and play various roles along transport chains, a suitable strategic orientation can contribute to achieving the reduction targets in varying dimensions. For example, alternative drive technologies may be supported by establishing electrified infrastructure and efficient handling operations, as well as a triple-mode design may support the modal shift.

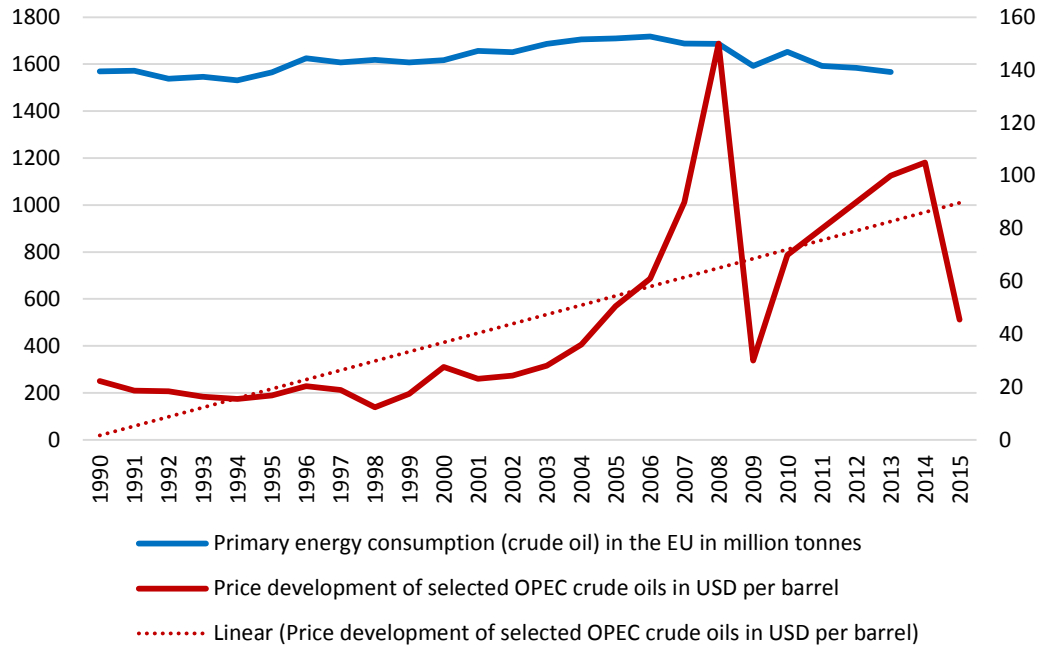
3.1.2 Reduction of oil dependency

Another objective of the European transport policy, which relates to the reduction of greenhouse gas emissions, is to decrease the dependency of traffic and transport on oil by alternative drive technologies.

The oil supply is becoming increasingly complicated in the coming decades. The amount of available oil becomes scarce and it will be necessary to use unsafe sources.[17] The following Figure 3 shows the development of primary energy consumption (crude oil) in the EU and the oil price in the period from 1990 until 2015.

[16] European Commission 2011a, pp. 3
[17] European Commission 2011a, p. 3

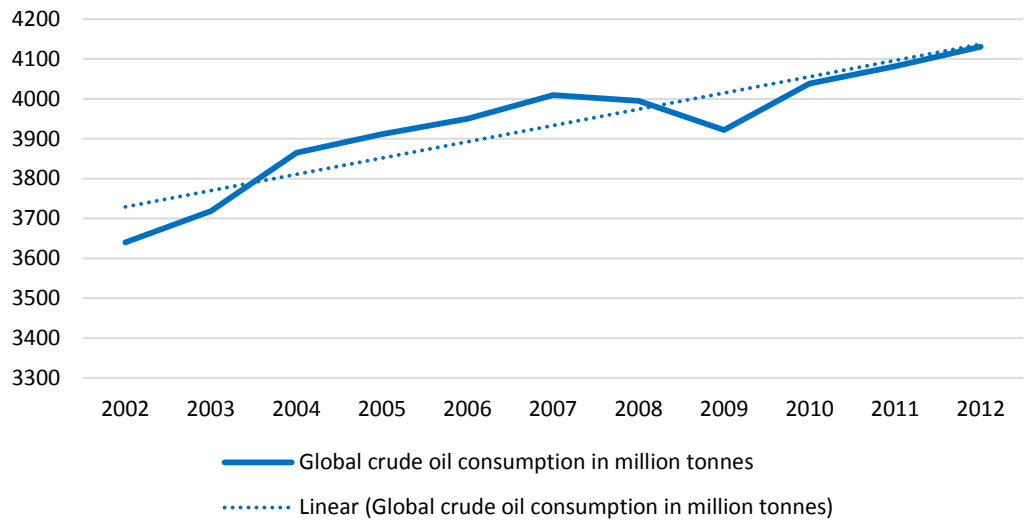
Figure 3: Development of the primary energy consumption in the EU and the oil price in the period from 1990 to 2015



Source: European Commission, 2011a, p.3

While the consumption of crude oil remained relatively constant in the shown period, including slight fluctuations, the oil price shows an increasing tendency. It increased between 1990 and 2014 by around 490% from 22 USD per barrel to 110 USD. This price increase is a result of the global rise in demand for oil and oil products (cf. Figure 4).

Figure 4: Global crude oil consumption in the period 2002-2012



Source: BP, 2013, p.11

In 2011, 13% of the EU energy supply originated from renewable and 87% from non-renewable energy sources.[18] If it is not possible to reduce the dependency on oil

[18] Eurostat 2013

significantly, the increasing scarcity and the rising oil price will lead to negative impacts on the competitiveness of the EU and the citizen's mobility.[19] Thus, in its strategy paper "Europe 2020: A European Strategy for Smart, Sustainable, and Inclusive Growth", the European Commission has formulated the objective of increasing the share of renewable energy to 20% by 2020.[20]

96% of the European traffic depends on oil and oil products[21] and 85% of the demanded crude oil is imported by the EU[22]. A foresight for the coming decades shows, that the development of traffic and transport has to be changed by targeted interventions. If these interventions fail to take place, the dependency on oil will amount slightly less than 90% in 2050 and the objective of increasing the share of renewable energy to 10% by 2020 will be exceeded insignificantly. As a result, the traffic-related CO_2 emissions will be about one third higher than the emissions in 1990. The European transport policy aims at decreasing the oil dependency of the traffic system, while maintaining or increasing its efficiency and avoiding limited mobility.[23]

In the future, traffic should consume relatively more environmentally friendly energy instead of non-renewables. In this context it is important to promote new technologies and to modernize the transportation networks.[24] It will not be possible to grow out of the oil dependency by focusing on a single technological solution.[25] The European Commission pursues the target of increasing the expenses for research and development to 3% of the GDP[26] to promote various research areas, e.g. resource-saving and clean drive technologies, electric mobility and intelligent traffic systems.[27,28]

Inland ports are multimodal hubs and serve as interfaces between different transportation modes. For example, by providing a charging infrastructure for trucks, electrified railways and access to shore power for vessels, electric mobility is supported. Furthermore, due to the installation of gas fuel stations (e.g. LNG, CNG) for trucks and vessels, the use of alternative fuels is encouraged. Thus, inland ports can contribute to the promotion of alternative drive technologies and the reduction of oil dependency.

