Territorial needs assessment for the port of Rijeka

Deliverable no. D.3.2.8

Title: D.3.2.8 territorial needs assessment (TNA) for the port of Rijeka

Client: PORT OF RIJEKA AUTHORITY

Riva 1

51000 Rijeka

Republic of Croatia

Contractor: AKSENTIJEVIĆ FORENSICS AND CONSULTING, Ltd.

Gornji Sroki 125a

51216, Viškovo

Republic of Croatia

Project manager: Davorin Mance, MSc ICT Eng.

Consultant: Saša Aksentijević, Asst. Prof., PhD

Table of contents:

1 INTRODUCTION

This Territorial Needs Assessment (TNA) for the port of Rijeka is assembled according to contract stipulated on 30.08.2019. between Port of Rijeka Authority as a client and Aksentijević Forensics and Consulting, Ltd., as a contractor, according to commercial offer 0108-2019 dated 20.08.2019.

Project PROMARES – *Promoting maritime and multimodal freight transport in the Adriatic Sea* is facing challenges disrupting development of the sea and multimodal cargo transport in the program area. They are mostly caused by imbalance in development of multimodal traffic systems, weak coordination and communication between stakeholders and policy makers and non-alignment of measures and tools on cross-border level, leading to increase of road traffic with negative implications in form of pollution, greenhouse gas (GHG) emissions and noise pollution.

Goal of PROMARES project is to enhance sea and multimodal cargo traffic in all ports of interest that generate intermodal and multimodal transport flows, facing the same type of challenges of accessibility of multimodal transport and efficiency of TEN-T corridor in the region (from the port to inland), and increase level of cooperation and stakeholder cooperation. Focus of cooperation of Port of Rijeka Authority and PP11[1] is research of elements of multimodal transport system with final goal of creating a solid set of KPIs and testing models of their measurement.

Project duration is 30 months from January 2019., and Territorial needs assessment (TNA) for the port of Rijeka needs to be delivered until 30th September 2019.

Activity 3.2 of Promares project foresees the analysis of maritime and multimodal freight transport in the Programme Area.

Involved Project Partners executing Activity 3.2 are as follows:

1. PP2 - Venice International University,
2. LP - Port Network Authority of Eastern Adriatic Sea,

[1] PP11 is abbreviation for „Project Partner 11“, University Of Rijeka, Faculty Of Maritime Studies Rijeka

3. PP1 - North Adriatic Sea Port Authority – Ports of Venice and Chioggia,
4. PP3 - Interporto Trieste - Fernetti,
5. PP5 - Port of Ravenna Authority,
6. PP6 - Central Adriatic Ports Authority,
7. PP7 - Southern Adriatic Sea Port Authority (Ports of Bari, Brindisi, Manfredonia, Barletta and Monopoli),
8. PP8 - Ram - Rete Autostrade Mediterranee Spa
9. PP9 - Port Authority of Rijeka, and
10. PP10 - Porth Authority of Ploče.

PP11 has already previously compiled a cross-border action plan for enhancing maritime and multimodal freight transport. The cross-border action plan has been created after intermediate results of the territorial needs assessments and best practice analysis were discussed at the 2nd PSC[2] meeting, when a training seminar was also held by the WPL on the most recent policies and practices for enhancing maritime and multimodal transport, also outside the Programme Area.

Based on the results of the Territorial Needs Assessments, the best practice analysis and the training session, WPL will also draft a cross-border action plan for enhancing maritime and multimodal freight transport, containing guidelines, priority measures and KPIs, to be tested in pilot actions (WP4) and laying the basis for the cross-border strategy, towards end of September 2019.

Based on a common methodology provided by PP2, LP, PP1, PP3, PP5, PP6, PP7, PP9 and PP10 **elaborate territorial needs assessments for the respective region**, containing SWOT analysis, future scenarios for the activation of new maritime/multimodal freight links and customs fast corridors, clusterisation and cross-border opportunities, stakeholder mapping and feasibility studies, if needed. Each PP involves the identified stakeholders – terminal and logistic operators, railway companies, policy makers – through ad-hoc meetings.

