Capitalisation of transport data and services availability from INTERMODADRIA IPA project

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Contents

1. Introduction

This document is part of work package 3 of TRANSPOGOOD project - Definition and development of the TRANSPOGOOD platform, part 3.2 Lesson learnt from INTERMODADRIA IPA project. In this document, data about cube-model from INTERMODADRIA IPA project will be analyzed. An analysis of the main cube-model results utilised in INTERMODADRIA project will be performed in order to have an initial database concerning the data grouped by traffic flows in the Programme Area and concerning information about cooperative systems between Italian and Croatian Ports (feeder services) to foster the availability of intermodal services in the Area.

TRANSPOGOOD projects main goal is to establish TRANSPOGOOD platform which will be used as a tool to find the best solution of transport services (e.g., best price of combined transport, lower emissions of entire chain, eprocurement tools for maritime transport services, higher bi-directional load factor).

The TRANSPOGOOD project has the main aim of providing significant development of the cross-border cooperation between Croatia and Italy and, in general, of creating beneficial effects across all the Adriatic Region.

The expected results of the project contribute to improve the quality, safety and environmental sustainability of marine and coastal transport by means of multimodal approaches in the Programme area by promoting multimodality and an increase of more sustainable modes of transport

This will develop through the capitalization of the main results of INTERMODADRIA IPA project an innovative approach towards intermodal and multimodal transport on the Adriatic

sea using a complex and coherent set of tools that enable key logistics stakeholders (shippers, logistic providers, transport operators and authorities) to achieve the main output.

INTERMODADRIA IPA projects objective was the improvement of the integration of the short sea shipping transport in the logistics chains crossing the Adriatic sea, and more specifically the provision of the best environment for the activation on intermodal railsea transport services between the ports and their own hinterlands. The project suported the implemented or ongoing infrastructural investments to promote intermodal transport by the joint definition of a set of outputs to improve the market, policy and regulatory conditions for intermodality.

Part of this project was creation of CUBE transport model which purpose was to show existing links between ports and data grouped by traffic flows. This model contains existing maritime liner services (ferries and container services) calling the Adriatic ports, as well as origin/destination analysis for the container flows in each port, identifying the best approximation of the origin and of the final destination of goods. The Cube Cargo, employed in the analysis is a model of demand for the transport of goods. It is a standalone module in the Cube suite software (a modelling tool) and it consist of a set of modules that support transportation planning.

This document will show results from INTERMODADRIA IPA project regarding CUBE transport model and give appropriate conclusions regarding lines and links existing between Italian and Craotian ports.

2. Methodology

TRANSPOGOOD lays its foundations on sound background and solid experiences such as INTERMODADRIA project. INTERMODADRIA improved the integration of the short sea shipping transport in the logistics chains crossing the Adriatic sea. So, the approach and the methodology from INTERMODADRIA will be followed.

Methods used in collecting data for this document are:

- Method of compilation: researchers can use scientific papers and studies, predictions and recommendations
- Method of description: in order to show the current state of the intermodal (maritime, road, railway) infrastructure and operation
- Method of comparison: in order to make certain conclusions and estimations this method will be used to compare infrastructure and operation on similar lines
- Statistical method: to give insights in certain operation and facts the interpretation of statistical data
- Inductive method: In order to give certain conclusions from the given facts, figures and predictions

The main purpose of CUBE model is to show existing links between ports and data grouped by traffic flows. In order to analyze that links, many data were provided. That data can be divided in several groups:

- Data provided by the operators and other subjects related to maritime infrastructure
- Data provided by the operators and other subjects related to road infrastructure
- Data provided by the operators and other subjects related to rail infrastructure
- Research, statistical data and field studies

Some of this data were collected for INTERMODADRIA project, and now are analysed and compared with new statistical data to provide us with relevant information in future work.

INTERMODADRIA project analyzed 8 ports in Adriatic and Ionian sea:

- Rijeka
- Zadar
- Split
- Bar
- Durres
- Ancona
- Bari
- Igoumenitsa

However, for Croatian ports in CUBE model, instead of ports of Rijeka, Zadar and Split, Port of Ploce was analysed.

The analysed data in these ports include:

- Analysis of container routes that connect said ports
- Analysis of ferry routes that connect said ports with emphasis on freight flows
- Analysis of links between ports and their hinterland connections

The objective of the analysis is to investigate if the interrelation between territories and freight flows can attract intermodal railways services, focusing on the routes with the most relevant traffic. The results will illustrate the potential areas where an intermodal connection could be sustainable.

The study area in INTERMODADRIA CUBE model consist of the following countries: Albania, Croatia, Greece, Italy, Montenegro and Slovenia. The study area is divided and

examined in a NUTS 1 or NUTS 2 level, considering the availability of data. Table 1 presents the selected areas that are included as internal zones in the CUBE model.

Table 1. Zones in CUBE model

NUTS CODE	ZONE NAME	COUNTRY
AL00	Albania	Albania
EL13	Dytiki Makedonia	Greece
EL14	Thessalia	Greece
EL21	Ipeiros	Greece
EL22	Ionia Nisia	Greece
EL23	Dytiki Ellada	Greece
EL24	Sterea Ellada	Greece
EL25	Peloponnisos	Greece
EL30	Attiki	Greece
EL41	Voreio Aigaio	Greece
EL42	Notio Aigaio	Greece
EL43	Kriti	Greece
ITF1	Abruzzo	Italy
ITF4	Puglia	Italy
ITF5	Basilicata	Italy
ITF6	Calabria	Italy
ITG1	Sicilia	Italy
ITH3	Veneto	Italy
ITH4	Friuli-Venezia Giulia	Italy
ITH5	Emilia-Romagna	Italy
ITI2	Umbria	Italy
ITI3	Marche	Italy
ME00	Crna Gora	Montenegro
SI01	Vzhodna Slovenija	Slovenia
SI02	Zahodna Slovenija	Slovenia

