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European Regional Development Fund - Instrument for Pre-Accession II Fund

ISTEN

Integrated and Sustainable Transport in Efficient Network - ISTEN

DT1.2.1 - Focus report on ADRION area and EU level

WP no. and title	WPT1 – Activity T1.2 – Local Analysis
WP leader	CERTH/HIT
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Planned delivery date	M8 – July 2018
Actual delivery date	M16 – April 2019
Reporting period	RP3

Dissemination Level		
PU	Public	X
PP	Restricted to other program participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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Document information

Abstract

The present report defines the importance and alternative forms of port-hinterland integration, presents an overview of the port-hinterland cargo volumes in the ADRION area and provide a comparison between the ADRION area and the rest of the EU in terms of port-hinterland integration.

Keywords

Port, hinterland, integration, ADRION, MED, EU

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Peer Reviewers	-

Document history

Version	Date	Reviewed paragraphs	Short description
1.0	10/12/2018	-	Draft final
2.0	30/4/2019	4.2, 4.3, Annex	Final version

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List of abbreviations

AF	Application Form
ESPO	European Sea Ports Organisation
GCI	Global Competitiveness Index
IAPH	International Association of Ports and harbours
LPI	Logistics Performance Indicator
MED	Mediterranean
R&I	Research & Innovation
RoRo	Roll-on/ Roll-off
ToC	Table of Contents
WEF	World Economic Forum
WPCI	World Ports Climate Initiative

1 Introduction

The aim of the current deliverable is to define the importance and alternative forms of port-hinterland integration, to present an overview of the port-hinterland cargo volumes in the ADRION area and to provide a comparison between the ADRION area and the rest of the EU in terms of port-hinterland integration.

The report is structured in five chapters. In Chapter 2, the importance of port-hinterland integration is discussed, followed by a presentation of the identified types and attributes of port-hinterland integration as defined in ISTEN. In Chapter 3, an overview of the flows in the ADRION area is presented based on data collected from 28 ports. In Chapter 4, differences of port-hinterland integration in the ADRION area and the rest of EU are presented, using the ports as key transfer points between the sea and the land. Finally, in Chapter 5, the key messages emerging from the previous analysis, are summarised. All data collected and used, are provided in the Annex.

2 The importance and alternative forms of port-hinterland integration

2.1 The importance of port-hinterland integration

The importance of port hinterland integration can be justified in three ways:

1. *Port-hinterland integration defines the competitiveness of existing port-hinterland corridors (in terms of cost & time efficiencies) and consequently the competitiveness of the respective ports.*
   A high level of port-hinterland integration can contribute substantially to the reduction of supply chain costs and thus increase competitiveness and facilitate trade. In most door-to-door transport chains, the costs of hinterland transport are higher than maritime transport costs and port costs combined[1].This is mainly due to bottlenecks encountered in the hinterland such as road congestion, insufficient rail infrastructure and barge handling problems in deep sea terminals[2].The efficiency of non-physical processes, the existence of high quality rail infrastructure and services and the coordination between the actors involved in the supply chain, are basic elements of high level port-hinterland integration which can minimize such problems, reduce risk and delays and lead to the reduction of the overall logistics cost.

2. *Port-hinterland integration has the ability to shift existing port catchment areas.*
   Nowadays port competition has moved from competition between ports to competition between transport chains[3]. Hinterlands are usually contestable areas with many ports competing to serve them and the logistics chain decision makers are considering the attributes of the entire chains rather than its specific legs or nodes. Consequently, as hinterland connections become the weakest link of the chain, ports may suffer a loss of traffic or may be unable to sustain/gain market share if their connections are inefficient or costly[4]. A typical example of this are the hinterland connections of the ports of Northern Europe, being an important factor in maintaining their established dominance and making it difficult for ports in the Mediterranean to gain a larger share of the European market[5]. This is the case even for cargo traffic from Asia where Mediterranean ports have an advantage in distance and time terms, because generalised transport costs are also influenced by factors such as the quality of infrastructure, frequency of services, efficiency of intermodal transport and other barriers. A higher level of port-hinterland integration of the South European ports would alleviate this competitive disadvantage in relation to the North European ports and would allow them to grow by attracting more clients and realising the required economies of scale.

[1] De Langen, P. (2008) *Ensuring Hinterland access: The role of port Authorities*, OECD-ITF Discussion paper No 2008-11
[2] De Langen, P. & van De Horst, M. (2008) Coordination in hinterland transport chains: A major challenge for the seaport community, *Maritime Economics & Logistics*, 10(1-2), 108-129
[3]Notteboom Th. & Winkelmans W. (2001) Structural Changes in Logistics: how will Port Authorities Face the Challenge? *Maritime Policy and Management*, 28(1), 71-89
[4]UNECE (2010) *Hinterland connections of Seaports*
[5] Gouvernal, E. et al (2005) Dynamics of change in the port system of the western Mediterranean, *Maritime policy & Management*, 32(2), 107-121

3. *Port-hinterland integration defines to a significant extent the social costs of freight transport (air pollution, congestion, noise).*
   Environmental sustainability can be improved mainly in two ways: by reducing the total mileage for freight transport and by applying greener transport operations. The application of IT systems for information sharing and transparency, together with the coordination of supply chain actors in port-hinterland operations, makes possible the optimisation of the logistics operations and the increased capacity utilisation of transportation means, leading to less kilometres driven. A study commissioned by the port of Rotterdam Authority and Deltalinqs estimated a potential CO_2 reduction of 5-10% through improvements in the efficiency of logistics operations and the load factor of containers and transport modes by the wide application of IT[6]. With regard to greener transportation, according to the World Ports Climate Initiative (WPCI), the main type of emissions to which ports have some influence, are: emissions from port activities (handling, etc.), indirect emissions from the generation of electricity used in port activities, and emissions from transport to/from the port (including vessels and hinterland transport)[7].The reduction of these types of emissions can be achieved by focusing on the sustainability attributes of port-hinterland integration, among which the facilitation of the use of alternative fuels and the promotion of renewable energy sources and environmental friendly modes of transport.

2.2 Types & attributes of Port-Hinterland Integration

Two broad types of port-hinterland integration can be identified:
1. infrastructural integration
2. operational integration.

Infrastructural port-hinterland integration includes the alignment of all infrastructural components (e.g. port-rail-dryport infrastructure alignment, port-rail-dryport infrastructure capacities, cargo transfer equipment, alternative fuel infrastructure, etc.) along the port-hinterland corridor.

Operational port-hinterland integration includes the alignment of processes and information exchanges among corridor stakeholders, to cover both the operational needs of the private actors involved, and also to facilitate the acceleration and simplification of the regulatory compliance processes (customs, border controls etc.) required for the unobstructed flow of freight along the port-hinterland corridor. In this context it also includes the application of relevant innovative information technology systems as well as procedures for the coordination between the supply chain actors. Finally, it includes the alignment of ports and the other corridor actors in the coordinated implementation of initiatives and processes which aim to reduce the environmental footprint of the supply chain.

In order to have a more concrete view on what port-hinterland integration actually means, ISTEN has defined a number of attributes that an integrated port-hinterland corridor should exhibit[8]:

[6] de Leeuw van Weenen et al (2016) *Sustainable logistics for Europe: The role of ports*, Panteia study, 2016
[7] Gonzalez Aregall, M. et al (2018) A global review of the hinterland dimension of green port strategies, *Transportation Research Part D*, 59 (2018) 23–34
[8] DT1.1.1.: Integrated and Sustainable Transport in Efficient Network - ISTEN

1. **Efficiency**, in terms of:
   - physical transfer processes between modes
   - administrative (e.g. customs) processes to hinterland
2. **Sustainability**, in terms of:
   - using environmentally friendly transport means to the hinterland, e.g.: (i) existence of regular, fixed schedule (at least 1/week) environmentally friendly (rail/barge) services to the hinterland; and (ii) considerable share of rail (>10%) in international hinterland throughput
   - efficiently using natural resources & reducing its environmental impact
   - facilitating the use of alternative fuels
   - promoting renewable energy sources
3. **High innovation content**, in terms of:
   - data capture, information sharing & insight generation
   - technology employment
4. **Cooperation & coordination**:
   - among port-hinterland actors
   - among operational & public (compliance) actors
   - between the port and the society (e.g. city)
   - among ports and hinterland corridors of the wider region.

The degree to which a corridor exhibits the above attributes, will reflect the level at which it has become an 'integrated port-hinterland corridor'.

The attributes related to each type of port-hinterland integration are summarized in the following table:

Table 1: Types of port-hinterland integration and their respective attributes

Integration attributes		**Types of integration**	
		Infra-structural integration	Operational integration
Efficiency	Efficient physical transfer processes between modes	✓	✓
	Efficient administrative/regulatory processes to hinterland		✓
Sustainability	Use of environmentally friendly services to the hinterland		✓
	Efficiency in using natural resources &reducing the environmental impact		✓
	Facilitating the use of alternative fuels	✓	
	Promoting renewable energy sources	✓	✓
High innovation	Employment of innovative data capture, information sharing & insight generation	✓	✓
	Employment of innovative technologies	✓	✓
Cooperation & coordination	Port & hinterland actors' coordination		✓
	Coordination of operational & public (compliance) actors		✓
	Port-city cooperation		✓
	Cooperation of regional port-hinterland corridors		✓

3 Port-hinterland cargo volumes in the ADRION area

3.1 Port-hinterland cargo volumes per country and port

3.1.1 Total cargo volumes and mix

For the purposes of the analysis presented in this report, data on annual port cargo throughput in the ADRION area were collected and analysed. The analysis covers the majority of the main ADRION ports[9], supplemented with data from ports participating in ISTEN, some of which can be considered as smaller ports. The final list of the 28 ports which are included in the analysis, along with the detailed data collected, are presented in the Annex (Table 22).

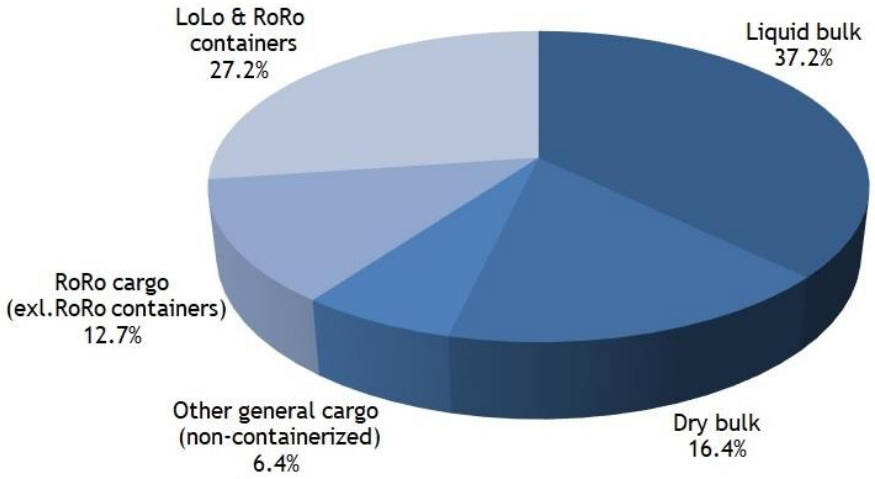
The data analysis covers the following categories: containers, general cargo, RoRo and dry bulk. Liquid bulk flows are not considered being of special interest for ISTEN, therefore these flows are presented only for reasons of data completeness with no further analysis. When looking at the data analysis results, one should keep in mind that:

- the data used were reported according to the ESPO guidelines. This means that the weight of RoRo containers is included in the 'containerized cargo' category and not in the 'RoRo cargo' category. Furthermore, 'general cargo' according to ESPO consists of three subcategories: 'containerized cargo', 'RoRo cargo' and 'other general cargo'. Container and RoRo volumes are analysed separately in this report and therefore 'general cargo' refers only to the 'other general cargo' subcategory.
- when referring to cargo volumes/flows in the ADRION area, we refer to the respective figures of the 28 ports
- the main data sources are the port authorities. Due to lack of detailed data for some ports (namely the port authorities of Ploce, Split, Patra, Igoumenitsa, Elefsina), data from Eurostat were used.

The 2017 annual throughput of the ports included in the analysis was approximately 405 million tonnes in total, consisting of 150 million tonnes of liquid bulk and 255 million tonnes of dry cargo. However, it must be noted that of the 250 million tonnes of dry cargo, a significant part refers to transhipped containers, mainly from the ports of Gioia Tauro and Piraeus, estimated around 60-70 million tonnes.

The shares of the different cargo categories are presented in Figure 1.

[9]According to Directive 42/2009, main ports are ports with annual throughput of at least 1,000,000 tonnes of goods or 200,000 passengers



* Refers to the throughput of 28 ADRION ports
** Percentages based on cargo weight
Source: Port Authorities, Eurostat

Figure 1: Port cargo mix in the ADRION area

To provide some indication of magnitude of the port cargo flows in the ADRION area, it should be mentioned that the total gross weight of goods handled in EU ports was estimated from Eurostat at around 3.9 billion tonnes in 2016.