3.1.3 Improvement of intermodality, modal shift and combined transport

The use of resource-saving vehicles and environmentally-friendly fuels will not be sufficient to reduce the greenhouse gas emissions sufficiently to attain the goal, and will not solve the overloading of the infrastructure. In addition, it is essential to optimize the traffic and transport system, to consolidate traffic volume and to promote modal shift[29], given that modal shift and multimodal transport chains will have a significant impact on the European transport sector.[30]

The majority of the freight traffic within the EU is handled via road transport. In the period from 1995 to 2012 the road transport increased by 31,3%, respectively 1,6% per year, so that a volume of 1.693 billion tkm has been achieved in 2012. The relative share

[19] European Commission 2011a, p. 3
[20] European Parliament 2008
[21] European Commission 2011a, p. 4
[22] European Commission 2012
[23] European Commission 2011a, pp. 3
[24] European Commission 2011b
[25] European Commission 2011a, p. 14
[26] European Commission 2010a
[27] European Commission 2011b
[28] European Commission 2011a, p. 14
[29] European Commission 2011a, p. 4
[30] European Commission 2011a, pp. 6

of the modal split amounted 71.6% in 2012. The second largest share is contributed by rail transportation. The rail transport volume grew between 1995 and 2012 by 4,9%, respectively 0,3% per year, to 407 billion tkm. The share of the modal split amounted 17,2% in 2012. The smallest share of the freight traffic in the EU is contributed by inland waterways (150 billion tkm) and pipelines (115 billion tkm). The shares of the modal split amounted 6,3% (inland waterways) and 4,9% (pipelines) in 2012. The following Table 1**Error! Reference source not found.Fehler! Verweisquelle konnte nicht gefunden werden.** presents the allocation of the European freight transport and its development in the EU.[31]

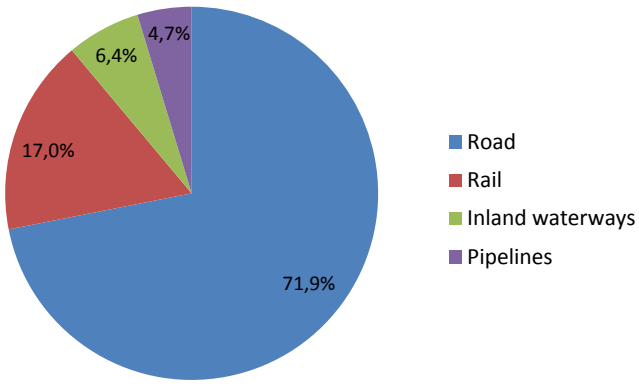
Table 1: Transport performance of different transport modes in the EU and development in the period 1995-2012

Transport mode	Transport performance in billion tkm 2012	Development 1995 - 2012	Development p.a.
Road	1.693	+ 31,3%	+1,6%
Rail	407	+ 4,9%	+0,3%
Inland waterways	150	+ 22,8%	+1,2%
Pipelines	115	– 0,1%	– 0,0%

Source: European Commission, 2015b, p.37

The modal split has only marginally changed in the recent years. The road transport grew slightly between 1998 and 2012. The share increased from 67,3% to 71,6%. The share of the inland waterways transport however remains at a constant level of 6,3% and the share of the rail transport decreased from 20,3% in 1998 to 17,3% in 2012.[32] Figure 5**Error! Reference source not found.Fehler! Verweisquelle konnte nicht gefunden werden.** illustrates the modal split in 2012.

Figure 5: Modal split in the EU in 2013



Source: European Commission, 2015b, p.37

The figure shows, that the development of the freight transport allocation is not on the right path and that new initiatives and measures have to be initiated.

The European Commission has set clear goals with regard to the modal shift. Road transports over 300 km are to be shifted to more efficient transport modes – i.e. rail and inland waterways – by at least 30% by 2030 and by at least 50% by 2050. In order

[31] European Commission 2015b, p. 37
[32] European Commission 2015b, p. 37

to achieve this aim, the Commission aims at establishing efficient and environmentally friendly freight corridors with a focus on an appropriate infrastructure.[33]

3.2 Homogeneous European transport area

A homogeneous transport area is of key importance for the competitiveness and the economic development of Europe. In this context, the liberalization of the European domestic markets, as well as the infrastructure development, are two important aspects.

3.2.1 Liberalization of the European domestic markets

The call for liberalizing the domestic transport markets for providers from all Member States as well as the creation of fair conditions of competition is based on the EEC Treaty of 1957[34]. This aim has essentially been achieved in the meantime. The borders for the road transport were opened in 1992 and six years later, in 1998, the approval of domestic transports by foreign logistics providers followed (freedom of cabotage). The release of maritime transports within the EU has been implemented in 1993 and the aviation market has been opened in 1997. These regulations have been implemented for the rail transport in 2006, by releasing the transboundary transport and in 2008 by establishing the freedom of cabotage. Finally, the borders were opened for passenger transport in 2010.[35]

The liberalization regarding rail traffic is still at an early stage. Domestic interests have been in the center of the strategic orientation since the early beginning of rail transport. This has not changed significantly until today. The railway companies are state-controlled in most Member States and the organization of rail traffic is focused on domestic requirements. Consequently, the European rail system is characterized by a high degree of fragmentation, shown by different country specific technological standards, signal systems, power supply and track gauges. These different circumstances will challenge the European rail system and require a reconstruction of the rail infrastructure.[36]

However, regardless of adjustment efforts, that have already been made, it is necessary to process the harmonization process. Even today there for example exist seven different track gauges, as well as seven different power supplies in the rail sector, five different national vignettes and 27 different air traffic management systems.[37]

3.2.2 Infrastructure development

A well-developed and technically unified infrastructure is the basis of an efficient and liberal transport system. In the period between 1995 and 2012, the volume of freight transport within the EU increased by 23,6%[38] and a growth of 80% is predicted by 2050[39]. This growth leads to an increasing congestion of the infrastructure, jams and excessive waiting times in many parts of Europe. In addition, the infrastructure of

[33] European Commission 2011a, p. 10
[34] Art. 74 to 84 of the EEC Treaty
[35] European Commission 2012
[36] European Commission 2014a
[37] European Commission 2012
[38] European Commission 2015b, p. 37
[39] European Commission 2013a

Western Europe and Eastern Europe shows differing degrees of development. Those have to be matched[40].