HR01	Sjeverozapadna Hrvatska	Croatia
HR02	Središnja i Istočna (Panonska) Hrvatska	Croatia
HR03	Jadranska Hrvatska	Croatia

Picture 1. Core Study Area Adriatic Ports/logistic nodes on CUBE model

3. Collected data from INTERMODADRIA IPA project

The main objective of the INTERMODADRIA project is the improvement of the integration of the short sea shipping transport in the logistics chains crossing the Adriatic Sea, and, more specifically, the best facilitation and promotion of intermodal rail-sea transport between the ports and their respective hinterlands. The objective of the Cube-model analysis is the identification of the current and the estimation of the future freight flows passing through the ports involved in the project partnership, focusing on (a) Lo-Lo container traffic and (b) MoS Ferry/SSS (Ro-Ro/Ro-Pax) freight traffic (MoS).

The CUBE model was developed and applied for two different scenarios: the base year and the forecast ones. Regarding the base year, year 2010 was selected, based on the availability of data for freight flows in the Adriatic area. With regard to forecasting, the model was run for two scenarios for two target years: 2025 and 2030, taking into account the socio-economic development of the region.

3.1. Port of Ancona

The port of Ancona is leader among the ports of the middle and lower Adriatic and Ionian Seas, in both Ro–Ro and Ro-Pax traffic. Main destinations of passengers and vehicles flows from and to port of Ancona are Greece, Croatia, Albania, and Montenegro. The port of Ancona is connected by ferry lines to several countries in the Adriatic Basin, such as Greece, Croatia and Albania.

The port of Ancona is the first Italian port for international movement on ferries, with annual passenger flows reaching 1.5 million. The total number of trucks transferred annually through the port of Ancona exceeds 200,000, representing the 26% of traffic in the Adriatic

Sea, while 45% of the Italy-Greece traffic and 80% of the Croatia-Italy traffic is transferred through this port.

Table 2 present Ro-Ro and container traffic of the Port of Ancona for base year 2010, provided by Eurostat and Ancona Port Authority.

Table 2. Ro-Ro and container traffic in the Port of Ancona

Type of traffic	2010 by Eurostat	2010 by Ancona Port Authority
Ro-Ro	2,403,000	2,401,474 (163,331 number of trucks)
Container	1,447,000	843,420 (110,395 Number of containers)

Table 3 presents the results of the Cube model for the base year, the data provided by Eurostat, the survey results obtained within the INTERMODADRIA project (Activities 3.2 & 3.3), as well as data obtained from the port's website for validation purposes.

Table 3. Port of Ancona data and results for base year

Type of traffic	CUBE (tons/year) Year: 2010	EUROSTAT (tons/year) Year: 2010	INTERMODADRIA Survey (tons/year) Year: 2013	Port's website (tons/year) Year: 2010
Ro-Ro	2,595,073,450	2,403,000	2,050,561	2,401,474
Container	1,532,561,940	1,447,000	1,055,811	843,420

It can be seen that a deviation among the estimated flows and the data provided by EUROSTAT is lower than 10% for both Ro-Ro and container traffic. The difference between the Cube results and the data gathered through the survey questionnaires is higher, particularly with regard to container traffic. Nevertheless, this difference could be justified by the fact that the survey data refer to year 2013.

Table 4 presents the total forecast freight flows estimated by the CUBE model at the port of Ancona for target years 2025 and 2030 per type of traffic. Table 5 lists the forecasted freight flows of the maritime links from/to the port of Ancona for years 2025 and 2030 and grouped in accordance with the type of service offered, that is, Ro-Ro or container connections.

Table 4. Forecast freight flows for Port of Ancona

Type of traffic	2025	2030
Ro-Ro	3,326,126.94	3,332,544.54
Containers	1,767,948.39	1,782,059.41

Forecast freight flows per maritime link 2025 & 2030 (tons/year)

Table 5. Forecast freight flows per maritime link for Port of Ancona

Ro-Ro links		2025	2030
Ancona	Igoumenitsa	966,472.75	966,484.19
	Patra	1,133,945.5	1,137,237.9
	Durres	344,229.22	343,966.28
	Split	722,639.75	726,042.13
	Zadar	31,150.85	31,115.87
	Corfu	127,688.87	127,698.17
Container links			
Ancona	Trieste	1,311,066.2	1,325,073.8
	Piraeus	11,195.19	11,191.14
	Gioia Tauro	445,687	445,794.47

According to the model results, significant Ro-Ro freight flows will be transferred between the ports of Ancona and Igoumenitsa, Ancona and Patra and the ports of Ancona and Split, followed by those between the ports of Ancona and Durres.

The maritime link Ancona-Igoumenitsa serves mainly flows among Central Italy and Central and West Europe with Northwest Greece, the Balkans and Turkey. The maritime link Ancona-Split could serve flows among the areas of Croatia and the Balkans with Central Italy and the Central and West Europe. The maritime link Ancona-Patra serves freight flows among Central Italy and Central and West Europe and South Greece.

Regarding the container traffic, according to the CUBE model, the maritime link Ancona-Trieste would attract the highest freight flows in years 2025 and 2030, followed by the maritime link connecting the ports of Ancona and Gioia Tauro. The maritime link

connecting the ports of Ancona and Trieste would probably serve freight flows between East Europe and Central Italy, avoiding the congested road network.

Table 6 present the forecast freight flows for the “last-mile” connections at the port of Ancona for years 2025 and 2030, respectively. “Last-mile” connections are considered to be the road and rail links connecting the port with the country’s major road and railway networks.