3.1.2 Container volumes

The 31 ADRION ports analysed, handled in total approximately 10.1 m TEUs, about 33% of which were directed to the hinterland. Focusing on country level (Annex-

Table 23):

- Italy accounted for the majority (44.01%) of the total port-hinterland container volumes of ADRION, with 35.3%[10] of the containers handled in the ADRION ports of Italy going to the hinterland. Overall, the ADRION ports of Italy handled 21.9%[11] of the country's total container volumes that moved to the hinterland.
- Slovenia, through Koper, its only port, is second in terms of hinterland container volumes with 26.77%.
- Greece and the ports of Croatia (Rijeka, Ploce and Split) follow with 15.82% and 8.43% of hinterland volume shares respectively.
- Albania and Montenegro through the ports of Durres and Bar, had significantly smaller volumes accounting for approximately 3.51% and 1.46% of the total hinterland container volume of the ADRION region respectively.
- The Greek ports of Piraeus, Thessaloniki, Elefsina, Heraklion, Lavrio and Volos handled in total 4,577,957 TEUs, mainly through the port of Piraeus (4,117,282 TEUs). In 2017, Piers II & III of the port of Piraeus which are operated by the COSCO subsidiary Piraeus Container Terminals (PCT) handled in total 3,691,815 TEU which were mainly transhipped. Specific percentages regarding the cargo volume split of containers from Piers II & III are not published and hence are excluded from the following table which presents the percentages of hinterland container traffic of the ADRION countries. Pier I, operated by Piraeus Port Authority (also majority-owned by COSCO since 2016) handled 425,467 TEUs, the 17.3% (73,725 TEUs) of which moved to hinterland serving the imports and exports of Greece and a minor traffic toward Balkan countries.

Table 2: Country shares of container port-hinterland traffic (% TEUs)

Country	Share of Container traffic
Italy	44.01%
Slovenia	26.77%
Greece	15.82%
Croatia	8.43%
Albania	3.51%
Montenegro	1.46%

Notes:
1. Only the traffic from Pier I of Piraeus port is included
2. The data source for the port of Split is Eurostat
3. Detailed data in Annex, Table 23
Source: Port Authorities' data

The top-5 ports in terms of container volumes (excluding Piraeus and Gioia Tauro) account for approximately 76% of the total container hinterland traffic (3,318,215 TEUs) of the ADRION area. Four out of the five ports show a higher growth in the over the last ten years compared to the top European container ports (Table 3).

Table 3: Container volumes of top 5-ADRION ports and top-5 EU ports

[10] The total container handling of the ADRION ports of Italy in 2017 was 4,201,278 TEUs. Of these containers, 1,483,988 TEUs (35.3%) were transported to the hinterland (source: Assoporti).
[11] The total container hinterland traffic of Italian ports in 2017 was 6,786,150 TEUs. The ADRION ports of Italy handled 1,483,998 (21.9%) of these containers (source: Assoporti).

Port	Container traffic 2007 (TEU)	Container traffic 2017 (TEU)	Growth between 2007 and 2017
Koper	305,648	911,528	+198%
Venice	329,512	611,383	+86%
Thessaloniki	447,211	402,422	-10%
Trieste	265,863	616,156	+132%
Rijeka	145,024	249,975	+72%
Total:	**1,493,258**	**2,791,464**	**+87%**
Port	**Container traffic 2007 (TEU)**	**Container traffic 2017 (TEU)**	**Growth between 2007 and 2017**
Rotterdam	10,791,000	13,734,344	+27%
Antwerp	8,176,614	10,037,341	+23%
Hamburg	9,889,792	8,815,496	-11%
Bremerhaven	4,892,000	5,509,000	+13%
Valencia	3,043,000	4,832,156	+59%
Total:	**36,792,406**	**42,928,337**	**+17%**

Source: Port Authorities' data

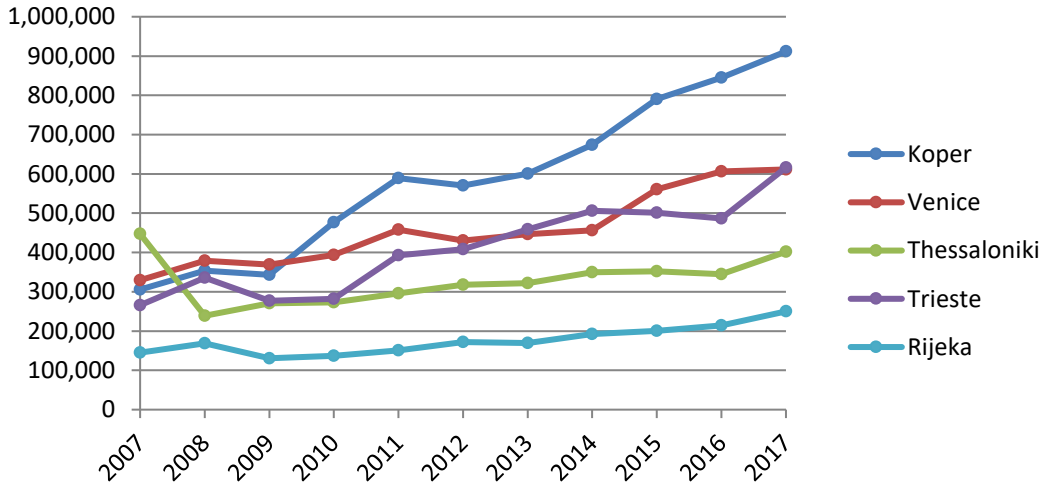


Figure 2: Cargo volumes of top-5 ADRION container ports (TEUs)

Finally, it should be noted that with the exception of the transhipment ports of Piraeus and Gioia Tauro, the port of Trieste is the only ADRION port with significant transhipment share of cargo; 57% (349,046 TEUs) of its container volume moved to the hinterland in 2017.

3.1.3 RoRo cargo volumes

The annual volume of RoRo cargo in 2017 of the ADRION ports was approximately 52 million tonnes. The 96% of this type of cargo is handled by the ports of Italy and Greece (83.76% and 12.08% respectively) while the other countries in the region, Slovenia, Croatia, Montenegro and Albania have relatively small throughputs. As for the ports, the top 10 ports in RoRo volume account for approximately 90% of the total RoRo volume (Annex-Table 24).

Table 4: RoRo cargo volumes of top 10 ADRION ports

Port	RoRo cargo volume (tonnes)
Trieste	8,844,000
Catania	7,756,000
Messina	6,324,000
Palermo	5,752,000
Ancona	4,693,000
Bari	3,165,000
Igoumenitsa	3,082,000
Brindisi	2,814,000
Patra	2,301,000
Ravenna	1,752,000
Total:	**46,483,000**

Source: Port Authorities' data

3.1.4 Dry bulk cargo volumes

The dry bulk cargo throughput of the ADRION ports was approximately 66.4 million tonnes in 2017. Again, leaders in this cargo category are the ports of Italy, which handled 65.62% of the total ADRION region's dry cargo throughput (Italy's ADRION ports handled 61.8%[12] of Italy's total dry cargo port throughput). Slovenia is the second most important country in this type of cargo, handling 11.92% (7,918,000 tonnes), followed by Greece's 10.46% (6,945,000 tonnes) and Croatia's 8.39% (5,571,000 tonnes). Montenegro and Albania have significantly lower throughputs with 2.03% and 1.58% of the total throughput respectively. The top 10 ports in dry cargo volumes account for approximately 82% of ADRION's total volumes (Annex, Table).

Table 5: Allocation of dry bulk cargo volumes among ADRION countries (based on cargo weight)

Country	Share of dry bulk cargo volumes
Italy	65.62%
Slovenia	11.92%
Greece	10.46%
Croatia	8.39%
Albania	2.03%
Montenegro	1.58%

Source: Port Authorities' data

Table 6: Dry bulk cargo volumes of top 10 ADRION ports

Port	Dry Bulk traffic (tonnes)
Ravenna	11,414,000
Taranto	11,347,000
Koper	7,918,000
Venice	6,846,000
Molfancone	3,458,000
Brindisi	3,434,000
Thessaloniki	3,187,000
Elefsina	3,078,000
Ploce	1,973,000
Bari	1,740,000
Total:	**54,395,000**

[12] The total dry bulk traffic of Italian ports in 2017 was 3,865,249 TEUs. The ADRION ports of Italy handled 1,483,998 (21.9%) of these containers (source: Assoporti)

Source: Port Authorities' data

3.1.5 General cargo volumes

Finally, approximately 26.1 million tonnes of general cargo were transferred through the ADRION ports in 2017, mainly through Italian ports (about 64.5 % of total volume). The top 5 ports in general cargo volumes account for 80% of ADRION's total volumes (Annex-Table 26).

Table 7: Allocation of general cargo volumes among ADRION countries (based on cargo weight)

Country	Share of general cargo volumes
Italy	64.69%
Greece	23.59%
Slovenia	5.28%
Croatia	4.44%
Albania	1.18%
Montenegro	0.82%

Source: Port Authorities' data

Table 8: General cargo volumes of top 5 ADRION ports

Port	General cargo traffic (tonnes)
Ravenna	6,339,000
Taranto	5,709,000
Piraeus	5,134,000
Venice	2,302,000
Koper	1,378,000
Total:	**20,862,000**

Source: Port Authorities' data

3.2 Port-hinterland cargo volumes per destination

3.2.1 Container flows

Currently, the majority of containers that move to the European hinterland from the ADRION region are handled by the ports of NAPA (North Adriatic Ports Association). The largest port in terms of port-hinterland container traffic is the port of Koper in Slovenia which showed a significant growth, from 305,648 TEU in 2007 to 911,528 TEU in 2017.

As for its hinterland destinations, the year's 2017 full/stuff+strip container traffic of Koper moved (53% by rail) to the following destinations: 29% to Austria, 22% to Hungary, 16% to Slovenia, 16% to Slovakia, 8% to Czech Republic, 3% to Italy, 2.5% to Poland, 1.7% to Germany, 1.2% to Romania and 1.1% to Serbia[13]. The main competitors of the port of Koper regarding the hinterland container flows to Central Europe are the ports of Trieste and Venice due to their proximity and their excellent railway connections to the European network, namely the TEN-T corridors of Baltic-Adriatic and Mediterranean. As far as the port of Ravenna is concerned, it is more oriented towards serving the market of the Italian region of Emilia-Romagna[14].

[13]Luka Koper - Port of Koper Presentation, March 2018
[14]Kristijan Stamatović, Peter de Langen, Aleš Groznika, Port cooperation in the North Adriatic ports, Research in Transportation Business & Management 26 (2018) 109–121

The port of Thessaloniki, serves mainly the hinterland of Northern Greece and the Balkans. In 2017, 400,998 TEUs were transported from/to the hinterland with approximately 13% (52,495 TEUs) of them being transit containers, to the markets of FYROM/Serbia (approx. 50%) and Bulgaria (approx. 50%). There was also a very small number of containers to/from Albania. The vast majority of these flows were undertaken by road[15].

The port of Ancona, which is a TEN-T core port and a southern terminus for the Scandinavian-Mediterranean cargo corridor, handled 168,578 TEUs in 2017, all of which to/from the hinterland. However only a minor percentage was transported beyond the ports of the nearby region; a 2013 ISFORT (Istituto Superiore di Formazione e Ricerca per I Trasporti) analysis on Ancona's Port Authority survey data, showed that 68% of the containers unloaded at the port of Ancona had regional destination.

The port of Bar, Montenegro's main port, handled 49,282 containers in 2017. It is the starting point for the Bar – Belgrade railway line, the most important infrastructure facility in Montenegro. The port has no regular train service for containerized cargo but only occasionally a container train between Bar and Belgrade and only a small percentage of the containers is transported by rail.

As for the port of Durres, it handled 118,270 TEUs in 2017, all by road. Finally, the remaining ADRION region main ports either do not have container traffic, or their traffic is less than 100,000 TEUs per year, serving mainly their domestic markets.

The main container markets served by selected ADRION ports are shown in the following Table.

Table 9: Main container markets served by selected ADRION ports

	Albania	Austria	Bosnia & Herzeg	Bulgaria	Croatia	Czech Rep.	North Macedonia	Germany	Greece	Hungary	Italy	Montenegro	Poland	Romania	Serbia	Slovakia	Slovenia	Switzerland
Ravenna (IT)								✓			✓							✓
Trieste (IT)		✓				✓		✓		✓	✓					✓		
Koper (SI)		✓	✓		✓	✓		✓		✓	✓		✓	✓	✓	✓	✓	
Rijeka (HR)			✓		✓					✓					✓			
Thessaloniki (GR)				✓			✓		✓						✓			
Durres (AL)	✓																	
Bar (ME)												✓			✓			

Source: Data from port authorities, terminal operators & logistics service providers

It must be noted that the largest ports in the ADRION region in terms of container traffic are the port of Gioia Tauro in the Calabria region and the port of Piraeus in Greece. However, as mentioned above, these two ports currently operate mainly as transhipment hubs connecting intercontinental routes passing through the Mediterranean to feeder routes and don't directly serve the hinterland.

[15]ThPA presentation, PROJECT ISTEN – 2st meeting, Thessaloniki, 26 – 27 June 2018

3.2.2 RoRo flows

RoRo traffic is an important part of the operations of many ports in the ADRION region. Currently there are no data available regarding the volume of RoRo freight flows between the ports of the ADRION region. However, the existing regular RoRo services between the ports can serve to a certain extent as proxy of these flows. Furthermore, it is important to mention that to some ports of Italy and Greece, a significant part of this type of traffic serves the connection of islands with the mainland and is not the subject of this report.

In the following tables, the international regular RoRo/RoPax services between the countries of the ADRION region and between ADRION ports are presented.