PP8 elaborates a wider strategic analysis of Italian TNAs with the goal of ensuring the consistency with and feeding the national strategies for port and intermodal transport development.

[2] PSC is abbreviation for „Project Steering Committee“

PP2 consolidates these reports in a cross-border study on maritime and multimodal freight transport, summarising and comparing the individual reports.

Activity 3.2 is led by PP2.

The deliverables of Activity 3.2 are the following:

1. D.3.2.1, Methodology for the implementation of the territorial needs assessments (TNA) (M3): PP2 elaborates a common methodology for drafting the TNAs on maritime and multimodal freight transport containing SWOT analysis, future scenarios for the activation of new maritime/multimodal links and customs fast corridors, clusterisation and cross-border cooperation opportunities, stakeholder mapping and feasibility studies, if needed,
2. D.3.2.2, TNA for the port of Trieste (M6 draft, M9 final),
3. D.3.2.3, TNA for the port of Venice (M6 draft, M9 final),
4. D.3.2.4, TNA for the intermodal logistic node of Padova (M6 draft, M9 final),
5. D.3.2.5, TNA for the port of Ravenna, with the support of PP4 (M6 draft, M9 final),
6. D.3.2.6, TNA for the port of Ancona (M6 draft, M9 final),
7. D.3.2.7, TNA for the port of Bari (M6 draft, M9 final),
8. D.3.2.8, TNA for the port of Rijeka (M6 draft, M9 final),
9. D.3.2.9, TNA for the port of Ploče (M6 draft, M9 final),
10. D.3.2.10, Strategic analysis for Italian TNAs (M6 draft, M9 final),
11. D.3.2.11, reports on stakeholder involvement (M9); LP, PP1, PP3, PP5, PP6, PP7, PP9, PP10, elaborate reports on the feedback received by stakeholders, and
12. D.3.2.12, Cross-border study on maritime and multimodal freight transport (M10): PP2 summarises and compares the individual reports This cross-border action plan for enhancing maritime and multimodal freight transport covers the third deliverable of Activity 3.3, D.3.3.1.

This document covers topic relevant for deliverable D.3.2.8, TNA for the port of Rijeka, and it is written in full compliance with guidelines set in D.3.2.1: *Methodology for the implementation of Territorial Needs Assessments (TNA).*

TNA for the port of Rijeka has the following composition:

1. *Introduction*
2. *Section A – Territorial analysis*

Section A focuses on territorial analysis and it aims at improving coordination between existing infrastructure and services. For this very reason it outlines key elements and factors existing and contributing to business and development activities in port of Rijeka.

2.1 Subsection A.1 – Territory description in the Programme Area focuses on most significant nodes and hubs, describes and discusses main features and characteristics of the port of Rijeka while highlighting the most relevant nodes and urban centers located in it,

2.2 subsection A.2 – Multimodal transport: supply and demand analysis examines main EU corridors for freight transport and multimodal hubs operating in and from the port of Rijeka, including analysing main infrastructures and existing data of freight transport flows, including modal share, and

2.3 subsection A.3 – Tools and measures supporting multimodal transport (policies, plans, etc.). This section is dedicated to reporting on tools and measures fostering multimodality (policies, plans, etc.). It touches specifics of the current regulatory framework, as well as relevant policies and measures linked to freight transport. Also, it highlights strategic plans and actions and discusses projects aimed at improving multimodality.

3. *Section B – Future Scenarios*

In Section B, measures that are either planned for the future or already being implemented are discussed including implications and forecasts for future scenarios and the impact of the above-mentioned measures. The impact on future infrastructure demand is considered. Future scenarios will serve as a basis for the implementation of pilot actions for ICT pilot actions involving multimodal hubs, to be carried out in WP4. In addition to future scenarios and measures that are specific to individual actions, other relevant projects and planned actions within the program area should are also mentioned and described.