The choice of transport modes, especially for short and medium range transports up to 300 km, is severely restricted for economic reasons[41]. Thus, an efficient combination of these modes is only partly successful.[42] Furthermore, major hubs in Europe, such as container terminals and ports, do not have sufficient capacities to exploit the full potential of multimodal transport, eliminate infrastructure bottlenecks and to bridge connection gaps[43]. In order to create the conditions for a homogeneous European transport area, a fair competition between different transport modes and the efficient design of intermodal transport chains, it is essential to expand the infrastructure during the coming decades.

The Commission aims at finishing the European high-speed rail network by 2050 and at tripling the track length of the existing network by 2030, whereby a dense rail network is to be maintained within all Member States. In addition, the EU intends to establish a fully functional, EU-wide and multimodal TEN-T 'core network until 2030 and the expansion of this network into a network with high capacity and quality by 2050. Also by 2050, all airports belonging to the core area, are to be integrated into the rail network, preferably the high-speed network, and it is to be ensured that all seaports are connected to the fright rail network and, if possible, to the inland waterway system as well.[44]

Inland waterways represent an important component in six of nine corridors of the TEN-T 'core network.[45] In order to integrate this transport mode comprehensively, it is necessary to provide interfaces between inland waterways and other transport modes. Thus, inland ports fulfill a node function in the European transport network.

3.3 Social compatibility

Besides economic and ecological aspects, the guiding principle of sustainability includes the social area as well. Two important factors in this context are presented by traffic safety and job creation, which are explained below.

3.3.1 Reduction of traffic accidents

Political action regarding traffic safety has been very successful in the recent years. In the last strategy period (2001-2010) the number of traffic fatalities was reduced by 48%[46], so that the goal of halving the number of victims could almost be achieved[47]. However, 28.000 people died in traffic accidents on European roads in 2012.[48] In addition, the number of severely injured people was ten times higher than the number of fatalities and it has to be noted that this number could only be decreased by 36% between 2001 and 2010[49]. Besides human suffering, caused by severe injuries and

[40] European Commission 2011a, p. 16
[41] European Commission 2011a, p. 7
[42] European Commission 2013b
[43] European Commission 2013b
[44] European Commission 2011a, p. 10
[45] European Commission 2013c
[46] Destatis 2013
[47] European Commission 2013d
[48] Destatis 2013
[49] European Commission 2013d

decedents, traffic accidents cause considerable socio-economic costs. These are estimated at about 2% of the annual gross domestic product (GDP) of the EU.[50]

In the coming years (2010-2020), the EU aims at decreasing the number of traffic fatalities by 50% compared to 2010[51] and at eliminating fatalities until 2050. In order to achieve these goals, the EU requests a range of initiatives, especially with regard to technology, traffic education and increased attention for endangered traffic participants.[52]

Presenting multimodal hubs and important transportation junctions with regard to the supply of cites, inland ports generate a high volume of road transport. Due to secure traffic control and sufficient space for parking and safe maneuvering, inland ports can contribute to increased road safety and the reduction of traffic accidents.

3.3.2 Job creation

Alongside the reduction of traffic accidents, job creation contributes to the successful design of a homogeneous European transport area. The need for open European traffic markets requires quality jobs and working conditions, because human resources present an important factor concerning efficient and sustainable transport systems. Thus, it will be important in the future to counter the problem of labor shortage actively.[53]

Inland ports are drivers for the creation of jobs. These jobs are not only created directly by port operators, but also indirectly by companies located in the port area respectively the surrounding area, which constitutes an attractive location various industries. Therefore, inland ports may influence the economic situation of entire regions. For example, in 2015, 45.300 jobs depended on activities related to the port of Duisburg. Of this amount, the city of Duisburg accounted for about 22.000 jobs and thus, more than one in eight jobs in Duisburg (13%) depended directly or indirectly on the port.[54]

3.4 Summary

Transport and mobility are fundamental to our economy and society. Sustainable transport is a driver for economic growth and job creation. Transport policy is a solidarity policy area within the EU and is represented by different organs. The transport policy at the EU-level develops objectives and guidelines which are implemented by the Member States.

The transport policy objectives are aligned substantially on the approach of sustainability and can be divided into three areas: environmental performance, homogeneous European transport area and social compatibility.

The environmental performance not only of transport and logistics, but also of other industries, is becoming increasingly important. The EU aims at reducing the transport-related emissions of greenhouse gases by 2050 by at least 60% compared to 1990 and 70% compared to 2008. Initially by 2030, a reduction of 20% is to be achieved.

[50] European Commission 2014b
[51] European Commission 2010b, p. 4
[52] European Commission 2011a
[53] European Commission 2011a, p. 13
[54] Duisburger Hafen 2015

Currently, 96% of the energy consumption in the transport sector depends on oil and oil products. In the period until to 2020, the share of renewable energy is to be increased to 10% and by 2050 the oil dependence is to be reduced to well below 90%. This goal will be achieved by increasing the efficiency of the transport system and the investment on research and development to 3% of GDP, as well as the establishment of resource-saving and environment-friendly transport technologies such as electric mobility and alternative fuels.

Moreover, a 30% shift of medium distance (>300 km) intercity passenger and freight journeys from road to rail and waterborne transport is to be achieved by 2030 and a 50% shift is to be achieved by 2050.

An important aspect in the context of a homogeneous European transport area is the liberalization of the European transport market. Although a lot of harmonization activities have been implemented in the past decades, it is necessary to further align the technical standards, particularly in rail transport, and legal framework conditions. It is important to create fair competitive conditions between the different transport modes and within the individual modes.

For the process of harmonization, a well-developed infrastructure is vitally important. The European high-speed rail network is to be completed by 2050 and a tripling of the length of the existing high-speed rail network is to be achieved by 2030, whereat a dense railway network in all Member States is to be maintained.