Table 10: Number of international regular RoRo/ RoPax services* between ADRION ports in 2016-2017 (country level)

	Italy	Slovenia	Croatia	Montenegro	Albania	Greece
Italy		2	4	4	7	12
Slovenia	2		0	1	0	2
Croatia	4	0		0	0	0
Montenegro	4	1	0		0	2
Albania	7	0	0	0		0
Greece	12	2	0	2	0	

* A service between two countries can serve one or more ports in each country.
Source: Harbours Review

Table 11: Number of international regular RoRo/RoPax services between ADRION ports, 2016-2017

	Ancona	Bari	Brindisi	Catania	Messina	Molfancone	Palermo	Ravenna	Taranto	Trieste	Venice	Koper	Split	Bar	Durres	Igoumenitsa	Patra	Piraeus	Total num. of services
Ancona (IT)												-	3	-	1	3	3	-	**10**
Bari (IT)												1	-	1	2	1	2	1	**8**
Brindisi (IT)												-	-	-	1	2	1	-	**4**
Catania (IT)												-	-	1	-	-	1	-	**2**
Messina (IT)												-	-	-	-	-	-	-	**0**
Monfalcone (IT)												1	-	1	-	-	-	1	**3**
Palermo (IT)												-	-	-	-	-	-	-	**0**
Ravenna (IT)												1	-	1	-	-	1	1	**4**
Taranto (IT)												-	-	1	-	-	-	-	**1**
Trieste (IT)												-	-	-	1	2	2	-	**5**
Venice (IT)												2	-	1	-	1	2	2	**8**
Koper (SI)	-	1	-	-	-	1	-	1	-	-	2		-	1	-	-	-	2	**8**

Split (HR)	3	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	**3**
Bar (ME)	-	1	-	1	-	1	-	1	1	-	1	1	-		-	-	1	1	**9**
Durres (AL)	1	2	1	-	-	-	-	-	-	1	-	-	-	-		-	-	-	**5**
Igoumenitsa (GR)	3	1	2	-	-	-	-	-	-	2	1	-	-	-	-				**9**
Patra (GR)	3	2	1	1	-	-	-	1	-	2	2	-	-	1	-				**13**
Piraeus (GR)	-	1	-	-	-	1	-	1	-	-	2	2	-	1	-				**8**

Source: Harbours Review

As can be concluded from the information in the two previous Tables, there are many RoRo/RoPax regular services connecting the ports of the ADRION region. The port of Patras has the largest number of services (13) followed by Ancona (10), Igoumenitsa and Bar (9). The ports of Venice, Bari, Koper and Piraeus have 8 services. Italy has established RoRo connections with all the countries in the ADRION region, while the ports of Igoumenitsa, Split and Durres are connected only with Italian ports. This fact partially explains the large total throughput of RoRo freight in the Italian Adriatic ports. The most important connection between ADRION ports in terms of volume is the line Ancona – Igoumenitsa – Patras. The port of Ancona in 2017 handled 4,693 thousand tonnes of RoRo cargo mainly through the regular service line Ancona – Igoumenitsa – Patras. According to the 2013 ISFORT analysis previously mentioned, this route was the main link between the central Europe and the South-East Med. More specifically, the 2/3 of RoRo traffic from Ravenna to Greece comes from central and west Europe[16]. Also, the ports of Patras and Igoumenitsa show significant RoRo traffic as part of this route.

As for the international RoRo services with Mediterranean ports outside the ADRION region, these are presented in Table 12:

Table 12: Number of regular RoRo/RoPax services between ADRION ports and other Mediterranean ports, 2016-2017

	ES					CY	MT	DZ		EG	IL		LB	LY	TN	TUR								
	Barcelona	Malaga	Sagunto	Tarragona	Valencia	Limassol	Valetta	Djen-Djen	Bejaia	Alexandria	Haifa	Ashdod	Beirut	Tobruk	Tunis	Haidarpasha(Ist.)	Pendik(Ist.)	Ambarli(Ist.)	Izmir	Mersin	Derince	Borusan	Autoport	Gemlik
Ancona (IT)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Bari (IT)	-	-	-	-	-	-	-	1	1	1	-	-	1	1	-	-	-	-	1	1	-	-	-	-
Brindisi (IT)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Catania (IT)	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Monfalcone (IT)	-	-	-	-	-	1	-	-	-	1	1	1	-	-	-	-	-	-	-	-	1	-	1	1
Palermo (IT)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
Ravenna (IT)	-	-	-	-	-	1	-	-	-	1	1	1	-	-	-	-	-	-	-	-	1	-	1	1
Taranto (IT)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trieste (IT)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	1	-	1	-	-	-	-

[16]INTERMODARIA: Supporting Intermodal Transport Solution in the Adriatic Sea, WP3 Freight Routes Analysis, Activity 3.2/3.3-Origin Destination RoRo and Container Traffic Analysis. Port of Ancona, Isfort

Venice (IT)	-	-	-	-	-	1	-	1	1	2	1	1	1	1	-	-	-	-	1	1	1	-	1	1
Koper (SI)	-	-	-	-	-	1	-	1	1	2	1	1	1	1	-	-	-	-	1	1	1	-	1	1
Split (HR)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bar (ME)	-	-	-	-	-	1	-	-	-	1	1	1	-	-	-	-	-	-	-	-	1	-	1	1
Durres (AL)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Igoumenitsa (GR)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Patra (GR)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Piraeus (GR)	1	1	1	1	1	2	-	1	1	3	1	2	1	1	-	-	-	-	2	1	2	2	1	1

Source: Harbours Review

As mentioned in 3.1.3, the leader in terms of RoRo traffic in the ADRION region is the port of Trieste which handled 8,844 thousand tonnes of cargo (excluding RoRo containers) in 2017. This was mainly due to the established strategic relationship of the port of Trieste with Turkey in the last decade. Several Turkish shipping companies have started RoRo ferry services between Trieste and ports such as Istanbul (Haidarpasha, Pendik, Ambarli), Mersin and Cesme, reaching around 5.5 million tonnes of traffic. About a third of the total trade between Europe and Turkey passes through the Port of Trieste, including the regular shipments of automotive components sent from Germany, France and Britain to assembly plants in Turkey.

The port of Koper handled in its RoRo and car terminal 1.12 million tonnes of new vehicles (721,253 units), of more than twenty world car manufacturers in 2017. The imports originated mainly from Japan, South Korea and Turkey. The port has regular connection to ports in Italy, Montenegro, Greece, Turkey, Cyprus and ports in North Africa and the Middle East.

The port of Bar, despite its small throughput (83 thousand tonnes in 2017), is connected to many ports, in Italy, Slovenia, Greece, Cyprus, Turkey, Israel and Egypt.

3.2.3 Dry Bulk and General cargo

Currently there are no detailed data available regarding the transhipment and hinterland flows of dry bulk and general cargo between the ADRION ports and between ADRION region and the rest of the EU.

3.2.4 Conclusions from the analysis

Summarizing the analysis above, the following conclusions are drawn:

- The leader in all cargo categories is Italy, due to the size of its economy, the large number of ports and the quality of connections and services. In total, Italian ports handle approximately 61% of the dry cargo and 77% of the liquid cargo throughput of the ADRION area.
- The ADRION area handles approximately 10% of the total gross weight of goods handled in EU ports. This volume is smaller than the throughput of Europe's largest port, the port of Rotterdam.
- The ADRION area and especially the ports of NAPA had a significantly larger increase in container traffic over the last years compared to the top ports of EU.

- The majority of containers with destination to central Europe are transferred through the ports of NAPA while the ports of East Adriatic (Croatia, Montenegro and Albania) and Greece serve mainly the Balkans.
- The most important RoRo/RoPax flows in terms of volume are observed between the ports of Ancona, Igoumenitsa and Patras within the ADRION area, and between Trieste and the Turkish ports of Istanbul and Mersin. RoRo traffic is an important part of operations for several Italian and Greek ports, having a large share of their international traffic.

3.3 Data sources used &availability

The analysis presented previously, was based on data collected from a number of data sources. These sources are described in the following sections for two reasons. First, to serve as a repository for further analysis throughout the project. Secondly, in order to highlight the main data gaps and also the incompatibilities among data sources.

3.3.1 Port Authorities

Port Authorities are public organisations, responsible for the port area's development, management and infrastructure. They provide information about the seaborne traffic of the ports by publishing statistical data and annual reports of ports' operations. Depending on the port's activities, they include all or some of the following information components:

- Annual total throughput of the port in tonnes.
- Annual container handling, classified into hinterland/transhipment, full/empty containers categories in TEUs and tonnes.
- Annual bulk cargo throughput, classified into dry, liquid and general cargo categories in tonnes.
- Annual RoRo Units or/and number of commercial vehicles transported.

Looking at the ADRION ports' websites, it was observed that there is lack of a common way of publishing freight data, a fact that makes difficult the collection of comparable data. Furthermore, regarding hinterland traffic volumes, there is limited data on containers and no data about bulk cargo. As for the freight flows, the port authorities provide limited data matching the origins and destinations of port-hinterland flows.

3.3.2 Associazione dei Portiltaliani - ASSOPORTI (Italian Ports Association)

The Italian ports' association is a non-profit association based in Rome. It represents 57 ports of national importance, operated by a system of 15 Port Authorities, which are entrusted with the strategic role of guiding, planning and coordinating the port system of their area. Assoporti is a member of the Organization of European Seaports (ESPO). Assoporti collects statistics from the port Authorities and publishes aggregated reports with the freight traffic of every port member presented in a uniform way. These reports include, among others, the following information components:

- Annual total throughput of the port in tonnes.

- Annual container traffic handling, classified into hinterland and transhipment in TEUs.
- Annual bulk cargo throughput, classified into dry, liquid and other cargo (which includes containers, RoRo and other goods weight in tonnes).
- Annual number of RoRo Units/ commercial vehicles transported.

3.3.3 Hellenic Ports Association (ELIME)

The Hellenic Ports Association (ELIME) provides on an annual basis data on freight operations in all Greek main ports including the following information components:

- Annual total freight throughput of the port in tonnes.
- Annual total number of TEUs handled by the port.
- Annual total number of commercial vehicles transported.

It must be noted that the data provided are aggregate. More specifically, there are no details regarding the type of cargo (dry/liquid bulk, general cargo) or hinterland/transhipment of containers in Greek ports.

3.3.4 European Sea Ports Organisation (ESPO)

The European Sea Ports Organisation (ESPO) is an organization based in Brussels, representing the common interests and promotes the common views and values of its members to the European institutions and its policy makers. It provides data for more than 50 European ports through the ESPO Rapid data Exchange System. It includes quarterly data on:

- Total tonnage: Tonnage of goods carried, including packaging and including the tare weight of containers or RoRo units (in tonnes).
- Total liquid bulk (in tonnes).
- Total dry bulk (in tonnes).
- Total general cargo (in tonnes).
- Containers (in tonnes, TEUs).

Furthermore, ESPO publishes market development annual reports which include freight volumes of selected member ports based on Eurostat figures, with the following information components:

- Liquid bulk traffic (in tonnes).
- Dry Bulk traffic (in tonnes).
- RoRo traffic including self-propelled units & other RoRo and mobile non self-propelled units (in tonnes).
- General non-containerised cargo traffic (in tonnes).
- Container traffic for selected ports (in TEU).

The most recent data provided by these reports is for 2016.

3.3.5 Eurostat

Eurostat provides extensive data regarding the freight traffic of European ports, annually and quarterly, which are used in many reports and documents from various

organisations and associations. However, this data comes from different sources and is recorded with a particular methodology, making the information provided not directly comparable to the relevant information provided by port authorities. The methodology used by Eurostat for the collection of maritime freight data differs from the port authorities in the following (source: ESPO):

- Eurostat disseminates figures on the gross weight of goods handled in the ports (excluding the tare weight of containers and RoRo units). However, port authorities use the gross-gross weight of goods (including the tare weight of containers and RoRo units).
- Eurostat figures on number of TEUs handled only cover LoLo containers (Lifted-on Lifted –off). RoRo containers (Rolled-on Rolled-off) are counted as RoRo units while port authorities' reports number of containers in TEU independently of the kind of vessel transporting them.
- Eurostat's maritime statistics are strictly limited to handling of goods related to seaborne transport. Any handling of inland waterway goods in ports is excluded.
- In addition, there might be differences in coverage of actual port facilities included in Eurostat's definition of a "statistical port" and the facilities included in the figures of a port authority.
- Eurostat relies on data from the National Competent Authorities (NCAs).

3.3.6 Other sources

Harbours review

The Harbours Review project is an on-line European ports database as well as a bi-monthly electronic magazine with expert views on the most important issues for Europe's port sector. It publishes reports every two years with maps and details about all the regular services for RoRo and container traffic in Europe.

4 Port-hinterland integration in the EU and the ADRION area

The aim of this chapter is to provide a comparison between the ADRION area and the rest of the EU in terms of specific aspects of port-hinterland integration. To achieve this, attributes of port-hinterland integration as defined in section 2.2 are being used as the main comparison indicators, while data from various sources are used as proxies for assessing each attribute. It should be noted that no data have been found in order to be able to assess the cooperation & coordination dimension. The assessment indicators and data sources which are being used in relation to each port-hinterland attribute, are presented in the following Table.