4. *Section C – Mapping out stakeholders*

This section deals with the involvement of major stakeholders in the programme area as a key element for project results' dissemination. Key stakeholders in the port of Rijeka are identified as they affect project activities and outcomes. The list of stakeholders, and their power of influence and interest is prepared and shown in table form according to their influence on the project, while another table outlines maps stakeholders according to their role and the benefit (or conflicts) their involvement could bring.

5. *Section D – Analysis of IT systems*

In order to facilitate these communication processes and the development of the inter-organizational relationships among stakeholders in the freight agent community, ICTs such as port community systems (PCSs) have been introduced. The implementation and/or upgrade of ICT and Port Community Systems are examples of territorial needs that have already been identified by several PPs.

5.1 Subsection D.1 - Architecture models

Architecture model is described using established architectural models for IT systems:

1. Bilateral (1 to 1);
2. Private hub (1 to N);
3. Central hub (N to 1 to M);
4. Modular distributed plug-and-play architecture (N to M).

5.2 Subsection D.2- Implementation stage

Self-evaluation and reporting have been done regarding individual steps of ICT systems' implementation. Four stage-system in designing and implementing of IT system is used:

1. Project initiation;
2. system analysis and design;
3. Implementation and adoption;
4. Maintenance and growth.

5.3 Subsection D.3 - Usage by and impact on freight agents

After assessing the architecture design and implementation stage of their ICT, one should also evaluate the impact of ICT adoption and the actual use different stakeholders make of ICT. should map out their relevant agents and stakeholders in the way the interact with each other and the system.

6. *Section E – SWOT Analysis*

SWOT analysis is used in TNA to identify key internal and external factors perceived as important to achieving project objectives as they stem from previous project activities. All relevant elements are divided into two main categories:

a. Internal factors — *Strengths* and *Weaknesses, and*
b. External factors —*Opportunities* and *Threats.*

Used factors are derived from the previous steps of TNA, and include examination of needs of port of Rijeka, future scenarios, stakeholder involvement and their feedback. SWOT analysis as a part of TNA outlines factors involved in reaching target objectives, thus enhancing cross-border maritime and multimodal freight transport, with a focus on ICT solutions, infrastructure development and optimization, implementation and upgrading.

7. *Section F – Main Results*

TNA study concludes with a one-page summary of the main achieved results and importance given to those elements that are relevant to the outcomes of PROMARES.

Finally, a **list of consulted resources** is compiled along with **glossary of used terms**.

2 SECTION A – TERRITORIAL ANALYSIS

Territorial analysis consists of the territory description of port of Rijeka and its main nodes, supply, basins and demand analysis of the main hubs and tools and measures supporting multimodal transport with highlight of strategic plans and project discussion aimed at improved multimodality. Overview of these topics is outlined in subsequent three chapters.

2.1 SUBSECTION A.1 – TERRITORY DESCRIPTION IN THE PROGRAMME AREA

Port of Rijeka is a multi-purpose port whose manipulations include all kinds of cargo along with the passenger movement. Its geographic gravitates towards central European countries, covering the following countries: Croatia, Bosnia and Herzegovina (especially northwest), Serbia (especially central and northern part), Hungary, Slovakia, the Czech Republic, Poland (especially the southern part), Romania (especially the western part) and Germany, the province of Bavaria.

Port of Rijeka belongs to NAPA ports (North Adriatic ports), including Koper, Trieste, Venice and Ravenna. NAPA has a common goal of transport container development and becomes a multifunctional bridge between Asia and the economies of central and eastern Europe.

The port system is organized within the Kvarner Bay through several basins that are dislocated and, in some cases, remote. Therefore, port of Rijeka is dispersed in multiple locations, with more entries to the ISPS area and a significant basin parts (Rijeka and Sušak) situated in the very city core.

Fig. 1: Port of Rijeka (Rijeka and Sušak basins) – aerial view[3]

Rijeka is predominantly oriented towards Central European countries and in a strong competitive environment with other Northern Adriatic ports (mostly Koper and Trieste). As far as logistics in Rijeka is concerned, there are several types of processes (e.g. transfer of livestock and wood in Raša port), and with larger traffic there is a greater amount of information in the exchange.

All of this has an impact on the technological level of the solution, its complexity and price.