Furthermore, an entirely functional and EU-wide multimodal TEN-T 'core network is to be constructed by 2030, expanded to a network with a high quality and capacity network by 2050 and a corresponding set of information services. In addition, all core network airports and seaports are to be connected to the rail network, preferably the high-speed network and, if possible, to the inland waterway system.

The TEN-T policy aims at supporting a powerful transport network, which involves all 28 Member States and contributes to the growth of Europe and to the strength of its economy. It is intended to combine the still divided transport network to a single network that connects particularly the east and the west of Europe. The core element of the expansion of the infrastructure is the creation of nine main transport corridors that involve at least three different transport modes, three Member States and two border crossings.

Apart from environmental aspects and aspects of a homogenous European transport area, the EU engages in items of social compatibility as well. In this context, particular attention will be focused on road safety and job creation.

The EU pursues the goal of reducing the fatalities in road transport to close to zero by 2050, and halving road casualties by 2020. Generally, the EU intends to be a world leader in safety and security for transport in all transport modes.

The necessity of a liberal European market is accompanied by quality jobs and working conditions, as personnel is vital for an efficient and sustainable transport system. For this reason it will be important in the future to combat the lack of labor and skilled workers in the transport sector actively. Especially for the infrastructure development in the coming years, the EU provides financial resources for job creation as part of the package "Connecting Europe".

4 LINKAGES OF INLAND PORT PERFORMANCE INDICATORS AND TRANSPORT POLICY OBJECTIVES

After the presentation of the European transport policy objectives in chapter 3, the following chapter 4 analyzes the reflection of these objectives in light of inland port performance indicators. For this reason, the individual objectives are contrasted with the key performance indicators from the project PORTOPIA and it is investigated to what extent the indicators represent the transport policy objectives. In order to ensure an isolated consideration of the objectives, the chapter is structured according to the major covered policy areas environmental performance, homogeneous European transport area and social compatibility.

4.1 Environmental performance

In the future, transport is to be designed environmentally friendly by reducing greenhouse gas emissions and oil dependency as well as the improvement of intermodality, modal shift and combined transport. The reflection of these goals is examined subsequently.

4.1.1 Reduction of greenhouse gas emissions

The greenhouse gas emissions can essentially be decreased by promoting modal shift, the reduction of transport volume and the usage of new technologies.

Modal shift describes the partial transfer of road transport volume to rail and inland waterways, which represent more efficient transport modes, whereby the transport volume and the transport performance are collected separately for each transport mode. Since modal shift requires handling processes between the various transport modes (road/rail, road/ inland waterway), waterside handling and railside handling are important parameters. Theses parameters are collected by the indicators “Waterside handling” and “Railside handling” in the project PORTOPIA. However, these performance indicators show the entire handling related to the respective transport mode. Thus, the calculation includes handling volume, which is not relevant in the context of modal shift, such as handling volume within transport modes and direct loading of material and products, produced or processed by companies with rail or quay wall connection. The indicators do therefore not allow conclusions about an increase of modal shift. In addition, the road transport volume and the development of the entire transport volume remain disregarded, which constitute important comparative figures. As a result, these indicators do not reflect the development of modal shift.

The indicators “Intermodal connectivity” and “Seaport connectivity” represent the number of intermodal connections within the port sector and into the hinterland of inland ports. The service of many transport relations at a high frequency is a fundamental requirement for efficient modal shift, so that these indicators cannot constitute the modal shift quantitatively, however, they indicate an increasing opportunity of transferring transport volume. Thus, there is an indirect relationship between modal shift and the indicators “Intermodal connectivity” and “Seaport connectivity”.

A reduction of transport volume can be achieved e.g. by bundling transport flows. The indicators “Waterside handling”, Railside handling”, “Dry bulk handling”, “Liquid bulk handling” and “General cargo” indicate the handling volume of an inland port, which

depends mainly on the total transport volume. This in turn essentially depends on macroeconomic trends, therefore it is not possible to draw conclusions about the development of the transport volume based on the total transport volume and the various handling volumes of an inland port. In addition, the road transport volume is not considered and thus, there are no references to prove a decrease of the total transport volume.

The environmental performance questionnaire collects different aspects in connection to the reduction of greenhouse gas emissions. For instance, it contains the question: ”Does the port have an environmental monitoring program?” and registers, if a port collects its carbon footprint, which describes the total amount of greenhouse gas emissions that are directly and indirectly caused by an activity.

The use of environmentally friendly technologies represents another opportunity to reduce greenhouse emissions. In this context, the environmental performance questionnaire captures the initiatives to implementing green actions with regard to on-shore power supply, biofuel production for port shelf-supply or bunkering and liquefied natural gas (LNG) bunkering. In addition, the questionnaire shows, if there are differentiated fees for green actions, e.g. for reduced vessel speed, ships using bunker oils with low sulphur content or ships using particle filters.

4.1.2 Reduction of oil dependency

The dependency of traffic on oil and oil related products, as well as the policy objective of reducing the oil dependency, are expressed as percentage of total energy consumption. The oil dependency can basically be decreased by alternative technologies. A distinction is made between the share of energy from oil products and the share of energy from alternative fuel and electricity.

The oil dependency can basically be decreased by using new technologies. As the road traffic is not taken into consideration, the share of energy from alternative drive technologies in the transport sector cannot be displayed quantitatively by indicators from PORTOPIA. However, under the heading of environmental performance, the questionnaire captures various aspects with regard to the reduction of oil dependency. For example, it is collected whether a port offers on-shore power supply, biofuel production for port self-supply or bunkering and LNG bunkering. This information cannot show the transport policy objective of reducing the oil dependency directly, but it indicates a tendency regarding the use of alternative drive technologies within the port sector.

4.1.3 Improvement of intermodality, modal shift and combined transport

An increase of intermodality, modal shift and combined transport can be expressed by the development of the modal split. Thus, the volumes transported by road, rail and inland water ways are important indicators with regard to this policy objective.

The collection of modal shift has already been analyzed in chapter 4.1.1. Modal shift cannot be shown by indicators from PORTOPIA. Although waterside handling and railside handling are collected, these indicators include the entire handling of the different transport modes. It is therefore not possible to draw conclusions about an increase of modal shift. Additionally, the road transport volume and the entire transport volume remain disregarded, which constitutes important comparative figures.

Combined transport is a special form of modal shift and cannot be collected directly by indicators from PORTOPIA either. As combined transport is carried out predominantly containerized, the indicators "Container handling" and "Container dependency" correlate with combined transport. According to the development of these indicators, they can be used to show a tendency regarding combined transport. Consequently, an improvement of combined transport can be shown indirectly by indicators from PORTOPIA.