Table 13: Port-hinterland attributes, assessment indicators and data sources

Port-hinterland attributes	Assessment indicators	Data sources
1. Efficiency		
Efficient physical transfer processes between modes	Overall LPI index	World Bank international LPI
	Quality of trade & transport infrastructure	World Bank international LPI
	Ease of arranging competitively priced shipments	World Bank international LPI
	Competence & quality of logistics services	World Bank international LPI
	Frequency with which shipments reach consignees within scheduled or expected delivery times	World Bank international LPI
	Quality of port infrastructure	World Economic Forum, GCI
	Quality of rail infrastructure	World Economic Forum, GCI
Efficient administrative/regulatory processes to the hinterland	Efficiency of customs & border management clearance	World Bank international LPI
2. Sustainability		
Use of environmentally friendly services to the hinterland	Fixed-schedule rail services to the hinterland	Port Authorities & Rail Operators websites
	Rail share in port-hinterland volumes	UIC data on combined transport in Europe
Efficiency in using natural resources & reducing the environmental impact	Certified environmental management processes	EcoPorts
	Port incentives for reducing the emissions from maritime transportation	Green Award Organisation, WPSP Environmental Ship Index, Clean Shipping Index Organisation, Blue Angel German Ecolabel
Facilitating the use of alternative fuels	Status of LNG provision in the ports	SEA\LNG coalition Bunker Navigator
3. Innovation content		
Employment of innovative data capture, information sharing & insight generation	Participation of European sea ports in ongoing H2020 R&D projects	INEA funded projects database
Employment of innovative technologies	Ability to track & trace consignments	World Bank international LPI

In the following chapters, where values for ADRION, Mediterranean (MED) and Europe are shown, these are median values calculated from the results of the corresponding individual countries. Furthermore, when presenting values for 'Europe' we take into

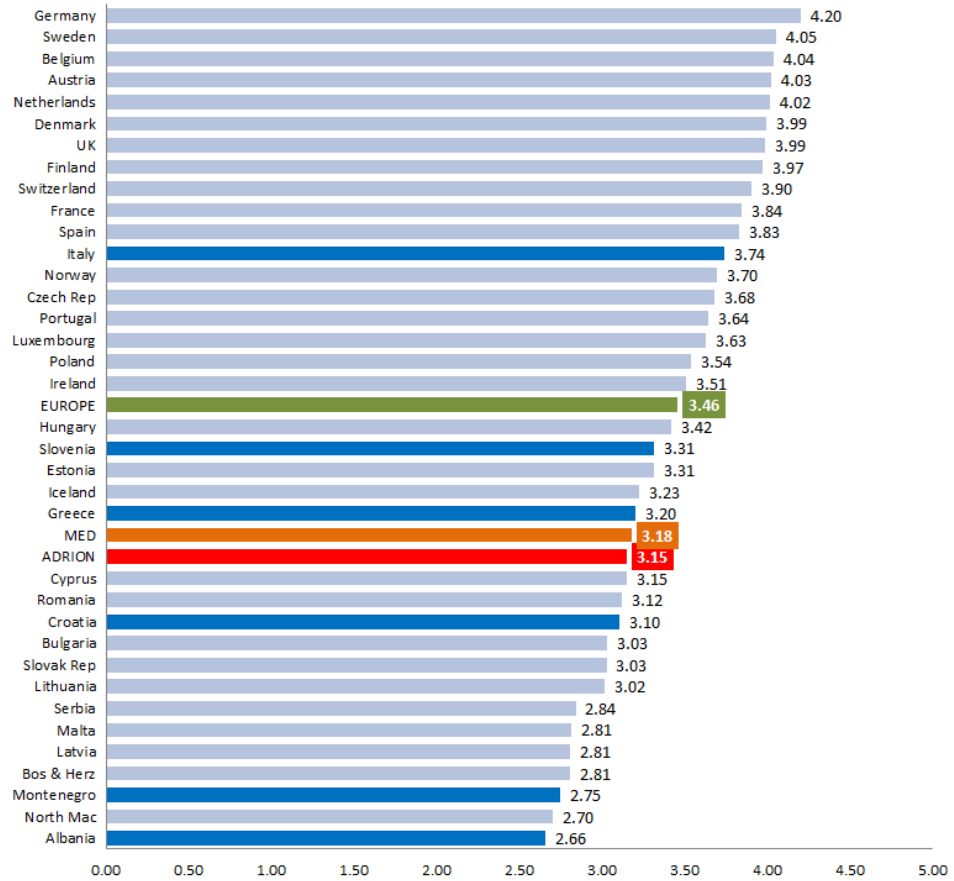
account all counties included, and when referring to 'MED' all Mediterranean countries, including the ADRION ones.

4.1 Efficiency

4.1.1 Efficient physical transfer processes

An assessment of port-hinterland efficiency in terms of physical transfer and administrative processes can be made using input provided by the World Bank and the World Economic Forum (WEF). Even though the information provided is at country level and not at the port level, port-hinterland operations are significantly depended on the prevailing conditions of a port's country and broader area hence this analysis can lead to useful conclusions. The ADRION area's performance is compared to the performance of the Mediterranean area and Europe as a whole (see Figures 3-7).

In terms of the overall LPI index, Europe shows a calculated value of 3.46, followed by the Mediterranean countries with a value of 3.18, while the ADRION countries come third with a value of 3.15. Albania and Montenegro are the ADRION countries with the lower LPI scores, while Italy and Slovenia are the ones with the highest scores. Greece ranks just above the ADRION median score. If we consider the European median LPI value as the comparison standard (100%), the MED LPI is at 92% and ADRION at 91%. Using the top performing country's (Germany) LPI value as the comparison standard (100%), ADRION is at 75%.



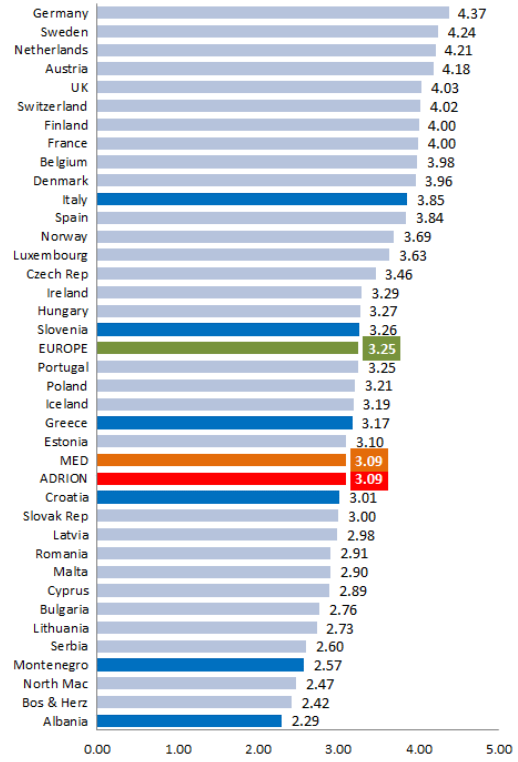
Source: Based on analysis of LPI 2018 results

Figure 3: LPI index comparison

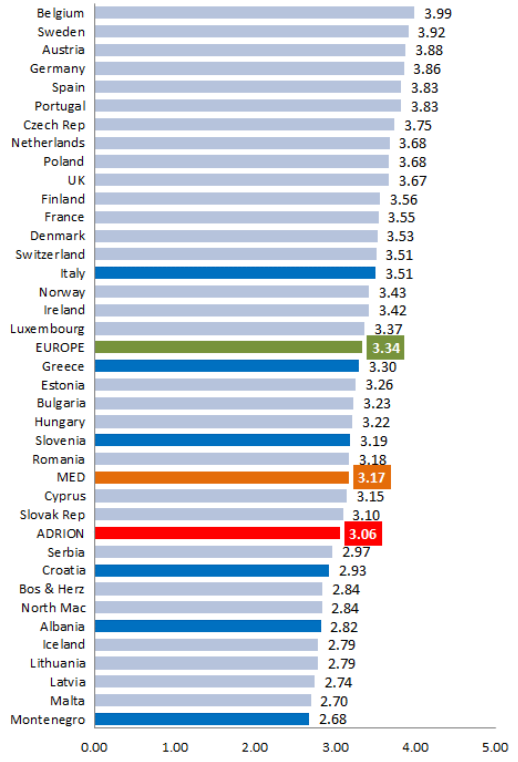
In terms of the quality of trade & transport related infrastructure, Europe shows a calculated value of 3.25, followed by the Mediterranean countries and the ADRION countries with a value of 3.09. Again, Albania and Montenegro are the ADRION countries with the lower scores. Italy and Slovenia are the ones with the highest scores, while Greece ranks above the ADRION and MED median scores. If we consider the European median value as the comparison standard (100%), the MED and ADRION performance is at 95%. Using the top performing country's (Germany) value as the comparison standard (100%), ADRION is at 71%.

Looking at the ease of arranging competitively priced shipments to individual countries, Europe shows a calculated value of 3.34, followed by the Mediterranean countries with a value of 3.17, while the ADRION countries come third with a value of 3.06. Montenegro and Albania are the ADRION countries with the lower scores, but this time with Montenegro at the lowest level. Italy and Greece are the ones with the highest scores in the ADRION area. If we consider the European median value as the comparison standard (100%), the MED LPI is at 95% and ADRION at 92%. Using the top performing country's (Belgium) value as the comparison standard (100%), ADRION is at 77%.

How do you rate the quality of trade & transport related infrastructure (e.g. ports, railroads, roads, IT) in the following countries?
(1 = very low; 2 = low; 3 = average; 4 = high; 5 = very high)



How do you rate the ease of arranging competitively priced shipments to the following countries?
(1 = very difficult; 2 = difficult; 3 = average; 4 = easy; 5 = very easy)



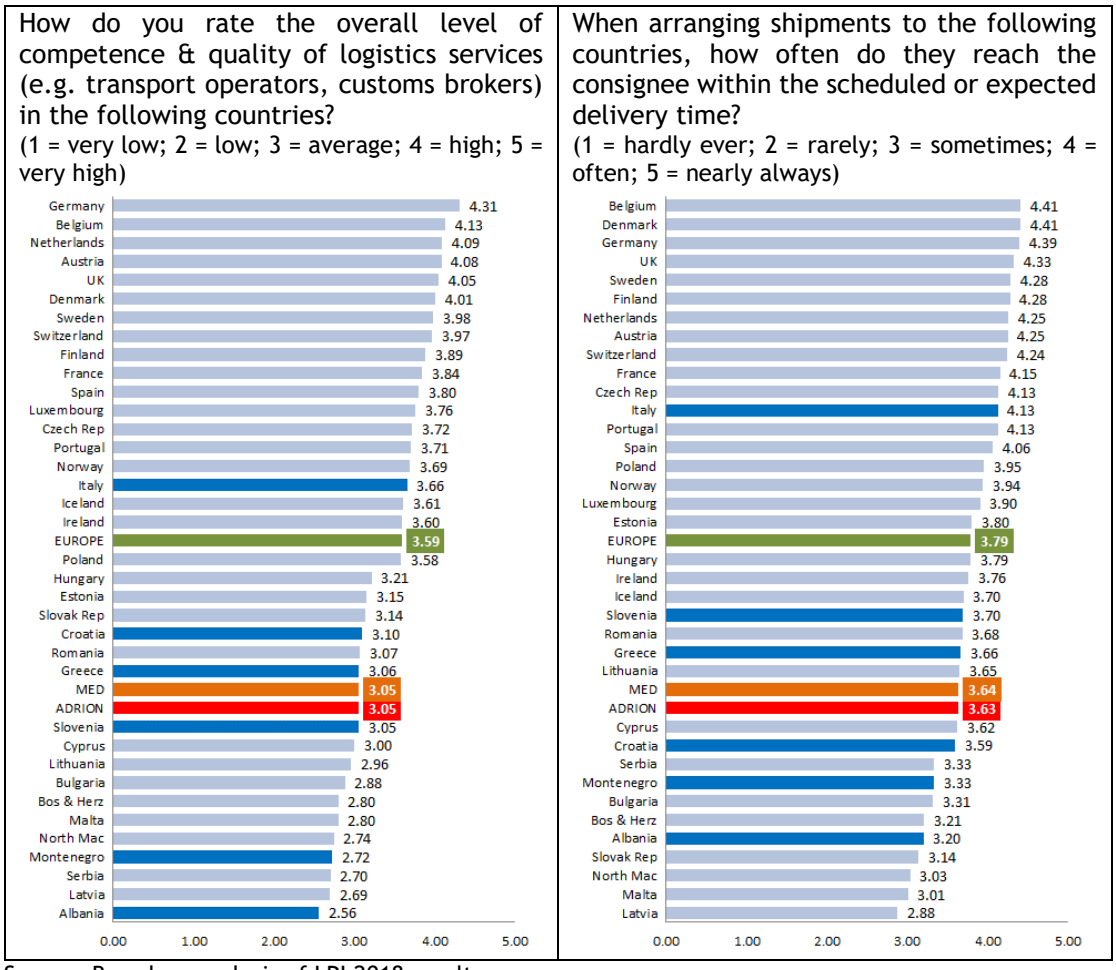
Source: Based on analysis of LPI 2018 results

Figure 4: Infrastructure quality & competitive pricing comparison

In terms of the competence & quality of logistics services, Europe shows a calculated value of 3.59, followed by the Mediterranean and ADRION countries with a value of

3.05. Again, Albania and Montenegro are the ADRION countries with the lower scores. Italy and Croatia are the ones with the highest scores, while Greece ranks just above the ADRION median score. If we consider the European median value as the comparison standard (100%), the MED and ADRION performance is at 85%. Using the top performing country's (Germany) value as the comparison standard (100%), ADRION is at 71%.