The description of the port of Rijeka territory and terminals for transhipment of goods follows in the next chapters, along with their main characteristics and relevant data.

Fig. 2: Berths, Piers and Moorings (Rijeka-Sušak basin)[4]

[3] Analysis of the Port Community System (PCS) in Ports Ploče and Rijeka, Info-Nad Ltd., Rijeka, 2017., p. 5

[4] Ibid., p.7

Explanation:

1. Kostrensko pristanište	2. Riva Galioti	3. Delta
4. Sušački lukobran	5. Ružićev gat	6.Vinodolsko pristanište
7. Senjsko pristanište	8. Riječki lukobran	9. Riva Boduli
10. Gat Karoline Riječke	11. Adamićev gat	12. Istarsko pristanište
13. De Franceschijev gat	14. Bečko pristanište	15. Orlandov gat
16. Budimpeštansko pristanište	17. Visinov gat	18. Praško pristanište
19. Bratislavsko pristanište	20. Zagrebačko pristanište	

2.1.1 Rijeka and Sušak basins

Rijeka and Sušak basins are located directly in front of the city center and stretch from Mlaka on the west side to Brajdica on the east side. Within these two basins are situated freight, passenger and fishing ports with their own terminals.

2.1.1.1 General cargo terminal

General cargo terminal is located in the old port core. It has 11 berths to which ships of up to 30,000 DWT can be moored. All the necessary equipment and personnel required for simultaneous work on all moored ships is readily available. The terminal's purpose is manipulation and storage of general cargo, but also has specialized units for the transfer of paper, wood, metallurgical products, dangerous cargoes, heavy goods, frozen and conditioned food and cargo handling capacities.

Characteristics of this terminal are the following:

- The depth of the sea: 12 m
- Annual capacity: 2.000.000 t
- 11 moorings on multiple operational shores
- Mobile cranes with nominal load capacity of 40 and 63 tons
- Two "Liebherr" cranes (installed in 2013) each rated capacity of 84 tons.

Concessionaire of this terminal’s operations is company Luka Rijeka j.s.c.

2.1.1.2 Grain terminal (silo)

Grain terminal is equipped for handling and storing wheat, soy and other grains and oil seeds. It is located in the Rijeka basin, has operational berth able to accommodate vessels up to 60,000 DWT, and operational bridge with capacity of 400 t/h. The terminal has modern equipment for drying, ventilation, grain weighing and disinfection. Concessionaire Luka Rijeka j.s.c. operates this terminal.

Additional characteristics of this terminal are:

- The depth of the sea: 14 m
- Annual capacity: 1.000.000 t
- Disposable storage capacity: 56.000 t
- Possible loading / unloading operations:
    - ship - silo; silo - ship
    - ship - silo - wagon (truck)
    - wagon (truck) – silo – ship.

2.1.1.3 Conditioned cargo terminal

Fruits (bananas and citrus fruits) and frozen meat and fish are mostly stored in this terminal. Cargo storage and handling is carried out in refrigerated areas with cooling chambers.

Characteristics of this terminal are the following:

- The depth of the sea: 10 m
- Annual capacity: 100.000 t
- Total area of the conditioned stock: 8.000 m²
- Disposable storage capacity: 3.175 t.

2.1.1.4 Bulk cargo terminal

Bulk cargo terminal is equipped for the manipulation and storage of iron ore, coal and other bulk cargo. The depth at the dock of 18 meters allows mooring of the ships up to 150,000 DWT. Total annual capacity of the bulk cargo terminal is 4,000,000 tons. Characteristics of this terminal are the following:

- Accepts Panamax and Capesize ships
- There is a rail connection to the hinterland
- Disposable storage capacity for:
    - fine iron ore 300.000 t,
    - iron ore pellets 250.000 t, or
    - coal 120.000 t.
- The port mechanics possesses:
    - a bare portal crane with a grabber
    - continuous conveyer
    - a continuous shipwreck
    - a movable storage bridges
    - transport tracks.

Bulk cargo terminal operator is Luka Rijeka j.s.c.