Table 6. Forecast freight flows for the "last mile" connections for Port of Ancona

Port	Type of traffic	Year/hinterland connection			
		2025		2030	
		Road	Rail	Road	Rail
Ancona	Ro-Ro	2,644,841.28	681,285.56	2,651,201.23	681,343.31
	Container	1,564,629.78	203,318.61	1,578.590.75	203,468.66

According to the above, the freight flows served by the port of Ancona are expected to be transferred to the port mainly by trucks on the road network. The railway mode is expected to attract a moderate percentage, equal to 17.5%. Potential improvements to the

port hinterland’s railway infrastructure could have a direct impact on the modal split, resulting to the increase of the rail share.

In regard to hinterland areas served by Port of Ancona, the model’s results indicate that the port would attract flows mainly from:

- Emilia-Romagna
- Marche
- Umbria

- Abruzzo
- Central and West Europe

It should be noted that the freight flows from/to Emilia-Romagna and Abruzzo are partly served by the port of Ancona, as the freight flows from/ to Emilia-Romagna are also served by the port of Ravenna, while those from/to Abruzzo area by the port of Bari. In addition, the freight flows from/to Central and West Europe are also served by the ports of Venice and Ravenna.

Based on the results of the model, a future intermodal rail connection, connecting the port of Ancona with its hinterland area, would be sustainable, as it is expected to attract approximately 18% of total freight flows, transferred by the port of Ancona. A potential change in the network's characteristics would result to considerable changes in rail traffic share, considering that the rail network in the wider hinterland area attracts significant freight flows.

The port of Ancona enjoys a strategic location with respect to routes, has the ability to accommodate the so-called fast ships (such as ships Superfast) requiring a morphological structure in favour of the port and adequate backdrops. Geographical proximity to the Dalmatian coast has determined the further successes in the connections between Ancona and Croatia.

3.2. Port of Bari

The port of Bari is situated in the South-east of Italy and traditionally considered as Europe's gateway to the Balkan Peninsula and the Middle East. The port of Bari is a multi-purpose port whose multifunctional operations can count on platforms equipped for handling all types of cargo.

According to data provided by public sources it is possible to recognise that in Port of Bari there is an intensive flow of Ro-Pax ferries transporting passengers and vehicles. The most important lines for both, traffic and passenger flows, are the ones to Albania, Greece, Montenegro and Croatia.

Table 7 present Ro-Ro traffic of the Port of Bari for base year 2010, provided by Eurostat and Levante Port Authority.

Table 7. Ro-Ro traffic in the Port of Bari

Type of traffic	2010 by Eurostat	2010 by Levante Port Authority
Ro-Ro	1,482,000	3,324,462

Table 8 presents the results of the Cube model for the base year, the data provided by Eurostat, the survey results elaborated within the INTERMODADRIA project (Activities 3.2 & 3.3) and data obtained from the port's website for validation purposes.

Table 8. Port of Bari data and results for base year

Type of traffic	CUBE (tons/year) *Year: 2010*	EUROSTAT (tons/year) *Year: 2010*	INTERMODADRIA Survey (tons/year) *Year:2013*	Port's website (tons/year) *Year: 2010*
Ro-Ro	1,986,332.614	1,482,000	approx. 2,785,680 (154,760 trucks & unaccompanied trailers)	3,324,462

In above table, there can be seen a lot of deviation. The freight flows estimated for the port of Bari by the Cube model are higher than those provided by Eurostat. However, the estimated freight flows are lower than those recorded through the questionnaire used in INTERMODADRIA survey and the freight flows provided by the port's website. Considering

that a significant deviation is observed among the various data sources providing statistical information for the port of Bari, the calibration of the model is achieved in such a way in order to eliminate the deviation among model's results and the various data sources.

Table 9 presents the estimated freight flows at the port of Bari for years 2025 and 2030 by type of traffic, Ro-Ro and containers. Table 10 lists the freight flows of maritime links originating/ destined from/to the port of Bari forecasted for years 2025 and 2030 for Ro-Ro maritime links.

Table 9. Forecast freight flows for Port of Bari

Type of traffic	Year 2025	Year 2030
Ro-Ro	2,037,457.57	2,048,097.734
Container	0	0

Table 10. Forecast freight flows per maritime link for Port of Bari

Ro-Ro links		2025	2030
Bari	Igoumenitsa	559,321.56	560,543.63
	Patra	585,874.9	587,886.56
	Durres	628,438.19	635,343.44
	Bar	84,070.28	84,215.844
	Dubrovnik	155,075.84	155,163.08
	Corfu	24,676.8	24,945.18

According to the results, significant Ro-Ro freight flows will be transferred among the ports of Bari and Durres and the ports of Bari and Patra. In addition, significant freight flows are expected to be transferred among the ports of Bari and Igoumenitsa.

The link between Bari and Durres would serve flows between South Italy and Albania, but also the wider South Balkan area (FYROM, Kosovo, Montenegro). Regarding the maritime links Bari-Igoumenitsa and Bari-Patra, both would attract more than 550,000 tons/year in the forecast years, serving freight flows between South Italy and Northwest and South Greece, respectively. In addition, the maritime link Bari-Igoumenitsa would also serve maritime flows between South Italy and the South Balkan area (FYROM, South Bulgaria) and Turkey.

Table 11 present the forecast freight flows for the “last-mile” connections at the port of Bari for years 2025 and 2030, respectively. “Last-mile” connections are considered to be the road and rail links connecting the port with the country’s major road and railway networks.