Looking at the arrival of shipments within the scheduled/expected delivery time to individual countries, Europe shows a calculated value of 3.79, followed by the Mediterranean countries with a value of 3.64, while the ADRION countries come third with a value of 3.63. Albania and Montenegro are the ADRION countries with the lower scores. Italy and Slovenia are the ones with the highest scores in the ADRION area. If we consider the European median value as the comparison standard (100%), the MED and ADRION is at 96%. Using the top performing country's (Belgium) value as the comparison standard (100%), ADRION is at 82%.

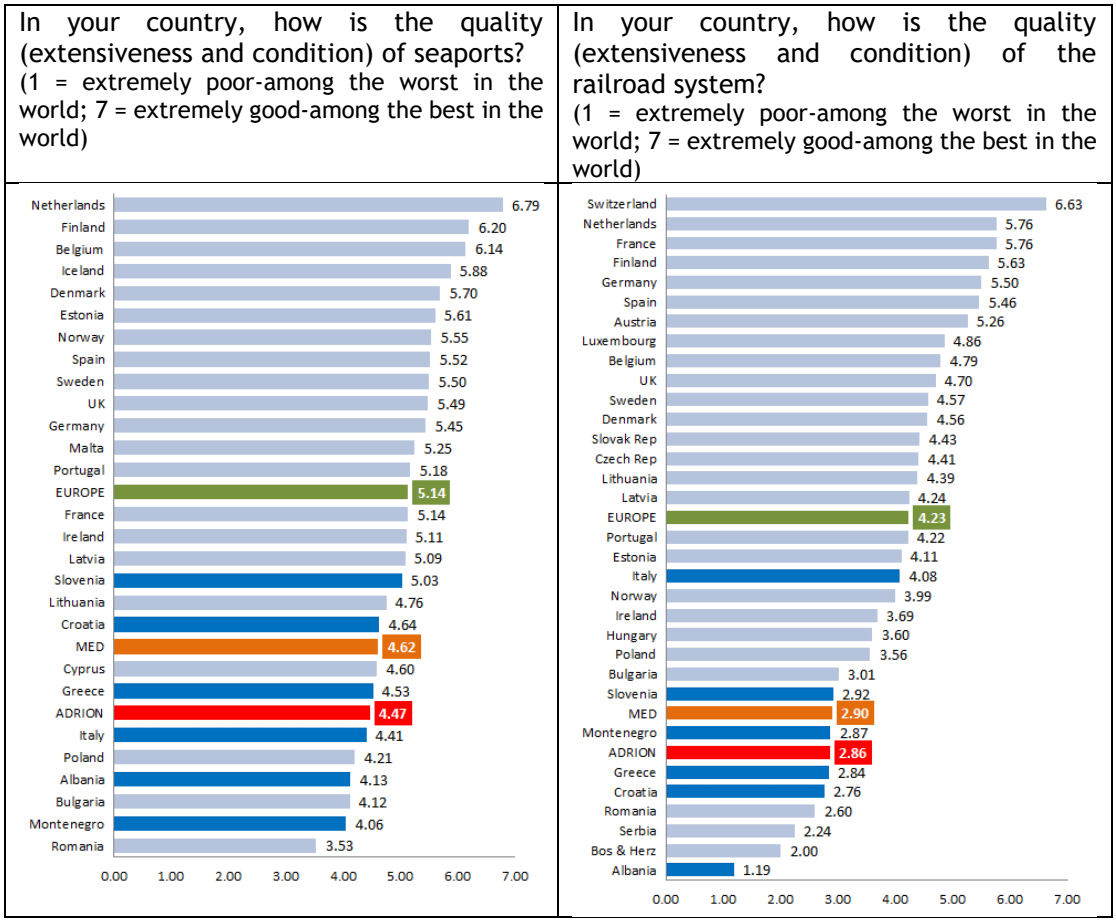


Source: Based on analysis of LPI 2018 results

Figure 5: Logistics service quality and delivery reliability comparison

In terms of the quality (extensiveness & condition) of sea ports, Europe shows a calculated value of 5.14, followed by the Mediterranean countries with a value of 4.62, while the ADRION countries come third with a value of 4.47. Montenegro and Albania are the ADRION countries with the lower scores. Slovenia and Croatia are the ones with the highest scores, while Greece ranks just above the ADRION median score. Interestingly, Italy has been ranked below the ADRION median score. If we consider the European median value as the comparison standard (100%), the MED is at 90% and ADRION at 87%. Using the top performing country's (Netherlands) value as the comparison standard (100%), ADRION is at 66%.

Looking at the quality (extensiveness and condition) of the railroad system, Europe shows a calculated value of 4.23, followed by the Mediterranean countries with a value of 2.90, while the ADRION countries come third with a value of 2.86. Albania and Croatia are the ADRION countries with the lower scores. Italy and Slovenia are the ones with the highest scores in the ADRION area. If we consider the European median value as the comparison standard (100%), the MED is at 69% and ADRION at 68%. Using the top performing country's (Switzerland) value as the comparison standard (100%), ADRION is at 43%.

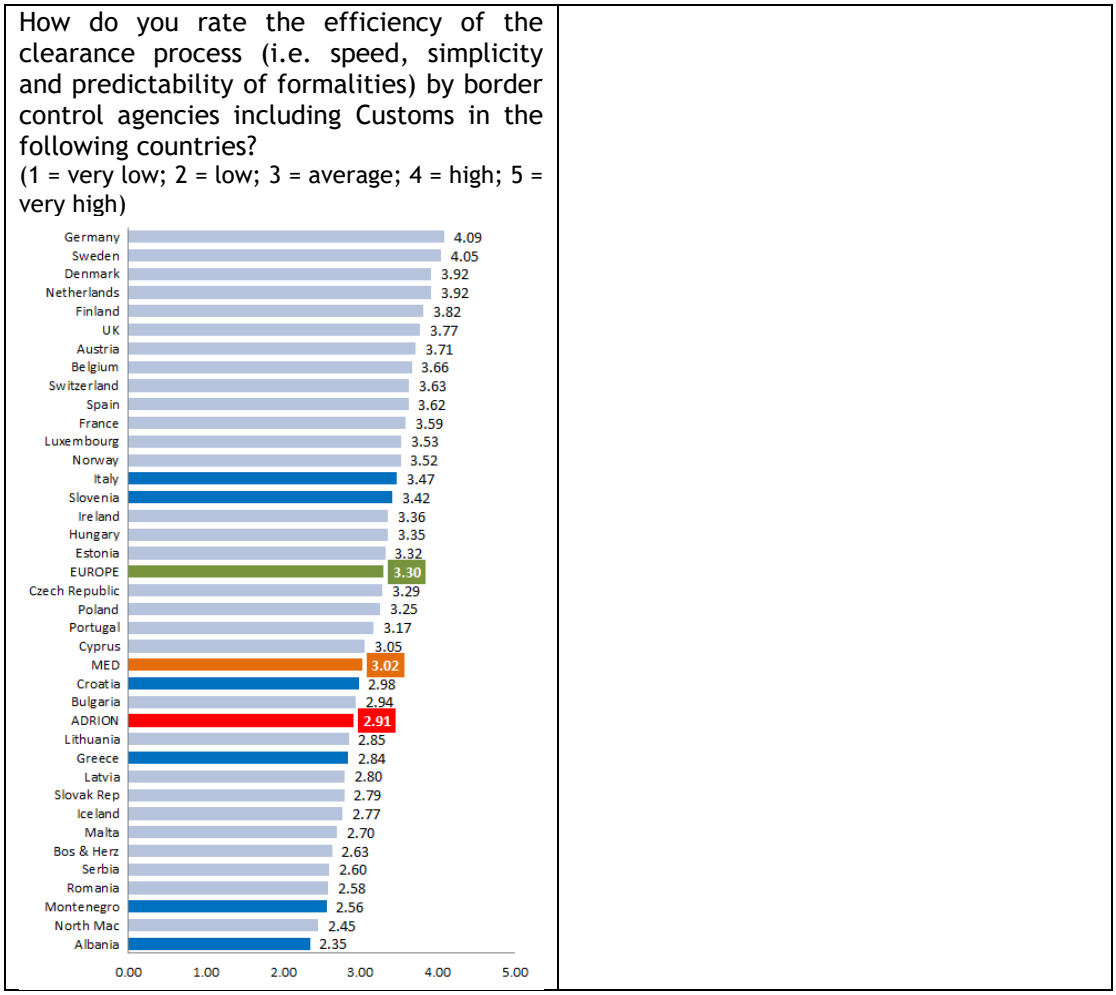


Source: The Global Competitiveness Index Historical Dataset 2007-2017, World Economic Forum, version 20180712

Figure 6: Port & rail infrastructure quality comparison

4.1.2 Efficient administrative/regulatory processes

Finally, in terms of the efficiency of the clearance process (i.e. speed, simplicity and predictability of formalities), Europe shows a calculated value of 3.30, followed by the Mediterranean countries with a value of 3.02, while the ADRION countries come third with a value of 2.91. Montenegro and Albania are the ADRION countries with the lower scores. Italy and Slovenia are the ones with the highest scores. If we consider the European median value as the comparison standard (100%), the MED is at 92% and ADRION at 88%. Using the top performing country's (Germany) value as the comparison standard (100%), ADRION is at 71%.



Source: Based on analysis of LPI 2018 results

Figure 7: Cargo clearance process comparison

From the previous analysis it becomes clear that the ADRION area countries lag behind the rest of Europe in terms of a number of parameters related to port-hinterland efficiency. Actually, there is a recurring pattern with the median values of Europe as a whole to be the highest ones, followed by the ones of the MED and then by the ones of ADRION. As the median values of Europe include all countries (including the ADRION ones) the direct comparison of ADRION countries with northern European countries would lead to an even wider gap. This is reflected to the comparison of the ADRION median values with the top European country in each

comparison (e.g. Germany in terms of the overall LPI, Belgium in terms of arranging competitively priced shipments, etc).

4.2 Sustainability

4.2.1 Environmentally friendly services to the hinterland

Data regarding fixed-schedule rail services were collected from major intermodal service providers which operate in the ADRION region and are presented in the following table. A table with the detailed data can be found in the annex (Table 27).

Table 14: Number of regular, fixed-schedule rail services from/to ADRION ports

Port	Austria	Germany	Slovakia	Hungary	Czech Republic	Belgium	Luxemburg	Poland	Romania	Serbia	Italy	Croatia	Slovenia	Switzerland	Netherland	France	TOTAL
TRIESTE																	
Container terminal	5	3	1	1	1	-	-	-	-	-	-	-	-	-	-	-	**11**
Multipurpose terminal	-	6	-	-	1	1	-	-	-	-	-	-	-	-	-	-	**8**
RoRo terminal	2	3	-	-	-	-	1	-	-	-	-	-	-	-	-	-	**6**
KOPER																	
	6	2	7	3	5	-	-	1	1	2	1	1	-	-	-	-	**29**
RIJEKA																	
	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	**1**
RAVENNA																	
	-	2	-	-	-	-	-	-	-	-	-	-	-	2	2	1	**7**
VENICE																	
	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**2**

Source: Port Authorities and various logistics operators

The ports of Koper and Trieste are the only ports in the ADRION region which have a relatively extended network of rail connections to access the central European markets. This fact partially explains their performance in terms of rail's share in the modal split, which is the highest among the ADRION ports. Rijeka is directly connected only to Ljubljana, through which it further connects to the markets of Hungary, Serbia and Bosnia & Herzegovina, while Ravenna and Bari are only connected to Switzerland through the Melzo inland terminal. Finally, the ports of Venice, Bar, Durres, Thessaloniki and the other container ports currently don't offer regular direct international rail services.

According to a recent study of the intermodal container (rail, barge and short sea) connections in Europe[17], the top container terminals in terms of rail/barge connections and services are located in the Hamburg Le-Havre range, namely the ports of Hamburg, Rotterdam and Bremerhaven. In general, the ports in this area appear to have a high level of hinterland connectivity with many intermodal operators providing frequent services from numerous container port terminals. Furthermore, the density of inland terminals in proximity to the Northern range ports is significantly larger than that of the ADRION area, creating a more effective network for intermodal services. The port of Rotterdam is the undisputable leader in terms of intermodal services, having in total 647 rail services in all of its terminals.

[17] de Langen, P.W. et al (2017) Intermodal connectivity in Europe, an empirical exploration, *Research in Transportation Business & Management*, 23, pp. 3-11

Table 15: Top terminals in Europe based on the number of port-hinterland services

Origin city	Origin terminal	Rail Services	Barge Services	Sum of services
Hamburg	Container terminal Altenwerden (CTA)	87	6	93
Hamburg	Burchardkai (CTB)	84	6	90
Rotterdam	ECT Delta	64	36	100
Bremerhafen	Eurogate C.T.	66	0	66
Bremerhafen	North Sea Terminal Bremerhafen	66	0	66
Rotterdam	Rail Service Center	52	0	52

Source: de Langen, P.W. et al (2017) Intermodal connectivity in Europe, an empirical exploration, Research in Transportation Business & Management, 23, pp. 3-11

The number of services of top European ports compared to top performing ADRION ports (Koper, Trieste) reveal a large gap between the northern European and the ADRION ports in terms of intermodal connectivity to the hinterland. This fact is partially explained by the corresponding difference in freight throughput of the two regions which induces the need for intermodal services but is also the result of northern European ports' long-term planning and investing in intermodal transportation systems.

With regard to the share of rail for hinterland transportation as an estimator of the level of port-hinterland integration, data of rail use in hinterland transportation of containers are presented in the following table.