2.1.1.5 Container terminal Brajdica

Container terminal Brajdica provides services related primarily to manipulation and storage of containers, as well as all other services related to container cargo:

- boarding and unloading of containers on / off the ship
- receipt and delivery of container on / off trucks
- receipt and delivery of container on / off the rail
- filling and emptying in / out of the container
- container washing
- fumigation
- customs or phytosanitary assistance, container sealing
- storage of cargo

The container terminal has the following characteristics:

- Dock 1: length of mooring - 300 m; sea depth - 11,21 m
- Dock 2: length of mooring - 328 m; sea depth - 14,88 m
- Annual capacity: 600.000 TEU
- Port mechanization:

- 2 Panamax container cranes
- 2 post Panamax container cranes
- 6 RTG (storage transhipment bridges)
- 2 RMG (railway transhipment bridges)

- BIP station for phyto-sanitary inspection of goods.

Container terminal operator is “Jadranska vrata” j.s.c. / AGCT (Adriatic Gate Container Terminal).

Adriatic Gate j.s.c. was founded on 11th September 2001 as a subsidiary company of Luka Rijeka j.s.c. International Container Terminal Services Inc. (ICTSI) entered the ownership structure on 15th April 2011 as a strategic partner with a concession for 30 years, i.e. until the year 2041. Thereafter the brand name Adriatic Gate Container Terminal is in usage.

Fig. 3: Container terminal Brajdica[5]

Currently Luka Rijeka dd holds 49 % of the shares of the Adriatic Gate while ICTSI holds 51 % of the shares.

2.1.1.6 Zagreb Deep Sea Container Terminal

The first phase of construction is completed in first half of 2019. Resulting in the pier having length of 400m with a minimum sea depth of 20m at the wharf. Phase 2 of the project includes construction of additional coast wall of 280 m. The Port of Rijeka Authority is looking for strategic

[5] http://pomorac.net/wp-content/uploads/2017/07/Brajdica2.jpg (accessed 15.08.2019.)

partner (concessionaire) for phase 1 and 2. Long term development (Phase 3) allows extension of the pier to maximum length of 1250 m. The planned depth of the sea by the quay wall is minimum 20 m and annual capacity of 650.000 TEU.

In parallel with the construction of the pier, terminal railway interface reconstruction has started along with building of the connecting road D-403.

Finally, completion of the project would make a pier with length of 680 m with operational quay average width of 300 m.

Illustrations of Zagreb Deep Sea Container Terminal is shown in figures on the next page.

Fig. 4: Zagreb Deep Sea Container Terminal[6]

[6] http://seebiz.eu:8080/upload/seebiz_eu/upload/sc_autogenerated_PART_3/article/ar_194112/zgobala_0_0_468X10000.jpg (accessed 15.08.2019.)

2.1.1.7 Passenger terminal

Located in the central part of the harbour next to the city center and it is intended for arriving passenger and tourist ships.

Fig. 5: Passenger terminal[7]

As a part of the newly built passenger terminal open late in 2009., there is alsso a port control center with the most modern maritime traffic control and management system (VTMIS).

2.1.1.8 Fishing port Torpedo

The port is intended for mooring of the fishing boats. It is located in the western part of the basin in the former port of the Torpedo factory. Continuous investment aims to improve conditions and increase the safety of fishing boats at berth.

[7] Ibid, p.7

2.1.1.9 Warehouse Complex – logistic terminal Škrljevo

The warehouse complex in Škrljevo offers wide possibilities for prolonged storage of general cargo, containers, vehicles and Ro-Ro trailers, also serves to carry out industrial processing and finishing works of various commodities. It has the following characteristics:

- Terminal is owned by Luka Rijeka j.s.c.
- Total area: 468.977 m²
  - 53.818 m^2 of closed warehouse space (of which 25.658 m² of new ones)
  - 36.016 m^2 of new eaves
  - 13.915 m^2 of new container depot, with a one-off capacity of 1.950 TEU
- Provision of Value-Added Services for goods
- Direct connection with the rail and highway
- Railway infrastructure: 6 track lengths 3.500 m

2.1.1.10. Logistic terminal Kukuljanovo

Logistic terminal Kukuljanovo is a multipurpose logistic center is designed for handling and storing, repairing containers and handling general cargo, with the following characteristics:

- Terminal is owned by Manšped Ltd.
- 25.000 m^2 warehouse space
- 1.200 TEU container storage capacity
- The specialty of this back-end terminal is the repair and maintenance of container equipment
- Manšped Ltd. has 170 trucks to transport all types of cargo.