In addition, the policy objective of improving intermodality, modal shift and combined transport is indirectly constituted by the indicators "Intermodal connectivity" and "Seaport connectivity". These indicators present the intermodal integration of inland ports into the infrastructure, which is vital to shift transport volume efficiently.

4.2 Homogeneous European transport area

The creation of a homogeneous European transport area is essentially based on two aspects. In this section, theses aspects, liberalization of the European domestic markets and infrastructure development, are contrasted with policy objectives.

4.2.1 Liberalization of the European domestic markets

The opening of borders within Europe, in particular the development of required prevailing circumstances, is not shown by indicators from PORTOPIA. A reflection of this transport policy objective cannot be provided by inland port performance indicators.

4.2.2 Infrastructure development

The European wide infrastructure expansion and the linkage of economically important regions are fundamental for economic growth and prosperity. The infrastructure development induces two major areas of activity: expansion of the railway infrastructure and establishment of intermodal freight corridors, including inland ports as important transshipment points and hubs. The enlargement of the high speed railway network is collected in km and the development of the TEN-T 'core network' is collected in the number of connected European ports, the number of railway connections between airports and conurbations and the total length of the railway network. The infrastructure development is covered in different ways by the indicators from PORTOPIA.

The indicators 'intermodal connectivity" and 'seaport connectivity' capture the development of the number of intermodal connections within the port system and to the hinterland of inland ports. Thus, these indicators refer directly to partial aspects of the infrastructure development.

In addition, the governance questionnaire collects, if an inland port is part of the TEN-T network, so it refers to the establishment of intermodal freight corridors and the infrastructure development as well.

4.3 Social compatibility

Human resources are essential for economic action. The coverage of the main traffic-related social aspects, reduction of traffic accidents and job creation, is analyzed below.

4.3.1 Reduction of traffic accidents

The aim of reducing the amount of traffic accidents is not covered by indicators from the project PORTOPIA. As most traffic accidents occur in road traffic[55], it is not possible to reflect this goal with inland port performance indicators.

The indicators collect only processes and structures within the port area, so there is no connection between the indicators and traffic accidents. Data about traffic accidents is not taken into consideration.

4.3.2 Job creation

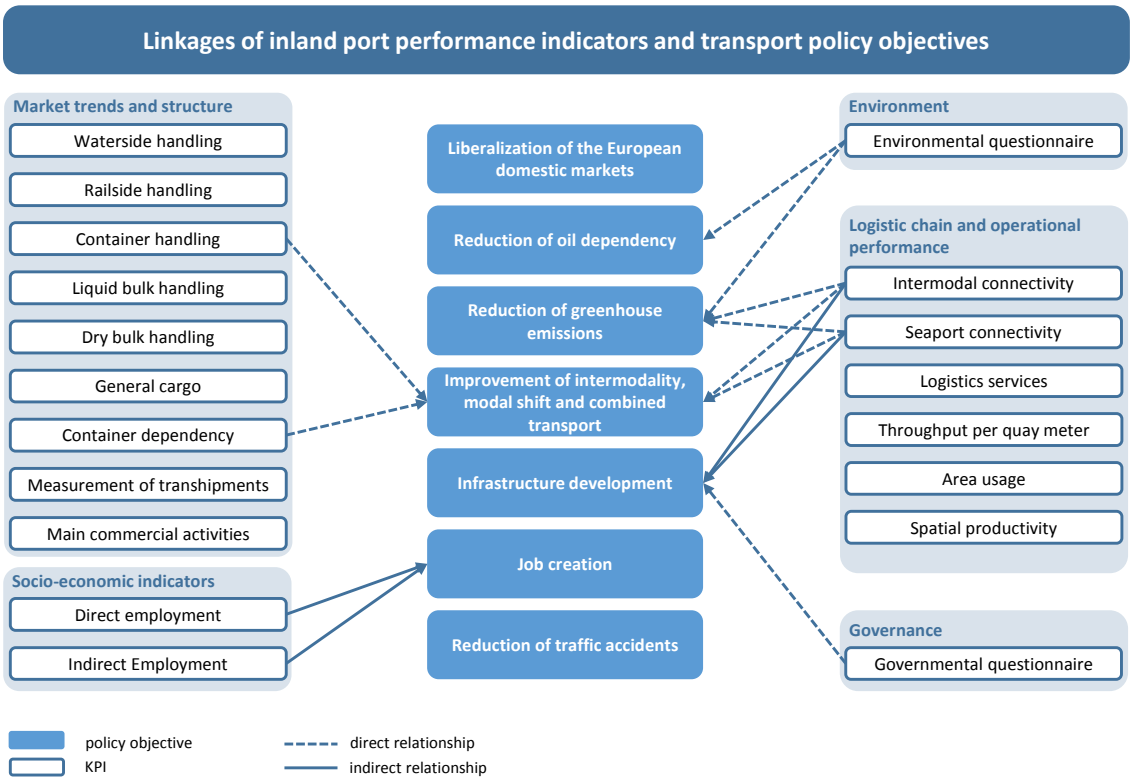
Another objective of the European transport policy is to increase the number of jobs in the transport industry. The indicators 'direct employment' and 'indirect employment' collect the number of existent as well as newly created jobs, which refer directly or indirectly to inland port activities. Thus, this objective is represented immediately by these indicators.

4.4 Summary

The results with regard to the linkages of inland port performance indicators and transport policy objectives are summarized below. The analysis shows, that the transport policy objectives are partially captured by the indicators from the project PORTOPIA. Figure 6 provides an overview of existing linkages.

[55] International Union of combined Road-Rail transport companies 2015, p. 4; Bundesregierung 2013, p. 99

Figure 6: Overview of linkages of inland port performance indicators and transport policy objectives



An environmentally friendly designed transport system is captured indirectly by different indicators. The indicators "Intermodal connectivity" and "Seaport connectivity" express an extending opportunity of transferring transport volume from road transport to more efficient transport modes. In addition, the environmental questionnaire collects different aspects in connection to the reduction of greenhouse gas emissions as well as the reduction of oil dependency. An improvement of intermodality, modal shift and combined transport is indirectly constituted by the indicators "Intermodal connectivity" and "Seaport connectivity". As combined transport is carried out mainly containerized, an improvement of combined transport can also be shown indirectly by the indicators "Container handling" and "Container dependency".

The infrastructure development, including the expansion of the railway infrastructure and the establishment of intermodal freight corridors, is directly collected by the indicators 'intermodal connectivity" and 'seaport connectivity'. Furthermore, the governance questionnaire refers to the establishment of intermodal freight corridors and the infrastructure development as well.