Table 16: Rail share of container hinterland transport for selected ports of Europe

Port	Country	Rail share (%)	Year	Port	Country	Rail share (%)	Year
Sines	PT	73.6%	2015	Klaipeda	LT	10.7%	2015
Lubeck	DE	56.0%	2015	Rotterdam	NL	10.4%	2017
Koper	SI	53.0%	2017	Oslo	NO	10.0%	2013
Gothenburg	SE	48.5%	2015	Ravenna	IT	8.9%	2017
Bremerhaven	DE	46.0%	2017	Valencia	ES	7.8%	2017
Trieste	IT	46.0%	2017	Lisboa	PT	7.7%	2017
Hamburg	DE	42.8%	2017	Antwerp	BE	6.9%	2017
Constanta	RO	38.8%	2017	Copenhagen/Malmo	DK	5.0%	2017
Zeebrugge	BE	38.6%	2017	Le Havre	FR	4.1%	2017
Southampton	UK	35.0%	2015	Dublin	IE	4.1%	2017
Gdansk	PL	33.4%	2017	Algeciras	ES	2.8%	2017
Wilhelmshaven	DE	33.3%	2017	Helsinki	FI	1.9%	2017
Felixstowe	UK	30.0%	2014	Rauma	FI	0.6%	2017
Gdynia	PL	25.5%	2017	Leixoes	PT	0.5%	2017
La Spezia	IT	25.5%	2015	Venezia	IT	0.5%	2017
Tallinn	EE	19.3%	2015	Thessaloniki	GR	0.1%	2017
Genova	IT	16.2%	2017	Ancona	IT	0.0%	2017
Livorno	IT	15.5%	2017	Bordeaux	FR	0.0%	2015
Rijeka	HR	14.0%	2013	Cadiz	ES	0.0%	2015
Barcelona	ES	12.8%	2017	Gijon	ES	0.0%	2017
Riga	LV	12.0%	2017	Marsaxlokk	MT	0.0%	2017
Ghent	BE	11.3%	2017	Nantes - St.	FR	0.0%	2017
Marseille-Fos	FR	11.0%	2017	Varna	BG	0.0%	2017
Helsingborg	SE	10.9%	2015	Durres	AL	0.0%	2015

Source: UIC (2019) 2018 Report on combined transport in Europe

ADRION ports show a considerable variation in the use of rail for container hinterland transport. NAPA ports, with the exception of the port of Venice, have a high share of rail in the modal mix. Especially the rail port-hinterland shares of the ports of Koper and Trieste are quite high, ranking them among the top ports in Europe in that respect. On the other hand, the port of Durres has no rail connection to its container terminal and the port of Thessaloniki shows a very small share of rail in container hinterland transportation. There are no data available for the port of Bar, but the share of rail is considered to be very low.

The two largest container ports of Europe, Rotterdam and Antwerp had in 2017 a modal share of rail of 10.4% and 6.9% respectively. Furthermore, it must be mentioned that additionally to the use of rail, a significant share of cargo in Europe is transported via inland waterways, namely through the Rhine, Seine/Scheldt/Meuse, Rhone-Saone, Danube-Main and Elbe-Mittellandkanal-Ems[18]. This increases significantly the share of environmentally friendly means of transport of the ports along these routes.

4.2.2 Efficient use of natural resources & reduced environmental impact

Certified environmental port management processes can contribute significantly to more efficient use of natural resources and reduced environmental impact. Three main systems for assessing and reporting the environmental performance of port operations have been identified: the EcoPorts Port Environmental Review System (PERS); the ISO 14000 family of environmental management standards; the EU Eco-Management and Audit Scheme (EMAS). EcoPorts is the main environmental initiative of the European port sector, promoting the improved environmental management of port operations.

The various environmental management certificates of the European ports per geographic area and country, are shown in Table 17.

Table 17: ADRION ports in the EcoPorts network and their environmental certificates (2017)

Area	Country (number of EcoPorts members)	PERS certified ports	ISO 14000 certified ports	EMAS certified ports
ADRION	Albania (1)	0	0	0
	Croatia (1)	0	1	0
	Greece (7)	2	3	1
	Subtotal (9):	2	4	1
Mediterranean	France (3)	0	2	0
	Italy (1)	0	1	0
	Spain (7)	7	6	3
	Subtotal (11):	7	9	3
Rest of Europe	Denmark (7)	0	2	2
	Estonia (1)	0	1	0
	Finland (5)	1	5	0
	Germany (11)	5	1	0
	Ireland (3)	2	2	0
	Latvia (1)	0	1	0

[18]https://www.inland-navigation.org/

Lithuania (1)	**0**	**1**	**0**
Netherland (8)	**6**	**0**	**0**
Norway (3)	**0**	**1**	**0**
Poland (1)	**0**	**0**	**0**
Romania (1)	**0**	**1**	**0**
Sweden (5)	**0**	**4**	**0**
UK (12)	**2**	**6**	**0**
France (7)	**4**	**4**	**0**
Portugal (2)	**0**	**2**	**0**
Spain (5)	**2**	**4**	**2**
Subtotal (73):	**22**	**35**	**4**

Source: EcoPorts

Focusing on the ADRION ports, only 2 ports are currently PERS certified, 4 ISO 14000 certified and 1 EMAS certified. In terms of PERS certification 14 out of the 22 ports are located in Hamburg – Le Havre area. The certifications being currently valid in the ADRION ports, are shown in Table 18.

Table 18: ADRION ports in the EcoPorts network and their environmental certificates (2017)

Country	Port	PERS certified	ISO 14000 certified	EMAS certified
Croatia	Dubrovnik		✓	
Albania	Durres			
Greece	Piraeus	✓		
Greece	Thessaloniki		✓	
Greece	Igoumenitsa	✓	✓	✓
Greece	Rafina		✓	
Greece	Volos			
Greece	Rethymno			
Greece	Skyros			

Source: EcoPorts

Furthermore, a number of ports are providing incentives for reducing the emissions from maritime transportation. These involve the voluntarily application of differentiated port infrastructure charges according to the environmental performance of ships. There are various certificates/indexes used in that respect, including the Green Award certification, the Environmental Shipping Index (ESI), the Clean Shipping Index (CSI) and the Blue Angel certification[19]. For example, the Green Award certification procedure is carried out by the Bureau Green Award, the executive body of the independent non-profit Green Award Organisation. It consists of an office audit and an audit of each individual ship applying for certification. Amongst others, the assessment focuses on crew, operational, environmental and managerial elements. The Environmental Shipping Index is a project within the World Ports Sustainability Program (WPSP) of the International Association of Ports and harbours (IAPH), identifying seagoing ships that perform better in reducing air emissions than required by the current emission standards of the International Maritime Organization. It provides a total score for a ship by evaluating the amount of nitrogen oxide (NOx) and sulphur oxide (SOx) it emits and the rewards can either be based on that total or on each of its constituent parts separately.

[19] COGEA (2017) *Study on differentiated port infrastructure charges to promote environmentally friendly maritime transport activities and sustainable transportation*, Final report, DGMOVE/B3/2014-589/SI2.697889

Table 19 provides an overview of the European ports which use environmental certificates/indexes to provide incentives.

Table 19: Environmental certificates/indexes used by seaports in Europe to provide incentives

Country	Seaport	Green Award certificate	Environ-mental Shipping Index	Clean Shipping Index	Blue Angel certificate
Belgium	Antwerp		✓		
	Ghent	✓	✓	✓	
	Zeebrugge		✓		
Finland	Helsinki		✓		
France	La Rochelle		✓		
	Le Havre		✓		
	Marseille		✓		
Germany	Bremen/Bremerhaven		✓		
	Brunsbüttel		✓		
	Hamburg	✓	✓		✓
	Kiel		✓		
	Niedersachsen Ports		✓		
	Rostock		✓		
Greece	Thessaloniki	✓			
Gibraltar	Gibraltar	✓			
Italy	Civitavecchia		✓		
Latvia	Riga	✓			
Lithuania	Klaipeda	✓			
Netherlands	Amsterdam	✓	✓		
	Arnhem	✓			
	Dordrecht	✓			
	Groningen	✓	✓		
	Moerdijk	✓			
	Rotterdam	✓	✓		
	Zeeland	✓	✓		
Norway	Alesund		✓		
	Bergen		✓		
	Borg Havn		✓		
	Drammen		✓		
	Flåm & Gudvangen		✓		
	Florø (Alden)		✓		
	Kristiansand		✓		
	Karmsund		✓		
	Oslo		✓		
	Stavanger		✓		
	Trondheim		✓		
Portugal	Leixões	✓			
	Lisboa	✓			
	Setúbal	✓	✓		
	Sines	✓			
Sweden	Brofjorden			✓	
	Gävle			✓	
	Gothenborg		✓	✓	
	Petroport			✓	

Source: Author's elaboration on data from the individual websites of certificate/index providers

By looking at Table 19 it becomes clear that the vast majority of ports that have introduced environmental charging for port infrastructure are in the Hamburg-Le Havre port range and the Scandinavian countries. As for the Mediterranean ports,

very few are providing environmental index-based incentives (Marseille, Civitavecchia and Gibraltar) while in the ADRION region the port of Thessaloniki has just joined the Green Award Organisation.

4.2.3 Facilitating the use of alternative fuels

The use of alternative fuels in maritime transport is a key attribute of sustainability, with IMO's mandate for the 0.50% global sulphur cap being the most important driver in the adoption of LNG as a fuel for shipping. Furthermore, Directive 2014/94/EU[20] requires Member States to put in place an appropriate number of refuelling points for LNG throughout the EU TEN-T Core network by 31 December 2025. The current status of LNG bunkering facilities in Europe is presented in Table 20.

Table 20: LNG bunkering facilities in European ports

Country	Port	Type of LNG bunkering	Status	Start date
Belgium	Antwerp	Truck to Ship	Operational	2012
	Zeebrugge	Tank to Ship, Truck to Ship, Ship to Ship	Operational	2015
France	Dunkerque	Ship to Ship	Planned	2020
	Le Havre	Truck to Ship	Operational	2016
	Marseille	Truck to Ship, Ship to Ship planned	Operational	2018
Germany	Hamburg	Tank to Ship (Q4 2018), Truck to Ship	Under construction	
Lithuania	Klaipeda	Truck to Ship, Tank to ship, Ship to Ship	Under construction	
Netherlands	Amsterdam	Truck to Ship, Ship to Ship	Operational	2013
	Rotterdam	Tank to Ship, Truck to Ship, Ship to Ship	Operational	2016
Norway	Hammerfest	Tank to Ship	Operational	2017
Spain	Barcelona	Truck to Ship, Ship to Ship in 2019	Operational	2017
	Bilbao	Ship to Ship	Operational	2018
	Valencia	Land based initially	Planned	2019
Sweden	Gothenburg	Ship to Ship	Operational	2016
	Stockholm	Tank to Ship, Ship to Ship	Operational	2011
UK	Gibraltar	TBC	Planned	

Source: https://sea-lng.org (accessed April 2019)

The Netherlands, Belgium, Sweden, France, Spain and Norway already have ports with operational LNG bunkering facilities, while Germany and Lithuania have facilities under construction. The types of bunkering and size of these facilities vary widely and there are plans for further expansion of their operations as well as the construction of more LNG bunkering facilities in other ports. The construction of several of these facilities is co-financed by the EU under the Connecting Euro Facility (CEF) programme. Currently no LNG bunkering facilities are operating or being under construction in any of the ADRION ports.

Employment of innovative data capture, information sharing & insight generation

[20] Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure

Employment of innovative technologies

4.3 Innovation content

4.3.1 Employment of innovative data capture, information sharing & insight generation

The main indicator used for assessing the employment of innovative data capture, information sharing & insight generation, is the participation of ports in relevant Research & Innovation (R&I) H2020 projects. The information collected in that respect is shown in Table 21.