Table 11. Forecast freight flows for the"last mile" connections for Port of Bari

Port	Type of traffic	Year/hinterland connection			
		2025		2030	
		Road	Rail	Road	Rail
Bari	Ro-Ro	334,396.7	1,703,061.1	335,530.14	1,712,567.6
	Container	0	0	0	0

According to the above results, the majority of freight flows (approximately 1,700,000 tons/year- 84% of total flows) at the port of Bari would be served by the rail links connecting the port with the Italian railway network, while a small percentage of freight flows would be transferred by road network.

With regard to the port’s wider hinterland areas, the model’s results indicate that the port of Bari would attract flows from:

- Abruzzo
- Puglia

- Basilicata

It should be noted that, concerning the freight flows originating/ destined from/to Abruzzo, part of them is served by the port of Bari, as the freight flows from/ to this area are also served by the port of Ancona.

According to the model results, the principal mode for the transport of freight flows at the port of Bari to its hinterland would be rail, providing thus great prospect for sustainable intermodal rail solutions. Accordingly, particular attention should be paid to the railway connections with the areas Abruzzo, Puglia and Basilicata.

3.3. Port of Ploče

The Port of Ploce is located in the southern part of the Adriatic has, therefore, been proclaimed, by a decision of the Croatian Government, a cargo port of special importance for the Republic of Croatia. Owing to its location, this port is of exceptional significance to the economy of the neighbouring state Bosnia and Herzegovina, as well as to the partners from Serbia and Montenegro, Hungary and other countries of Central Europe.

The location of the port of Ploče enables good-quality maritime connections with the cities of the Adriatic Coast and Italy, as well as with the ports of the entire world. A key service has been established by the opening of the weekly feeder line which connects the port of Ploče to Malta and Italian hub ports Taranto and Gioia Tauro.

Table 12 presents the results of the Cube model for the base year along with the data provided by Eurostat and that obtained from the port's website for validation purposes.

Table 12. Port of Ploče data and results for base year

Type of traffic	CUBE (tons/year) *Year: 2010*	EUROSTAT (tons/year) *Year: 2010*	INTERMODADRIA Survey (tons/year) *Year:2013*	Port's website (tons/year) Year: 2009
Containers	165,397.931	169,000	approx. 195,738 (18,713 TEU)	approx. 518,620 (25,931 TEU)

According to the results, the deviation between the estimated flows through Cube model and the data provided by EUROSTAT is equal to 2%. Concerning the deviation between the flows estimated through Cube model and the data provided by INTERMODADRIA survey, it is higher than 10%. This difference could be justified as the data collected through the survey refer to a year (2013) different than the one that Cube's results refer to (base year: 2010).

Table 13 presents the estimated freight flows at the port of Ploce for years 2025 and 2030 for container traffic. No Ro-Ro traffic is forecasted. Moreover, Table 14 includes the freight flows of container maritime links originating/ destined from/to the port of Ploce forecasted for years 2025 and 2030.

Table 13. Forecast freight flows for Port of Ploče

Type of traffic	Year 2025	Year 2030
Container	166,892.15	168,325.669

Table 14. Forecast freight flows per maritime link for Port of Ploče

Container links		2025	2030
Ploce	Gioia Tauro	135,077,59	136,492.06
	Taranto	27,621.23	27,621.309
	Bar	4,194.13	4,212.3

According to the above results, the maritime link Ploce-Gioia Tauro would attract significant freight flows in years 2025 and 2030, followed by the maritime link connecting the ports of Ploce and Taranto.

The port of Gioia Tauro constitutes the main hub port in the Adriatic area, distributing freight flows from several destinations to Adriatic ports through feeder services. The maritime link Gioia Tauro-Ploce would probably act as a feeder service as well, transferring freight flows from Croatia to the hub (Gioia Tauro) and from there on to ports around the world.

Table 15 present the forecast freight flows for the “last-mile” connections at the port of Ploce for years 2025 and 2030. “Last-mile” connections are considered to be the road and rail links connecting the port with the country’s major road and railway networks.

Table 15. Forecast freight flows for "last mile" connections for Port of Ploče

Port	Type of traffic	Year/hinterland connection			
		2025		2030	
		Road	Rail	Road	Rail
Ploce	Ro-Ro	0	0	0	0
	Container	234,237.8	164,277.2	234,333.72	165,770.22

According to the results, the majority of freight flows is transferred to the port of Ploce by road. However, a considerable part of total freight flows is transferred to the port by rail. The port of Ploce is well connected with the railway network in the area,p ermitting the transfer of goods by train from its neighbouring countries (Bosnia and Herzegovina and Croatia) to the port and from there to the Adriatic area.

With regard to the hinterland area of the port of Ploce, the model’s results indicate that the port would attract flows from the zone of Središnja i Istočna (Pansonska) Hrvatska. In addition, Bosnia and

Herzegovina is part of the hinterland area of the port of Ploce, while the completion of the four lanes motorway network throughout the country and the railway modernisation are expected to attract increased container flows from/to this area.

3.4. Port of Bar

The Port of Bar is Montenegro's main sea port. Presently, there are only two ferry lines connecting the passenger terminal at the Port of Bar with the Italian ports of Bari and Ancona. The ferry line Bar – Bari operates throughout the year, while the ferry line Bar – Ancona operates from July to September.

Table 16 presents the results of Cube model for the base year, and the INTERMODADRIA survey results. EUROSTAT does not provide data for the port of Bar, while no data was obtained from the port's website.

Table 16. Port of Bar data and results for base yearr

Type of traffic	CUBE (tons/year) *Year: 2010*	EUROSTAT (tons/year) *Year: 2010*	INTERMODADRIA Survey (tons/year) *Year:2013*	Port's website (tons/year)
Ro-Ro	83,516.453	n/a	46,555	n/a
Containers	30,577.971	n/a	n/a	*n/a*

The freight flows estimated through the Cube model for Ro-Ro ships are higher than those recorded in the questionnaire of the INTERMODADRIA survey. This difference could be justified as the data collected through the survey refers to year 2013, while Cube's results refer to base year 2010.