With regard to the social compatibility, the policy objective of creating jobs within the transport industry is directly constituted by the indicators 'direct employment' and 'indirect employment'.

The liberalization of the European domestic markets and the reduction of traffic accidents cannot be shown by indicators from PORTOPIA. An essential factor in this context is a lack of consideration of the available road transport data as well as the overall economic development. Thus, no or only vague statements about the attainment of the respective policy objectives can be derived However, this circumstance is not to be considered to be a weakness of the indicators. On the one hand certain information cannot be collected by means of port performance indicators and on the other hand, the representation of transport policy objectives is not the primary objective of PORTOPIA.

5 BENCHMARKING METHODS FOR INLAND PORTS

Benchmarking means a continuous, systematic process to evaluate and improve products, services and practices[56]. A company, using the benchmarking method, orientates itself on reference values, so-called best practices[57]. These are often key performance indicators, which represent important comparative figures and serve as relevant input.[58] Benchmarking can be used for assessing the competitive situation of units or even systems as a whole. Within the port, and maritime industry, benchmarking is an important opportunity used by the majority of companies and organizations in order to improve practices, functions and products. While the idea of benchmarking methods and tools is already established for seaports, the situation with regard to inland ports looks quite different. Benchmarking has its origin in the field of business management and is currently being introduced within the port industry. At the moment, there are no approved benchmarking methods for inland ports so that the inland port sector makes little use of the potential of benchmarking, in contrast to other medium-sized industries. Thus, the performance measurement and the identification of approaches to improve the performance are difficult. However, there are approaches to analyze inland ports giving benchmarking a basis.[59] In addition, missing KPIs complicate the economic evaluation of the industry, which is adverse with regard to the representation of interests to the European Union[60].

Benchmarking aims at transferring knowledge and experiences of other units into the own unit. It can take place within the own company (internal benchmarking) and in the external environment (external benchmarking)[61] and differs with regard to the considered object (e.g. process, product, service, performance)[62]. Furthermore, there is currently a large variety of techniques in existence, for instance various academic tools like comparable ratios or indexes and tools from practice like the gap analysis and the SWOT analysis. For a detailed description of existing benchmarking techniques see Deliverable 9.1[63].

Port activities have a considerable environmental impact not only at the local level but also on an entire region[64]. The port industry is characterized by a high level of dynamism and is undergoing various changes. The uncertainty is growing, ships are getting bigger, the power is shifting, sustainability is becoming increasingly important, ports are privatizing and have a growing influence to macro-economic interrelations. These changes drive the need for benchmarking. In addition, the growing academic interest and the fact, that this method influences all layers of the industry, drive the importance of benchmarking within the inland port industry as well.[65]

A categorizing system of inland ports can give benchmarking a basis. Inland ports show several attributes, which can be used to set characters. One approach to define a set of attributes for providing an inland port characterization is done by Langenus et al. The basis is the dominant traffic flow, e.g. maritime or continental traffic flows. Moreover,

---

[56] Bichler et al. 1994, p. 33
[57] Luczak 2004, p. 6
[58] Werner 2014, p. 12
[59] Langenus et al. (in press), p. 1
[60] MBV NRW 2008, p. 53
[61] Luczak 2004, p. 8
[62] Bichler et al. 1994, pp. 35
[63] Vonck, Notteboom 2014
[64] Dooms, Haezendonck, Valaert 2013, p. 171
[65] Vonck, Notteboom 2014, pp. 7

Langenus et al. describe a more particular characterization of inland ports traffic flows. Attributes are transported goods in the dominant traffic flow, for instance oil or construction material. Also the ports size compared to the supplied area and the ratio of inbound and outbound traffic are attributes of this characterization. For example, they difference between metropolitan and industrial inland ports.[66]

However, such a strict division is usually difficult to implement because the boundaries are often fluid. Therefore Portopia gives each inland port the opportunity to characterize himself by defining different dimensions or rather parameters. By choosing this way each port can compare itself to other inland ports in the same category. However, the idea of Portopia is not to label the ports by specific parameters, but to give them a possibility to categorize themselves (see Deliverable 7.1).

According to the aim of the benchmarking process, the considered data and indicators has to be chosen from a wide variety. For a comprehensive benchmarking, these data has to meet several requirements. Data availability and completeness are of a great importance and represent the basis to compare different parameters to other units. The considerate data ought to be relevant, which means that the data generates an added value for the users. The accuracy of the data is another important aspect. The accuracy captures how correctly the characteristics that they are designed to measure are estimated or described. In addition, the data ought to be timeliness, assessable, interpretable and coherent. The timeliness of data represents the period of time between their availability and the actual event or phenomenon. The accessibility is the degree of access to the data and metadata. The interpretability of the data relates to the ease of understanding and analyzing the data. The last requirement, the coherence, captures the degree to which the considerate data is logically connected and consistent[67].

In the Portopia program, benchmarking is to be enabled within the European port industry by providing meaningful performance data to increase individual port performance and the performance of the European port system. Therefore one idea is to increase the value of a performance management system for port industry stakeholders by providing an appropriate and scientifically correct benchmarking module. For this purpose an integrated benchmarking tool will be developed. As there are currently no approved benchmarking methods for inland ports, Portopia aims at creating an integrated and balanced view on port performance for inland ports.

Furthermore, benchmarking methods can be used to identify cooperation potential and not only be used for a pure performance comparison. Because cooperation within the port sector – between different inland ports as well as between inland ports and seaports to create a hinterland network – is very important. The dynamic growth of container handling in seaports, for example, requires powerful landside operations. In many cases, the landside transports modes in the hinterland have reached the capacity limit. This creates an increased demand for additional storage and handling areas in the seaports, which are rarely available. Regionalization is an approach to solve this problem. Inland ports can act as complementary location for handling, storage and additional logistics services. The use of this potential depends highly on the ability of inland ports to establish themselves as hubs by providing the required logistics services.[68]

[66] Langenus et al. (in press), p. 5-6
[67] Vonck, Notteboom 2014, p. 26
[68] Binnen_Land 2011, p. 7-8

Competition within the inland port sector is a fundamental element for efficient inland waterway transport. However, it is not opposed to the cooperation of different inland ports so far as the cooperation serves to develop market potential and to utilize scant resources efficiently and not to restrict competition. Due to economic and ecological reasons the cooperation as well as the specialization of inland ports constitutes a sustainable development[69]

In general, there are various benefits of cooperation for ports, which are listed below[70, 71]:

- lower investment volume by bundling,
- higher/better utilization of facilities,
- reliability even at peak capacities,
- joint selling of services, in which the performance of individual ports is too low for efficient marketing,
- development of joint information platforms for shippers and logistics service providers,
- joint development of rail services,
- development of container services,
- bundling of competence.