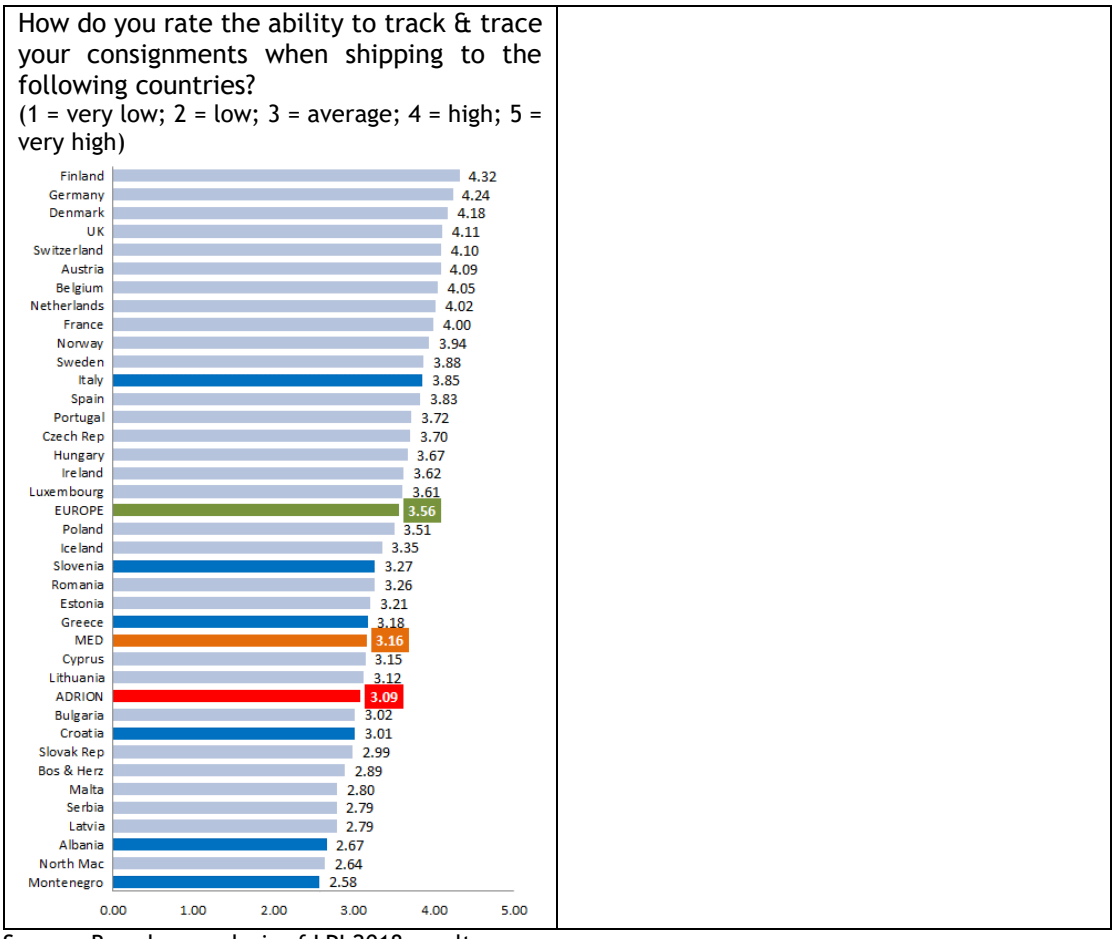
Table 21: Participation of European sea ports in ongoing H2020 R&D projects

Project	Duration	Funding source	Participating Port	Country
AEOLIX	9/2016 - 8/2019	INEA / Logistics	Hamburg Port Authority	Germany
CLUSTERS 2.0	5/2017 - 4/2020	INEA / Logistics	Piraeus Container Terminal	Greece
ICONET	9/2018-2/2021	INEA / Logistics	Antwerp Port Authority	Belgium
SELIS	9/2016 - 8/2019	INEA / Logistics	Rotterdam Port	Netherlands
COREALIS	5/2018-4/2021	INEA / Infrastructure	Piraeus Container Terminal Fundacion Valencia Port Antwerp Port Authority Northern Tyrrhenian Sea Port Authority	Greece Spain Belgium Italy
INTERMODEL EU	9/2016-8/2019	INEA / Infrastructure	Eastern Liguria Sea Port Authority	Italy
PIXEL	5/2018-4/2021	INEA / Infrastructure	Piraeus Port Authority Thessaloniki Port Authority Monfalcone Port Grand Port Maritime de Bordeaux	Greece Greece Italy France
PortForward	5/2018-10/2021	INEA / Infrastructure	Vigo Port Authority Balearic Islands Port Authority Northern Tyrrhenian Sea Port Authority Kristiansand Port	Spain Spain Italy Norway

Looking at Table 21, it can be seen that from the total number of 14 Port Authorities / Terminal Operators currently participating in ongoing H2020 R&D projects, 4 of them are located in the ADRION area (3 in Greece and 1 in Italy). The rest of the MED is represented with additional 4 ports (2 in Italy and 2 in Spain).

4.3.2 Employment of innovative technologies

The ability to track & trace consignments has been considered as an indicator of employing innovative technologies, using the respective information provided by the World Bank's LPI survey (see Figure 8).



Source: Based on analysis of LPI 2018 results

Figure 8: Consignment track & trace ability comparison

In terms of the ability to track & trace your consignments when shipping to a particular country, Europe shows a calculated value of 3.56, followed by the Mediterranean countries with a value of 3.16, while the ADRION countries come third with a value of 3.09. Montenegro and Albania are the ADRION countries with the lower scores. Italy and Slovenia are the ones with the highest scores. If we consider the European median value as the comparison standard (100%), the MED LPI is at 89% and ADRION at 87%. Using the top performing country's (Finland) value as the comparison standard (100%), ADRION is at 72%.

5 Key messages

5.1 The need to further define port-hinterland integration

The importance of port hinterland integration can be justified in three main ways: (i) it defines the competitiveness of existing port-hinterland corridors (in terms of cost & time efficiencies) and consequently the competitiveness of the respective ports; (ii) it has the ability to shift existing port catchment areas; it defines to a significant extent the social costs of freight transport (pollution, congestion, noise). Although such an importance is to a large extent well appreciated, the term 'port-hinterland integration' remains quite vague. As a result, its assessment, monitoring and improvement remains problematic.

To contribute in addressing this issue, ISTEN proposes two types of port-hinterland integration: (i) infrastructural integration and (ii) operational integration. Furthermore, in order to have a more concrete view on what port-hinterland integration actually means, ISTEN has defined four attributes that an integrated port-hinterland corridor should exhibit: (i) efficiency; (ii) sustainability; (iii) high innovation content; (iv) cooperation & coordination. The degree to which, a corridor exhibits the above attributes, will reflect the level at which it has become an 'integrated port-hinterland corridor'.

5.2 The need to harmonise and expand data & information collection

Looking at the ADRION ports' websites, it was observed that there is lack of a common way of publishing freight data, a fact that makes difficult the collection of comparable data. Furthermore, regarding hinterland traffic volumes, there is limited data on containers and no data about bulk cargo. Overall, there is a strong need for cargo data linking the ports to specific destinations in the hinterland, thereby establishing a clear view of the volumes transported along certain port-hinterland corridors. Finally, information on cooperation initiatives among port-hinterland actors is also lacking.

5.3 The need to close the gap between the ADRION area and the rest of Europe, with a focus on specific areas

Although a wide diversification exists among ADRION ports regarding their level of port-hinterland integration. Furthermore, ADRION ports as a whole appear to be lagging in the process of becoming port-hinterland integrated hubs, mainly compared to the ports in the Hamburg-Le Havre range but also to certain major ports of other countries such as Spain, UK and the Scandinavian countries. A clear gap exists in the vast majority of port-hinterland aspects when the ADRION area is compared to the rest of the EU. When comparing the average situation (median LPI values) in the ADRION area with the best performing European countries, ADRION's gap is especially wide in terms of railroad and ports' quality of infrastructure.

The railroad quality gap is reflected also to the lack of fixed-schedule rail services (environmentally friendly services to the hinterland) from many ADRION ports to the hinterland and the very low (or nil) share of rail cargo in most ADRION ports. Currently only two ports in the ADRION area, namely Koper and Trieste which also

present the higher share of rail in container transportation, offer a relatively dense rail port-hinterland network while the vast majority of the other ports have few or no connections, with road being the dominant hinterland mode.

An equally important gap exists in the area of port environmental sustainability, with the limited environmental certification of port management processes and provision of environmental incentives by the ADRION ports. Furthermore, this gap is also evident in the use of alternative fuels, with no ADRION port having in operation any LNG bunkering facility yet.

Having focused on the gaps so far though, one should mention that in terms of research & innovation, the ADRION ports seem to be in a good position compared to its counterparts, when R&I projects underway are considered.

ANNEX

Table 22: Freight throughput in ADRION ports in 2017

Port	Bulk cargo (thousand tonnes)			Other Cargo (thousand tonnes)				Containers (TEU)			Total Throughput (thousand tonnes)
	Liquid	Dry	Total	Containerised	RoRo/RoPax	General	Total	Transhipment	Hinterland/ Transit	All Containers (TEUs)	
Ancona (IT)	4,643	582	5,225	1,107	4,693	0	5,800	0	168,578	168,578	11,025
Augusta (IT)	26,232	1,162	27,394	0	0	0	0	0	0	0	27,394
Bari (IT)	0	1,740	1,740	730	3,165	27	3,922	0	68,695	68,695	5,662
Brindisi (IT)	2,424	3,434	5,858	613	2,814	222	3,649	0	1,106	1,106	9,507
Catania (IT)	9	446	455	492	7,756	2	8,250	0	50,111	50,111	8,705
Chioggia (IT)	0	540	540	0	0	627	627	0	0	0	1,167
Corigliano (IT)	0	225	225	0	0	0	0	0	0	0	225
Crotone (IT)	0	320	320	0	0	3	3	0	0	0	323
GioiaTauro (IT)	860	0	860	31,178	351	0	31,529	2,448,570	0	2,448,570	32,389
Messina (IT)	20,055	382	20,437	0	6,324	0	6,324	0	0	0	26,761
Monfalcone (IT)	0	3,458	3,458	0	275	900	1,175	0	0	0	4,633
Palermo (IT)	352	46	398	159	5,752	0	5,911	0	13,310	13,310	6,309
Ravenna (IT)	4,548	11,414	15,962	2,457	1,752	6,339	10,548	1,600	221,769	223,369	26,510
Taranto (IT)	4,590	11,347	15,937	0	2	5,709	5,711	0	0	0	21,648
Trieste (IT)	43,751	1,640	45,391	6,973	8,844	749	16,566	267,110	349,046	616,156	61,957
Venice (IT)	8,788	6,846	15,634	5,676	1,524	2,302	9,502	0	611,383	611,383	25,136
Koper (SI)	3,877	7,918	11,795	9,071	1,124	1,378	11,573	9,115	902,413	911,528	23,368
Ploce (HR)	812	1,886	2,698	244	0	238	482	0	28,169	28,169	3,180
Rijeka (HR)	7,998	1,548	9,546	2,146	0	923	3,069	0	249,975	249,975	12,615
Sibenik (HR)	0	406	406	0	0	18	18	0	0	0	424
Split (HR)	438	1,538	1,976	104	115	55	274	0	10,091	10,091	2,250
Bar (ME)	268	1,350	1,618	388	83	213	684	0	49,282	49,282	2,302
Durres (AL)	15	1,053	1,068	1,480	826	309	2,615	0	118,270	118,270	3,683
Elefsina (EL)	13,493	3,078	16,571	0	22	431	453	0	819	819	17,024
Igoumenitsa (EL)	0	77	77	0	3,082	0	3,082	0	0	0	3,159
Patras (EL)	327	163	490	0	2,301	31	2,332	0	0	0	2,822
Piraeus (EL)	0	440	440	39,420	737	5,134	45,291	4,043,557	73,725	4,117,282	45,731
Thessaloniki (EL)	7,710	3,187	10,897	4,061	94	558	4,713	949	401,473	402,422	15,610
Total:	151,190	66,226	217,416	106,299	55,896	21,047	183,242	6,770,901	3,318,215	10,089,116	400,990

(Source: Port Authorities & Eurostat)

Notes:
1. The data for the ports of Ploce, Split, Igoumenitsa, Patras, Elefsina are from Eurostat.
2. The container weight data for the port of Piraeus is from Eurostat.
2. The Piers II & III in Piraeus port are not considered to have any hinterland traffic.
3. The number of containers that tranship to the port of Koper is approximately estimated, based on the 1% transhipment share information.
4. The ports of Croatia (Rijeka, Ploce, Split) and Elefsina are not considered to have hinterland traffic.

Table 23: Container traffic share of ADRION ports and countries in 2017

	Transhipped containers (TEUs)	Transhipped containers (% of the ports' total TEU volume)	Hinterland containers (TEUs)	Hinterland containers (% of the ports' total TEU volume)	Total container volume (TEUs)	Hinterland containers (port share in ADRION's total volume)	Hinterland containers (country share in ADRION's total volume)
	[A]	[B]=(A/E)*100	[C]	[D]=(C/E)*100	[E]=A+C	[F]=[C]/Σ[C]	[G]
ITALY							
Ancona	0	0%	168,578	100%	168,578	5.00%	
Augusta	0	-	0	-	0	-	
Bari	0	0%	68,695	100%	68,695	2.04%	
Brindisi	0	0%	1,106	100%	1,106	0.03%	
Catania	0	0%	50,111	100%	50,111	1.49%	
Chioggia	0	-	0	-	0	-	
Corigliano	0	-	0	-	0	-	
Crotone	0	-	0	-	0	-	44.01%
Gioia Tauro	2,448,570	100%	0	0%	2,448,570	0.00%	
Messina	0	-	0	-	0	-	
Monfalcone	0	-	0	-	0	-	
Palermo	0	0%	13,310	100%	13,310	0.39%	
Ravenna	1,600	0.70%	221,769	99.30%	223,369	6.58%	
Taranto	0	-	0	-	0	-	
Trieste	267,110	43.40%	349,046	56.60%	616,156	10.35%	
Venice	0	0%	611,383	100%	611,383	18.13%	
Subtotal	**2,717,280**		**1,483,998**		**4,201,278**		
SLOVENIA							
Koper	9,115[1]	1.00%	902,413	99.00%	911,528	26.77%	26.77%
CROATIA[2]							
Ploce	0	0%	24,123	100%	24,123	0.72%	
Rijeka	0	0%	249,975	100%	249,975	7.41%	8.43%
Sibenik	0	-	0	-	0	-	
Split	0	0%	10,091	100%	10,091	0.30%	
Subtotal	**0**		**284,189**		**284,189**		
MONTENEGRO							
Bar	0	0%	49,282	100%	49,282	1.46%	1.46%
ALBANIA							
Durres	0	0%	118,270	100%	118,270	3.51%	3.51%
GREECE							
Elefsina	0	0%	420	100%	420	0.01%	
Heraklion	0	0%	23,353	100%	21,353	0.69%	
Igoumenitsa	0	-	0	-	0	-	
Lavrio	0	0%	15,463	100%	15,463	0.46%	15.82%
Patras	0	-	0	-	0	-	
Piraeus	4,043,557	98.20%	73,725[3]	1.80%	4,117,282	2.19%	
Thessaloniki	949	0.20%	401,473	99.80%	402,422	11.91%	
Volos	0	0%	19,017	100%	19,017	0.56%	
Subtotal	**4,044,506**		**533,451**		**4,577,957**		
Total:	6,770,901	66.76%	3,371,603	33.24%	10,142,504		

1. Approximate number, the Port Authority of Koper estimates transhipment rate at 1%.
2. It is assumed that the ports of Croatia do not to have any container transhipment.
3. It is assumed that all container hinterland traffic of the port of Piraeus comes from Pier I.