Table 17 presents the estimated freight flows at the Port of Bar for years 2025 and 2030 by type of traffic, Ro-Ro and containers. Table 18 lists the freight flows of maritime links originating/ destined from/to the port of Bar forecasted for years 2025 and 2030 for Ro-Ro and container maritime links.

Table 17. Forecast freight flows for Port of Bar

Type of traffic	Year 2025	Year 2030
Ro-Ro	84,070.28	84,215.844
Container	38,128.802	39,297.27

Table 18. Forecast freight flows per maritime link for Port of Bar

Ro-Ro links		2025	2030
Bar	Bari	84,070.28	84,215.844
Container links			
Bar	Rijeka	33,934.67	35,084.97
	Ploce	4,194.13	4,212.3

According to the results, significant Ro-Ro freight flows will be transferred between the ports of Bari and Bar, serving freight flows between South Italy and Montenegro. With regard to the container traffic, the maritime link Rijeka-Bar would attract significant freight flows in years 2025 and 2030. The port of Rijeka constitutes a hub port in the Adriatic area, distributing freight flows from several destinations to Adriatic ports through feeder services. The maritime link Rijeka-Bar would probably act as a feeder service as well, transferring freight flows from Montengero to the hub (Rijeka) and from there on to ports around the world.

Table 19 present the forecast freight flows for the “last-mile” connections at the port of Bar for years 2025 and 2030. “Last-mile” connections are considered to be the road and rail links connecting the port with the country’s major road and railway networks.

Table 19. Forecast freight flows for the "last mile" connections for Port of Bar

Port	Type of traffic	Year/hinterland connection			
		2025		2030	
		Road	Rail	Road	Rail
Bar	Ro-Ro	81,571.73	2,498.55	81,715.93	2,500
	Container	34,931.87	3,196.93	36,098.7	3,199.12

According to the results, the majority of freight flows will be transferred to the port of Bar by the road network. A small percentage of the estimated freight flows would be transferred by the rail network, connecting the port with its hinterland area.

With regard to the hinterland area of the port of Bar, the model’s results indicate that the port would attract flows from Montenegro, and, in addition, the port of Bar could potentially serve freight flows from/ to Serbia and the wider Balkan area.

The Port of Bar do not utilize its potential and capacity. The port has to acquire new markets to which it would cater. The announced building of Belgrade–Bar motorway and proposed reconstruction of Belgrade–Bar railway would thus mark a breakthrough in attracting the Serbian, and thus the Central European market.

3.5. Port of Durres

The Port of Durres is the most important, attractive and equipped of all Albania. There is intensive flow of passengers and vehicles. Main destinations of flows toward Europe are with Italy (Ancona and Bari) and for the internal areas of all Albania, Kosovo, Macedonia.

Table 20 presents Ro-Ro and Container traffic of the Port of Durres for base year 2010, provided by Port Authority of Durres

Table 20. Ro-Ro and container traffic in the Port of Durres

Type of traffic	2010 by Port Authority Durres
Ro-Ro	59,224 trucks & trailers
Container	71,700 TEU

Table 21 presents the results of the Cube model for the base year, the data provided by the INTERMODADRIA survey results and data obtained from the port's website for validation purposes. EUROSTAT does not provide data for the port of Durres.

Table 21. Port of Durres data and results for base year

Type of traffic	CUBE (tons/year) *Year: 2010*	EUROSTAT (tons/year) *Year: 2010*	INTERMODADRIA Survey (tons/year) *Year:2013*	Port's website (tons/year)
Ro-Ro	1,464,959.590	n/a	699,426	approx. 1,066,032 (59,224 trucks & trailers) -*Year: 2013*
Containers	1,488,724.196	n/a	1,105,179	approx. 1,434,000 (71,700 TEU) -*Year: 2011*

The deviation among the estimated container flows and the data recorded at the questionnaire of the INTERMODADRIA survey is approximately, 34% while a lower difference is observed between Cube's results and the data obtained from the port's website. Concerning the estimated freight flows for Ro-Ro ships, the flows estimated through Cube model are higher. This difference could be justified as the data collected through the survey and the data provided through the port's website refer to a year (2013) different than the one that Cube's results refer to (base year: 2010).

Table 22 presents the estimated freight flows at the Port of Durres for years 2025 and 2030 by type of traffic, Ro-Ro and containers. Table 23 lists the freight flows of maritime links originating/ destined from/to the port of Durres forecasted for years 2025 and 2030 for Ro-Ro and container maritime links.

Table 22. Forecast freight flows for Port of Durres

Type of traffic	Year 2020	Year 2030
Ro-Ro	1,484,968.19	1,491,860.31
Container	1,530,467.74	1,546,723.07

Table 23. Forecast freight flows per maritime link for Port of Durres

Ro-Ro links		2025	2030
Durres	Bari	628,438.19	635,343.44
	Ancona	344,229.22	343,966.28
	Trieste	512,300.78	512,550.59
Container links			
Durres	Piraeus	72,044.6	72,364.547
	Gioia Tauro	314,945.34	315,359.22
	Koper	1,143,477.8	1,158,999.3

According to the results, the highest Ro-Ro freight flows would be transferred between the ports of Durres and Bari and the ports of Durres and Trieste. Also, significant freight flows are expected to be transferred between the ports of Durres and Ancona.

The maritime link Durres-Bari would serve flows between South Italy and Albania but also among the wider area of South Balkans (FYROM, Kosovo, Montenegro). The maritime link Durres-Trieste could serve maritime flows among Albania and its wider area and East Italy and Central Europe (Austria, Slovenia, South Germany).