2.1.1.11 Wood terminal - Rijeka

At the terminal there are favourable climate conditions for cut materials that allow for the successful process of natural drying.

- The depth of the sea: 10 m
- Annual capacity: 500.000 t
- Disposable storage capacity: 35.000 -50.000 m^3 (depending on the type of wood)
- Preparation of sawn timber for:

- sorting
- impregnation
- marking
- packaging and binding

2.1.2 Bakar port basin

It covers the north-eastern and western coast of the Bakar Bay, situated approximately 16 kms southeast of the center of the city of Rijeka.

2.1.2.1 Bulk cargo terminal

Located on the north-eastern coast of the Gulf and with a minimum depth of 18m it allows mooring of up to 150,000 DWT ships. It is intended for the manipulation and storage of iron ore, coal and other bulk cargo such as sand, stone, cement, kaolinite and coke. Due to the short quay and lack of compliance with the current operational needs of the terminal, and due to the environmental protection measures, a complete reconstruction is planned.

2.1.2.2 Ro-Ro terminal

It is located on the opposite side of the bay, on the site of the former coke factory. There are plans for expansion to 55,000 square feet of landscaped and enclosed space. It is intended for the relocation of goods stored in the background warehouses in the Free Zone of Škrljevo – Kukuljanovo, making it a unique technological unit.

2.1.2.3 Industrial port Bakar

The industrial Port Bakar, controlled by INA j.s.c., Croatian national oil and gas company, operates two terminals:

- terminal for oil and petroleum products (Bakar),
    - 3 operating gates: two gates for the side bonnet and one gable for the stern bend (four-way)
    - length of the operational shore
    - sea depth is 10 meters
    - capacity of 4 million tons per year
- The gas terminal for liquefied petroleum gas LPG (Sršćica) has:
    - 1 operating mol for the side hatch
    - sea depth is 10 meters
    - capacity 720.000 tons.

2.1.3 Raša port basin

The port is located in a natural bay with depth of up to 40m. It has two special units, the Bršica terminal for the general cargo, wood and livestock, and the storage space of Štalije. They are connected to the railway line and the road.

The concessionaires on the terminal are Luka Rijeka j.s.c., Exportdrvo j.s.c. and Šerif export - import Ltd.

2.1.3.1 Terminal Bršica

It has two special berths for ships (depth at the pier is 8m) and covered stables with a capacity of 1,000 head of large livestock.

Characteristics of this terminal are as follows:

- Annual capacity: 600.000 t
- Accommodation capacity: approx. 1.000 head of livestock
- Continuous veterinary supervision

- Wood terminal:
  - Total storage area: 510,383 m²
  - Covered surface: 35.500 m².

2.1.3.2 Warehouse Štalije

This warehouse is a hinterland wood terminal and located in Štalije in Istra and it is also used for housing and transhipment of woodcutting, general and bulk cargo.

2.1.4 Omišalj port basin - Omišalj Liquid cargo terminal

The port basin includes part of Omišalj bay with the terminal of the Adriatic oil pipeline operated by JANAF j.s.c. The JANAF system was built as an international oil transportation system from Omišalj port terminal to domestic and foreign refineries in Eastern and Central Europe.
Projected pipeline capacity amounts to 34 million tons of oil per year (MTG) and installed 20 MTGs. JANAF has a storage capacity of 1.54 million m3 and 202,000 m3 for the storage of petroleum products.