Data from Assoporti (Italian ports), Port Authorities (ports of Koper, Rijeka, Sibenik, Ploce, Bar, Durres, Thessaloniki, Piraeus-Pier I), COSCO SHIPPING Ports Limited (Piraeus-Piers II & III) and Eurostat (ports of Split, Igoumenitsa, Patras and Elefsina).

Table 24: RoRo cargo share of ADRION ports and countries in 2017

	RoRo cargo (thousand tonnes)	Share of ADRION RoRo cargo		Ports' ranking based on RoRo cargo	Top 10 ports volume	Top 10 ports share of ADRION RoRo volume
		Port level	Country level			
ITALY						
Ancona	4,693	9.09%		5	4,693	
Augusta	0	0.00%		-		
Bari	3,165	6.13%		6	3,165	
Brindisi	2,814	5.45%		8	2,814	
Catania	7,756	15.02%		2	7,756	
Chioggia	0	0.00%		-		
Corigliano	0	0.00%		-		
Crotone	0	0.00%		-		
Gioia Tauro	351	0.68%	**83.76%**	15		
Messina	6,324	12.25%		3	6,324	
Monfalcone	275	0.53%		16		
Palermo	5,752	11.14%		4	5,752	
Ravenna	1,752	3.39%		10	1,752	
Taranto	2	0.00%		21		
Trieste	8,844	17.13%		1	8,844	
Venice	1,524	2.95%		11		
SLOVENIA						**90.02%**
Koper	1,124	2.18%	**2.18%**	12		
CROATIA						
Ploce	0	0.00%		-		
Rijeka	0	0.00%	**0.22%**	-		
Sibenik	1	0.00%		22		
Split	115	0.22%		17		
MONTENEGRO						
Bar	83	0.16%	**0.16%**	19		
ALBANIA						
Durres	826	1.60%	**1.60%**	13		
GREECE						
Elefsina	22	0.04%		20		
Igoumenitsa	3,082	5.97%		7	3,082	
Patras	2,301	4.46%	**12.08%**	9	2,301	
Piraeus	737	1.43%		14		
Thessaloniki	94	0.18%		18	3,187	
Total:	**51,637**			Total:	**46,483**	

Table 25: Dry bulk traffic share of ADRION ports and countries in 2017

	Dry bulk traffic (thousand tonnes)	Share of ADRION dry bulk traffic		Ports' ranking based on dry bulk traffic	Top 10 ports traffic	Top 10 ports share of ADRION dry bulk traffic
		Port level	Country level			
ITALY						
Ancona	582	0.88%		17		
Augusta	1,162	1.75%		15		
Bari	1,740	2.62%		10	1,740	
Brindisi	3,434	5.17%		6	3,434	
Catania	446	0.67%		20		
Chioggia	540	0.81%		18		
Corigliano	225	0.34%		24		
Crotone	320	0.48%		23		
Gioia Tauro	0	0.00%	**65.62%**	-		
Messina	382	0.57%		22		
Monfalcone	3,458	5.21%		5	3,458	
Palermo	46	0.07%		27		
Ravenna	11,414	17.18%		1	11,414	
Taranto	11,347	17.08%		2	11,347	
Trieste	1,640	2.47%		11		
Venice	6,846	10.31%		4	6,846	
SLOVENIA						**81.90%**
Koper	7,918	11.92%	**11.92%**	3	7,918	
CROATIA						
Ploce	1,973	2.97%		9	1,973	
Rijeka	1,613	2.43%	**8.39%**	12		
Sibenik	447	0.67%		19		
Split	1,538	2.32%		13		
MONTENEGRO						
Bar	1,350	2.03%	**2.03%**	14		
ALBANIA						
Durres	1,053	1.58%	**1.58%**	16		
GREECE						
Elefsina	3,078	4.63%		8	3,078	
Igoumenitsa	77	0.12%		26		
Patras	163	0.25%	**10.46%**	25		
Piraeus	440	0.66%		21		
Thessaloniki	3,187	4.80%		7	3,187	
Total:	**66,419**			Total:	**54,395**	

Table 26: General cargo traffic share of ADRION ports and countries in 2017

	General cargo traffic (thousand tonnes)	Share of ADRION general cargo traffic		Ports' ranking based on general cargo traffic	Top 5 ports traffic	Top 5 ports share of ADRION general cargo traffic
		Port level	Country level			
ITALY						
Ancona	0	0,00%		-		
Augusta	0	0,00%		-		
Bari	27	0,10%		19		
Brindisi	222	0,85%		13		
Catania	2	0,10%		21		
Chioggia	627	2,40%		9		
Corigliano	0	0,00%		-		
Crotone	3	0,01%	**64,69%**	20		
Gioia Tauro	0	0,00%		-		
Messina	0	0,00%		-		
Monfalcone	900	3,45%		6		
Palermo	0	0,00%		-		
Ravenna	6,339	24,30%		1	6,339	
Taranto	5,709	21,88%		2	5,709	
Trieste	749	2,87%		8		
Venice	2,302	8,82%		4	2,302	**79.95%**
SLOVENIA						
Koper	1,378	5,28%	**5,28%**	5	1,378	
CROATIA						
Ploce	209	0,80%		15		
Rijeka	858	3,29%	**4,44%**	7		
Sibenik	37	0,14%		17		
Split	55	0,21%		16		
MONTENEGRO						
Bar	213	0,82%	**0,82%**	14		
ALBANIA						
Durres	309	1,18%	**1,18%**	12		
GREECE						
Elefsina	431	1,65%		11		
Igoumenitsa	0	0,00%		-		
Patras	31	0,12%	**23,59%**	18		
Piraeus	5,134	19,68%		3	5,134	
Thessaloniki	558	2,14%		10		
Total:	**26,093**			Total:	**20,862**	

Table 27: Direct international railway connections and frequency of services in ADRION ports

PORT OF TRIESTE			
Container Terminal Operator: Trieste Marine Terminal	**AUSTRIA**		
	Destination	**Frequency**	**Operators**
	Villach Süd CCT Via Villach: -Wolfurt CCT -Salzburg Hbf CCT -Linz Stadthafen -Wien Freudenau/Süd	6-7 round trips/week	Alpe Adria "Julia shuttle" antenna train via Villach. Wien Süd →Links to Brno, Bratislava, Praha
	Wien Süd – Linz terminal	1 trip/week	T.O Delta in partnership with Rail Cargo Operator and Alpe Adria
	Wolfurt terminal	1 round trip/week	T.O Delta in partnership with Rail Cargo Operator and Alpe Adria
	Salzburg CTS	2 round trips/week	Alpe Adria *"Martina Express" (direct service)*
	Graz CCT	1-2 round trips/week	Alpe Adria *(direct service)*
	GERMANY		
	Destination	**Frequency**	**Operators**
	München Riem	6 round trips/week	T.O Delta in partnership with Rail Cargo Operator and Alpe Adria. Links to Ludwigshafen, Köln, Leipzig
	Burghausen KTB terminal	2 round trips/week	T.O Delta in partnership with Rail Cargo Operator and Alpe Adria
	Giengen	2 round trips/week	Rail Cargo Operator
	SLOVAKIA		
	Destination	**Frequency**	**Operators**
	Dunajska Streda	3-4 round trips/week	Metrans
	CZECH REPUBLIC		
	Destination	**Frequency**	**Operators**
	Paskov	3 round trips/week	EP Logistics
	HUNGARY		
	Destination	**Frequency**	**Operators**
	Budapest Mahart Container Center	10-14 round trips/week	T.O Delta in partnership with Alpe Adria
Multipurpose Terminal Operator: Europa Multipurpose Terminals	**GERMANY**		
	Destination	**Frequency**	**Operators**
	Köln Eifeltor	9 round trips/week	
	Ludwingshafen	4 round trips/week	
	Ludwingshafen/DUS	3 round trips/week	
	Kiel	1 round trip/week	Alpe Adria
	Munich	3	

		round trips/week	
	Karlsruhe	3 round trips/week	
	CZECH REPUBLIC		
	Destination	**Frequency**	**Operators**
	Ostrava/Havirov	4 round trips/week	Alpe Adria
	BELGIUM		
	Destination	**Frequency**	**Operators**
	Zeebruge	2 round trips/week	
RoRo Terminal, Riva Traiana and Pier V Operator: Samer Seaports & Terminals S.r.l.	**GERMANY**		
	Destination	**Frequency**	**Operators**
	Duisburg		
	Ludwigshafen		
	Munich		
	AUSTRIA		
	Destination	**Frequency**	**Operators**
	Salzburg	3 round trips/week	Alpe Adria and Rail Cargo Operator (RoLa train)
	Wels	6 round trips/week	Alpe Adria ("ISU" Train-combined/ semitrailers)
	LUXEMBURG		
	Destination	**Frequency**	**Operators**
	Bettembourg	7 round trips/week	Alpe Adria
PORT OF KOPER			
	AUSTRIA		
	Destination	**Frequency**	**Operators**
	Graz (Cargo Center Graz)	10 round trips/week	
	Villach Via Villach: -Vienna -Linz -Salzburg -Wolfurt	Up to 5 round trips/week	RCO/Adria Kombi (antenna train via Villach)
	Enns-Salzburg	2 round trips/week	TFG Transfracht
	Enns (Maersk)	1 round trip/week	
	Ybbs-Krems	2 round trips/week	Metrans
	Linz	4 round trips/week	Metrans
	HUNGARY		
	Destination	**Frequency**	**Operators**
	Budapest Bilk	7 round trips/week	Adria Kombi
	Budapest Csepel	12 round trips/week	Metrans
	Budapest Törökbálint	3 round trips/week	Integrail
	SLOVAKIA		
	Destination	**Frequency**	**Operators**
	Dunajska Streda	14	Metrans

		round trips/week	(antennas to Kosice, Krems an der Donau, Ceska Trebova)
	Bratislava - Terminal RCO	4 round trips/week	Adria Kombi
	Žilina	3 round trips/week	Metrans
	Žilina	up to 6 round trips/week	Adria kombi/RCO
	Bratislava Spap Terminal	1 round trip/week	Metrans (dedicated)
	Žilina	1 round trip/week	Raillex
	Košice (Terminal RCO) via Dunajska Streda	4 trips/week	Metrans
	CZECH REPUBLIC		
	Destination	**Frequency**	**Operators**
	Dobra u Fridku Mystku	4 round trips/week	Adria Kombi (dedicated)
	Ostrava	2 round trips/week	Metrans
	Paskov	1 round trip/week	AWT (dedicated)
	Dunajska Streda	daily	Metrans (antennas to Ceska Trebova)
	Ostrava CZ Terminal Senov – South Poland	7 round trips/week	Metrans
	POLAND		
	Destination	**Frequency**	**Operators**
	Wroclaw (Siechnice) - Ostrava	2 round trips/week	Baltic Rail
	GERMANY		
	Destination	**Frequency**	**Operators**
	München (via Ljubljana)	5 round trips/week	Adria Kombi
	München	3 round trips/week	Adria Kombi
	ROMANIA		
	Destination	**Frequency**	**Operators**
	Arad	1 round trip/week	Adria transport
	ITALY		
	Destination	**Frequency**	**Operators**
	Padova	1 trip/week	Adria Kombi (dedicated)
	SERBIA		
	Destination	**Frequency**	**Operators**
	Novi Sad (via Budapest)	weekly service	Adria Kombi/ Transagent d.o.o.
	Beograd (via Ljubljana)	2 round trips/week	Adria Kombi
	CROATIA		
	Destination	**Frequency**	**Operators**
	Zagreb (via Ljubljana)	2 round trips/week	Adria Kombi
PORT OF RIJEKA			
	SLOVENIA		
	Destination	**Frequency**	**Operators**
	Ljubljana KT		Adria Kombi

PORT OF RAVENNA			
	SWITZERLAND		
	Destination	**Frequency**	**Operators**
	Frenkendorf (via Melzo)	3/5 trips/week	Hannibal
	Niederglatt (via Melzo)	3/5 trips/week	Hannibal
	GERMANY		
	Destination	**Frequency**	**Operators**
	Munich (via Melzo)	3/3 trips/week	Hannibal
	Duisburg (via Melzo)	3/11 trips/week	Hannibal
	NETHERLAND		
	Destination	**Frequency**	**Operators**
	Rotterdam (via Melzo)	3/6 trips/week	Hannibal
	Amsterdam (via Melzo)	3/3 trips/week	Hannibal
	FRANCE		
	Destination	**Frequency**	**Operators**
	Lyon (via Melzo)	3/3 trips/week	Hannibal
PORT OF VENICE			
	GERMANY		
	Destination	**Frequency**	**Operators**
	Duisburg	3/3 trips/week	Rail Cargo Group
	Frankfurt	2/2 trips/week	Kombiverkehr

(Source: Port Authorities and various logistics operators)