Concerning the container traffic, the maritime link Durres-Koper would attract significant freight flows in years 2025 and 2030, followed by the maritime link connecting the ports of Durres and Gioia Tauro.

The container link Durres-Koper is expected to serve freight flows among Albania and Central and East Europe. In addition, the port of Koper constitutes a major hub port for the Adriatic area, distributing freight flows from distant areas, such as the Far East, to Adriatic ports through feeder services. The maritime link Durres-Koper would probably act as a feeder service as well, transferring freight flows from Albania to a major hub (Koper) and from there on to ports around the world.

Table 24 present the forecast freight flows for the “last-mile” connections at the port of Durres for years 2025 and 2030, respectively. “Last-mile” connections are considered to be the road and rail links connecting the port with the country’s major road and railway networks.

Table 24. Forecast freight flows for the "last mile" connections for Port of Durres

Port	Type of traffic	Year/hinterland connection			
		2025		2030	
		Road	Rail	Road	Rail
Durres	Ro-Ro	732,371.63	752,596.56	738,177.88	753,682.44
	Container	888,528.5	641,909.19	904,276.7	642,446.38

According to the results, in year 2025, 49.3% of total Ro-Ro freight flows would be transferred by road links accessing the port and 50.7% of total Ro-Ro freight flows would be transferred by rail. In 2030, 49.5% of total Ro-Ro traffic would be transferred by road network and 50.5% of total Ro-Ro traffic would be transferred by rail network.

Concerning container traffic, the 58.1% of container freight flows estimated for year 2025 would be transferred by road and 41.9% would be transferred by the rail network. The respective results for year 2030 are equal to 58.5% for road network and 41.5% for rail network.

With regard to the port's wider hinterland areas, the model's results indicate that the port of Durres would attract flows from:

- Albania
- Montenegro

It should be noted that part of the freight flows originating/ destined from/to Montenegro are served by the port of Durres, as the freight flows from/ to this area are also served by the port of Bar.

3.6. Port of Igoumenitsa

Igoumenitsa is the chief port of Thesprotia and Epirus, and one of the largest passenger ports of Greece, connecting northwestern Mainland Greece with the Ionian Islands and Italy. It is situated on easternmost end of the Gulf of Igoumenitsa in the Ionian Sea.

Currently the port dominates in the intermodal O/D shipping flow market (especially passenger flows and truck), predominantly servicing with suitable ferries all Adriatic Italian ports.

Table 25 presents Ro-Ro traffic of the Port of Igoumenitsa for base year 2010, provided by Eurostat and Port of Igoumenitsa.

Table 25. Ro-Ro and container traffic in the Port of Igoumenitsa

Type of traffic	2010 by Eurostat	2010 by Port of Igoumenitsa
Ro-Ro	2,294,000	Approx. 3,277,360 (163,868 trucks)

Table 26 presents the results of the Cube model for the base year, the data provided by Eurostat, the survey results elaborated within the INTERMODADRIA project (Activities 3.2 & 3.3) and data obtained from the port's website for validation purposes.

Table 26. Port of Igoumenitsa data and results for base year

Type of traffic	CUBE (tons/year) *Year: 2010*	EUROSTAT (tons/year) *Year: 2010*	INTERMODADRIA Survey (tons/year) *Year:2013*	Port's website (tons/year) *Year: 2010*
Ro-Ro	2,667,235.980	2,294,000	approx. 2,496,132 (138,674 trucks)	approx. 3,277,360 (163,868 trucks)

The deviation among the estimated flows and the data provided by EUROSTAT is approximately 15%. Concerning the freight flows recorded in the questionnaire within the INTERMODADRIA survey, they are estimated equal to 2,496,132, assuming that each truck corresponds to 18 tons. In this case, the difference among the Cube results and the statistical data is equal to a minimal 6%.

Table 27 presents the estimated freight flows at the Port of Igoumenitsa for years 2025 and 2030 by type of traffic, Ro-Ro and containers. Table 28 lists the freight flows of maritime links originating/ destined from/to the port of Igoumenitsa forecasted for years 2025 and 2030 for Ro-Ro maritime links.

Table 27. Forecast freight flows for Port of Igoumenitsa

Type of traffic	Year 2020	Year 2030
Ro-Ro	2,714,312	2,717,218.31
Container	0	0

Table 28. Forecast freight flows per maritime link for Port of Igoumenitsa

Ro-Ro links		2020	2030
Igoumenitsa	Bari	559,321.56	560,543.63
	Venice	371,737.8	372,753.44
	Trieste	125,538.7	125,610.55
	Brindisi	691,241.19	691,826.5
	Ancona	966,472.75	966,484.19

According to the results, significant Ro-Ro freight flows will be transferred between the ports of Igoumenitsa and Ancona and the ports of Igoumenitsa and Brindisi. The maritime

link Ancona-Igoumenitsa serves mainly flows among Central Italy and Central and West Europe with North and West Greece, the Balkan area and Turkey. In addition, considerable freight flows are also expected to be transferred between the ports of Igoumenitsa and Bari and Igoumenitsa and Venice as well as between the ports Igoumenitsa and Brindisi. The maritime links connecting the port of Igoumenitsa with Bari and Brindisi would serve freight flows among South and Central Italy and Northwest Greece, South Balkan area (FYROM, South Bulgaria) and Turkey. The link Venice-Igoumenitsa would serve freight flows among North Italy and Central and West Europe and North and West Greece.

Table 29 present the forecast freight flows for the "last-mile" connections at the port of Igoumenitsa for years 2025 and 2030, respectively. "Last-mile" connections are considered to be the road and rail links connecting the port with the country's major road and railway networks.