Within the logistic chain and operational performance sector there already exists a lot of cooperation between ports, on horizontal and as well vertical level. In this context, a horizontal cooperation refers to the cooperation of companies that actually represents competitors[72]. A vertical cooperation means alliances or comparable associations of companies or participants along a transport supply chain, which removes the traditional division of labor between participants of a supply chain[73]. For instance, there are initiatives between different inland ports as well as between inland ports and seaports on administrative level; examples are the cooperation between the port of Hamburg and the port of Dortmund, CCP21 and RheinCargo.

The connection between the ports of Hamburg and Dortmund represents an example for cooperation between a seaport and an inland port. The port of Dortmund is the most important intermodal terminal for the hinterland transport in the Rhine-Ruhr-Region and an important hub in the future of the port of Hamburg. Through the branch office in Dortmund, the cooperation will be intensified. The aim is to prepare for an increasing transport volume and to shift transport volume to rail transport or inland navigation.[74]

CCP21 connects seven important inland ports and aims at promoting the accessibility and sustainable transport by optimizing the logistics processes and the spatial development. The partners are listed below:

- Port of Brussels (BE)
- Port of Lille (FR)
- Port of Paris (FR)
- Port of Liege (BE)

[69] MBV NRW 2008, p. 45
[70] Lange 2006, p. 24
[71] MBV NRW 2008, p. 45
[72] Lange 2006, p. 25
[73] Lange 2006, p. 28
[74] DVZ 2014

- Port of Utrecht (NL)
- Port of Switzerland (CH)
- RheinPorts Basel-Mulhouse-Weil (DE)

In order to develop the transnational cooperation, the CCP21-Project initiates various projects. These projects pursue essentially four goals, including: sensitization of the population and increasing the acceptance of inland ports, promotion of joint spatial utilisation, optimization of freight transport processes and promotion of sustainable inner-city allocation.[75]

RheinCargo represents another example of inland port cooperation. After several years in which the ports of Neuss-Duesseldorf and Cologne have been competitors, the company Rhein Cargo was founded as joint venture between "Häfen und Güterverkehr Köln AG" and "Neuss-Düsseldorfer Häfen" in 2012. The company operates a total of seven inland ports and constitutes the second largest port operations in Germany. In addition to port logistics services, RheinCargo provides logistics services within the rail sector as well.[76]

An efficient benchmarking not only supports individual ports to classify their own performance and to get an overview about the own services, but also to identify potential cooperation partners.

[75] CCP 21 2016
[76] RheinCargo 2016

6 ASSESSMENT

The present task: "Policy linkages, interrelations and benchmarking suggestions (Inland ports performance indicators)", aimed at identifying linkages between key performance indicators from PORTOPIA and current transport policy objectives. The revision shows that transport policy objectives can be covered by inland port performance indicators only at a limited basis.

The transport policy represents a solidary policy area within the EU. It develops laws, directives and standards, which form a framework for the national transport policy of the member states. While the EU policy addresses predominantly transboundary themes, the national policy focuses on the domestic transport. The major policy objective is to create a sustainable transport system, which satisfies economical, ecological and social requirements, including themes like environmental performance, homogeneous European transport area and social compatibility.

The transport policy objectives are partially captured by the indicators. An essential factor in this context is a lack of consideration of the road transport as well as the overall economic development. Thus, no or only vague statements about the attainment of policy objectives can be derived in some cases.

7 REFERENCES

Aachener Stiftung Kathy Beys, 2009. EU Klima- und Energiepaket. Retrieved 02/11/2015 from: http://www.nachhaltigkeit.info/artikel/eu_klima_und_energie paket _2009_ 1526.htm?sid=7a89d6faba0eb3210a2749935c2cc03.

Bichler, K.; Gerster, W.; Reuter, R., 1994. Logistik-Controlling mit Benchmarking. Praxisbeispiele aus Industrie und Handel. Wiesbaden: Gabler.

Binnen_Land, 2011. Logistische Integration von Binnenschiff und Stadthafen: Elemente intelligenter Transportketten für den Güterverkehr. Ergebnisbroschüre.

BP (ed.), 2013. BP Statistical Review of World Energy June 2013. Retrieved 24/11/2015 from: bp.com/statisticalreview.

Bundesregierung (ed.), 2013. Bericht der Bundesregierung über den Stand von Sicherheit und Gesundheit bei der Arbeit und über das Unfall- und Berufskrankheitengeschehen in der Bundesrepublik Deutschland im Jahr 2012. Retrieved 02/12/2015 from: http://dip21.bundestag.de/dip21/btd/18/001/1800 179.pdf.

CCP21, 2016. Über CCP21. Retrieved 14/03/2016 from: http://www.citizenports.eu/de/about-ccp21-german/.

Clausen, U.; Geiger, C., 2013. Verkehrs- und Transportlogistik. 2nd edition. Berlin: Heidelberg: Springer (VDI-Buch), 2013.

Destatis, 2013. Verkehr. EU-weit starker Rückgang der Straßenverkehrstoten. Retrieved 02/12/2015 from: https://www.destatis.de/Europa/DE/Thema/Verkehr/ Verkehr.html.

Die Welt, 2015. Das Märchen von der großen Ölpreisverschwörung. Retrieved 02/12/2015 from: http://www.welt.de/wirtschaft/article136741255/Das-Maerchen-von-der-grossen-Oelpreisverschwoerung.html.

Dooms, M; Haezendonck, E; Valaert, T, 2013. Dynamic green portfolio analysis for inland ports: An empirical analysis on Western Europe. In: Research in Transportation Business & Management 8 (2013), 171-185.

Duisburger Hafen, 2015. Jobmotor Duisburger Hafen sichert mehr als 45.000 Arbeitsplätze (press release). Retrieved 19/01/2016 from: http://presse.duisport.de /newsroom/jobmotor-duisburger-hafen-sichert-mehr-als-45-000-arbeitsplaetze-249.html.

DVZ, 2014. Dortmund schnuppert Seeluft. Retrieved January 2014 from: www.dvz.de/rubriken/binnenschifffahrt/single-view/nachricht/dortmund-schnuppert-seeluft.html.