Table 29. Forecast freight flows for "last mile" connections for Port of Igoumenitsa

Port	Type of traffic	Year/hinterland connection			
		2025		2030	
		Road	Rail	Road	Rail
Igoumenitsa	Ro-Ro	1,841,841.6	749,745.75	1,844,005.4	750,074.31
	Container	0	0	0	0

According to the results in table 29, the majority of freight flows at the port of Igoumenitsa would be transferred by road network, while a significant percentage (27.6%) would be attracted by the future rail network.

With regard to the port's wider hinterland areas, the model's results indicate that the port of Igoumenitsa would attract flows from:

- Dytiki Makedonia
- Thessalia
- Ipeiros
- Ionia Nisia

It should be noted that part of the freight flows from/ to the areas of Dytiki Makedonia and Thessalia would be served by the port of Igoumenitsa, while the ports of Thessaloniki, Volos and Piraeus could also serve freight flows from these areas. In addition, part of the freight flows from/ to Ionia Nisia would be transferred through the port of Igoumenitsa, as this area is mainly served by the port of Corfu, which is connected with the ports of Ancona and Bari.

Apart from the above, the port of Igoumenitsa is expected to serve part of the freight flows transferred from the areas of South Balkans, South Bulgaria and Turkey to Italy and Central and West Europe. According to the Cube model results, the majority of freight flows at the port of Igoumenitsa would be transferred by the road network, however, a significant percentage could also be attracted by the future rail network, demonstrating thus, that there is ground for intermodal rail solutions, once the construction of the railway network connection and the freight village are realised.

4. Main outputs and results

The CUBE model was developed for two different scenarios: the base year (2010) and the forecast ones (2025 and 2030). This model also resulted in the identification of the main maritime links, for both Ro-Ro and container freight flows. The links that exist in this area, as well as forecasted freight flows for years 2025 and 2030 are shown in next table:

Table 30. Existing maritime links and forecast freight flows in Adriatic-Ionian region

Maritime link			
Ro-Ro links		2025	2030
Igoumenitsa	Bari	559,321.56	560,543.63
	Venice	371,737.81	372,753.44
	Trieste	125,538.7	125,610.55
	Brindisi	691,241.19	691,826.5
	Ancona	966,472.75	966,484.19
Patra	Venice	674,500.38	684,786.63
	Bari	585,874.94	587,886.56
	Ancona	1,133,945.5	1,137,237.9
	Brindisi	284,746.31	284,706.38
	Trieste	298,119.5	298,250.16
	Catania	300,623.63	309,466.69
Bari	Durres	628,438.19	635,343.44
	Bar	84,070.281	84,215.844
	Dubrovnik	155,075.84	155,163.08
Ancona	Durres	344,229.22	343,966.28
	Split	512,300.78	512,550.59
	Zadar	722,639.75	726,042.13

Durres	Trieste	31,150.85	31,115.871
Corfu	Bari	24,676.8	24,945.18
	Ancona	127,688.87	127,698.17
Container links			
Venice	Piraeus	1,829,562	1,861,961.7
	Taranto	848,968	848,968
	Trieste	35,896.199	37,253.551
	Koper	834,822.56	837,091.25
Ancona	Trieste	1,311,066.2	1,325,073.8
	Piraeus	11,195.19	11,191.14
	Gioia Tauro	445,687	445,794.47
Koper	Gioia Tauro	290,879.31	298,974.25
	Piraeus	17,765.87	17,801.561
	Taranto	92,272.391	93,145.92
Piraeus	Gioia Tauro	408,305.2	416,581.91
Trieste	Piraeus	321,288.8	321,048.72
	Taranto	113,299.18	113,238.95
Rijeka	Piraeus	794,065.5	820,668.56
	Gioia Tauro	182,761.05	182,761.05
	Bar	33,934.67	35,084,96
Ravenna	Koper	3,450.32	3,511,17
Gioia Tauro	Ploce	135,077,59	136,492.06
	Durres	314,945.34	315,359.22
Taranto	Ploce	27,621.23	27,621.309
Durres	Piraeus	72,044.6	72,364.55

	Koper	1,143,477.8	1,158,999.3
Bar	Ploce	4,194.13	4,212.23

In table 31 are shown freight flows (Ro-Ro and container) for Croatian and Italian ports in years 2010 and 2016 (Eurostat source) and forecasted total throughput for years 2025 and 2030:

Table 31. Freight flows for Italian and Croatian ports

Port	Type of traffic	Year			
		2010	2016	2025	2030
Ancona	Ro-Ro	2,403,000	2,236,000	3,326,126	3,332,544
	Container	1,447,000	1,717,000	1,767,948	1,782,059
Bari	Ro-Ro	1,482,000	1,793,000	2,037,457	2,048,097
	Container	0	678,000	n/a	n/a
Ploce	Ro-Ro	0	0	0	0
	Container	169,000	220,000	166,892	168,325
Rijeka	Ro-Ro	0	0	n/a	n/a
	Container	893,000	1,435,000	n/a	n/a
Split	Ro-Ro	599,000	389,000	n/a	n/a
	Container	42,000	93,000	n/a	n/a

As can be seen from above 2 tables, Italian and Croatian Ports have many established links. The most important in Ro-Ro traffic are:

- Ancona-Split
- Ancona-Zadar

- Bari-Dubrovnik

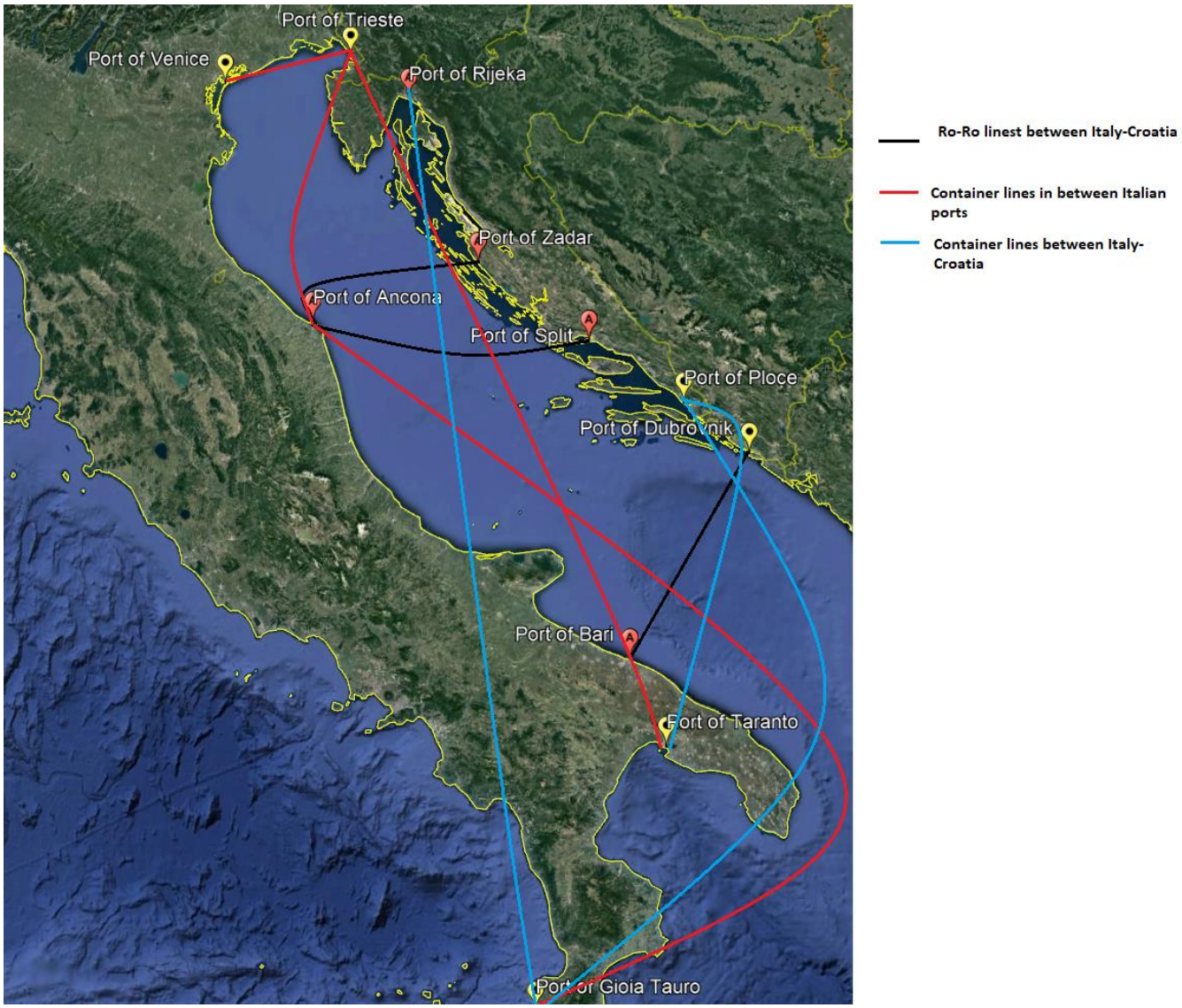
For now, link between Ancona and Split is most important, and with largest freight flows. CUBE model from INTERMODADRIA project forecasted that link between Ancona and Zadar will be more important in the future, but that stay to be seen. For now, line Ancona-Zadar is operational only part of the year, while line Ancona-(Stari Grad)-Split is operational whole year, and in summer months direct line Ancona-Split is operational.

In container lines, the linest that are interesting for study are:

- Gioia Tauro-Ploce
- Taranto-Ploce
- Rijeka-Gioa Tauro

Lines Gioia Tauro-Ploce and Rijeka-Gioia Tauro are especcialy interesting because they can connect South Italy with South and North Croatia, while line Trieste-Taranto can connect North and South Italy.

Picture 2 shows map with lines that exist between Italy and Croatia. As can be seen, connection between Italy and Croatia exist, and can be used for further promotion of intermodal transportation in this area.



Picture 2. Existing lines between Italian and Croatian ports

Conclusion

The document presented the analysis of results of the WP3.1 – Freight Route Analysis carried out by setting up a freight forecasting model via the CUBE software tool in INTERMODADRIA project. This model was carried out in order to estimate future freight flows - both RORO and container traffic- passing through the ports of the INTERMODADRIA partnership.

The special attention was given ports in Italy and Croatia, since TRANSPOGOOD project work on establishment and encouragment of intermodal transportation in this area.

It could be said that lines that exist in this Area are sustainable, and can be used to further promote connection and trade between Italy and Croatia. Also, it is worth to look at establishment of new Ro-Ro lines. For example, Ro-Ro line that would connect South Italy and North Croatia (e.g. Bari-Rijeka, or, alternatively, Dubrovnik-Rijeka. Since Dubrovnik alredy have established line with Bari, by connecting Dubrovnik and Rijeka we can also connect Bari and Rijeka on second level)

Although lines exist between these two countries, information exchange between the different actors in the transport logistics chain (shippers, logistic providers, transport operators and authorities etc.) is small or non – existent.

By increasing information exchange between key logistics stakeholders we can find the best solution of transport services (e.g., best price of combined transport, lower emissions of entire chain, eprocurement tools for maritime transport services, higher bi-directional load factor).

Table of figures