European Commission, 2006. Keep Europe moving – Sustainable mobility for our continent Mid-term review of the European Commission's 2001 Transport White Paper. Luxembourg: Publications Office of the European Union, 2006.

European Commission, 2010a. Europe 2020: the European Union strategy for growth and employment. Luxembourg: Publications Office of the European Union, 2010.

European Commission, 2010b. Road safety: Policy orientations on road safety 2011-20. Luxembourg: Publications Office of the European Union, 2010.

European Commission, 2011a. White Paper. Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system [COM (2011) 144 final.]. Luxembourg: Publications Office of the European Union.

European Commission, 2011b. Europe 2020 – A strategy for smart, sustainable and inclusive growth. Luxembourg: Publications Office of the European Union, 2011.

European Commission, 2012. 8 Politikfelder der EU / Einführung / Die großen Arbeitsfelder. Aufgabenbereich Gemeinsame Verkehrspolitik. Retrieved 20/11/2015 from: http://www.europarl.europa.eu/brussels/website/content/modul_08/einzel_06.html.

European Commission, 2013a. Die neue EU-Verkehrsinfrastrukturpolitik – Hintergrund (press release). Brüssel: 17/10/13. Retrieved 16/12/2015 from: http://europa.eu/ rapid/press-release_MEMO-13-897_de.htm.

European Commission, 2013b. Verkehr: Neue EU-Infrastrukturpolitik (press release) Brüssel: 17/10/13. Retrieved 16/12/2015 from: Online verfügbar unter http://europa.eu/ rapid/press-release_IP-13-948_de.htm.

European Commission, 2013c. Towards quality inland waterway transport. [COM(2013) 623 final]. Luxembourg: Publications Office of the European Union.

European Commission, 2013d. Entwicklung einer Strategie in Bezug auf schwere Verletzungen bei Verkehrsunfällen – FAQ. Retrieved 16/12/2015 from: http://www.google.de/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=4&ved=0CDkQFjAD& url=http%3A%2F%2Feuropa.eu%2Frapid%2Fpress-release_MEMO-13-232_de.doc&ei=aGBPVICUNaSAzAOp50KgBQ&usg=AFQjCNEmZwNNbqecdYSlp-KFmEi-VJS3RA.

European Commission, 2014a. Transport. Connecting Europe's citizens and businesses. The European Union explained. Luxembourg: Publications Office of the European Union, 2014.

European Commission, 2014b. Serious traffic injuries. Retrieved 14/12/2015 from: http://ec.europa.eu/transport/road_safety/topics/serious_injuries/index_en.htm.

European Commission, 2015b. EU transport in figures. Statistical Pocketbook 2015. Luxemburg: Luxembourg: Publications Office of the European Union, 2015.

European Commission, 2015a. 2020 climate & energy package. Retrieved 15/01/2015 from: http://ec.europa.eu/clima/policies/strategies/2020/index_en.htm (last update 23/12/2015).

European Environment Agency, 2012. EEA greenhouse gas - data viewer. Emissions share by sector in EU28. Retrieved 02/11/2015 from: http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer.

European Parliament, 2008. EP seals climate change package. Retrieved 09/11/2015 from: http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP// TEXT+IM-PRESS+20081208BKG44004+0+DOC+XML+V0//EN.

European Parliament, 2013. REGULATION (EU) No 1315/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 on Union guidelines for

the development of the trans-European transport network and repealing Decision No 661/2010/EU. Retrieved 02/11/2015 from: http://eur-lex.europa.eu /legal-content/DE/TXT/?uri=CELEX%3A32013R1315. Luxembourg: Publications Office of the European Union, 2013.

Eurostat, 2012. Transport. Eurostat Statistics Explained. Retrieved 02/11/2015 from: http://ec.europa.eu/eurostat/statistics-explained/index.php/Transport.

Eurostat, 2013. Share of renewable energy up to 13% of energy consumption in the EU27 in 2011. Retrieved 09/11/2015 from: http://europa.eu/rapid/press-release_STAT-13-65_en.htm?locale=en. Eurostat Press Office 26/04/2013.

Eurostat, 2015. Primary energy consumption. Retrieved 16/12/2015 from: http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&pcode=tsdcc120&language=en.

International Union of combined Road-Rail transport companies, 2015. UIRR Report 2014-15. Retrieved 16/12/2015 from: http://www.uirr.com/de/media-centre/annual-reports/annual-reports/mediacentre/716-annual-report-2014-15-incl-statistics.html.

Lange, B., 2006. Entwicklung der deutschen Nordseehäfen. Studie im Auftrag des Bundes (Bund für Umwelt und Naturschutz Deutschland e.V.).

Langenus, M.; Dooms, M.; Haezendonck, E.; Aerts, G., (in press): Socio-Economic Valuation of Traffic in Inland Ports. The Development of a Weighing Rule for the Port of Brussels. International Journal of Decision Sciences, Risk and Management.

Luczak, H., 2004. Logistik-Benchmarking. Praxisleitfaden mit LogiBEST. 2., vollst. überarb. Aufl. Berlin: Springer (VDI).

Ministerium für Bauen und Verkehr des Landes Nordrhein-Westfalen (MBV NRW), 2008. Wasserstraßenverkehr, Binnenhäfen und Logistik in Nordrhein-Westfalen. Fortschreibung des Wasserstraßenverkehrs- und Hafenkonzeptes Nordrhein-Westfalen.

Rheincargo, 2016. Unternehmen. Retrieved 14/03/2016 from: http://www.rheincargo.com/unternehmen/.

Schöller, O. (ed.), 2007. Handbuch Verkehrspolitik. 1st edition. Wiesbaden: VS Verlag für Sozialwissenschaften.

Stackelberg, F. von; Malina, R., 2012. Verkehrspolitik. Hg. v. Springer Gabler Verlag. Gabler Wirtschaftslexikon. Retrieved 27/11/2015 from: http://wirtschaftslexikon.gabler.de/Archiv/54307/verkehrspolitik-v6.html.

Thomas, M., 2014. Fact Sheets on the European Union. Transport policy: General. European Parliament. Retrieved 27/11/2015 from: http://www.europarl.europa.eu /atyourservice/en/displayFtu.html?ftuId=FTU_5.6.1.html.

Vonck, I.; Notteboom, T.,2014. Deliverable 9.1. A review of existing benchmarking techniques and practices. From the PORTOPIA program.

Werner, H., 2014. Kompakt Edition: Supply Chain Controlling. Grundlagen, Performance-Messung und Handlungsempfehlungen. Wiesbaden: Springer Fachmedien Wiesbaden.