At the terminal there are two moorings with a depth of 30 m, which can accept VLCC tankers. At each connection there are four dispensing arms for crude oil and two for petroleum products with the possibility of a transfer of 5,000 m3/h each, or 20,000 m3/h of oil per connection. Tankers can embark and unload oil 24 hours a day, 365 days a year. Due to the expansion of the concessionaire's activity, it is planned to convert one piston arm to the inert gas inlet connection and the installation of safe joints for quick disconnection of emergency picks in case of danger.

Fig. 6: Omišalj liquid cargo terminal[8]

Liquid cargo terminal Omišalj on the island of Krk has the following characteristics:

- Sea depth 30 meters; Two tanker embroidery can accept the largest tankers without limitation

[8] Ibid, p.9

- At each embroidery there are four palm springs for crude oil and two for petroleum products with the possibility of a transfer of 5.000 m^3 / h each, or 20.000 m^3 / h of oil per embroidery.
- Tankers can embark and unload oil 24 hours a day, 365 days a year
- For oil storage at Omišalj terminal the following facilities are used:
  - four tanks of nominal capacity 40.000 m^3
  - five tanks of nominal capacity 72.000 m^3
  - six tanks of nominal capacity 80.000 m^3
  - Total capacity: 1.000.000 m^3

Omišalj terminals also contains fuel tanks, and near the tanks there is also a petrol station.

- For storing petroleum products at Omišalj Terminal the following tanks are used:
  - four tanks of nominal capacity 10.000 m^3
  - one tank of nominal capacity 15.000 m^3
  - one tank of nominal capacity 5.000 m^3
  - Total capacity: 60.000 m^3

2.2 SUBSECTION A.2 – MULTIMODAL TRANSPORT: SUPPLY AND DEMAND

Port of Rijeka is located in a strong competitive environment among other ports at North Adriatic route (Koper and Trieste) that gravitate towards the same area. Looking at the broader gravitational area, it is necessary to co-operate among them, due to other competing directions, primarily from the North-western European ports (Rotterdam, Hamburg and Bremen) and the eastern direction across the Black Sea.

Very high quality analysis of the supply and demand forces has been done mid-2018. as a part of document "Analysis on multimodal nodes efficiency and connections – Rijeka (NAPA)". Methodology used within this analysis is applied also in this TNA, as preliminary research has shown that it is suitable also for TNA methodology. This subsection significantly relies on findings of that document, and when quoted, it is cited as a reference. However, considering that mentioned analysis was done more than a year ago, it is refreshed with new data related to cargo traffic, new projects and information available from national statistical data sources.

In addition to the land gravitational area, in the case of the port of Rijeka, accent should be made on the smaller ports in the Adriatic that cannot accept large container mother ships (Split, Ploče, Durres, Ravenna, Ancona) and are in regular sea connection with the port of Rijeka. This opens the possibility for the port of Rijeka to be a transhipment port for end-destination cargo (import) or departure (export) in these smaller Adriatic ports.

Thanks to its geographic position, the port of Rijeka has a strategic advantage over the ports of the North Sea as it connects Europe with the Far East via the Suez Canal. The distance to the main Asian ports is shorter for 5 to 7 days compared to the North Sea ports (eg. Hamburg, Rotterdam), which reduces the length of travel time or transit time from Far East ports to destinations in Central Europe.

Port of Rijeka belongs to the Mediterranean transport corridor, an important transport route connecting the port of Rijeka with the European rail and road network. Equally important is Corridor X connecting to Zagreb by connecting Austria (Salzburg and Graz) to the port of Rijeka. Along with road and rail connections, oil pipeline is important, which enables connecting refinery capacities in Croatia, Hungary, Austria, Bosnia and Herzegovina, Serbia, Czech Republic and Slovakia. The international airport is located near Rijeka, on the island of Krk.

2.2.1 Market breakdown trends in the European Union

Within the European Union, there has been a steady increase in traffic in the last decade. Road and maritime transport are dominant modes for transport of goods, but with the crisis in 2008/2009, the volume of goods in the market fell for about 11% in maritime traffic and 10% in road traffic. In 2010., market recovery started with around 4% increase in road transport and almost 6% increase in maritime traffic. The third major mode of transport is rail transport, but with only a third of the volume of road transport.

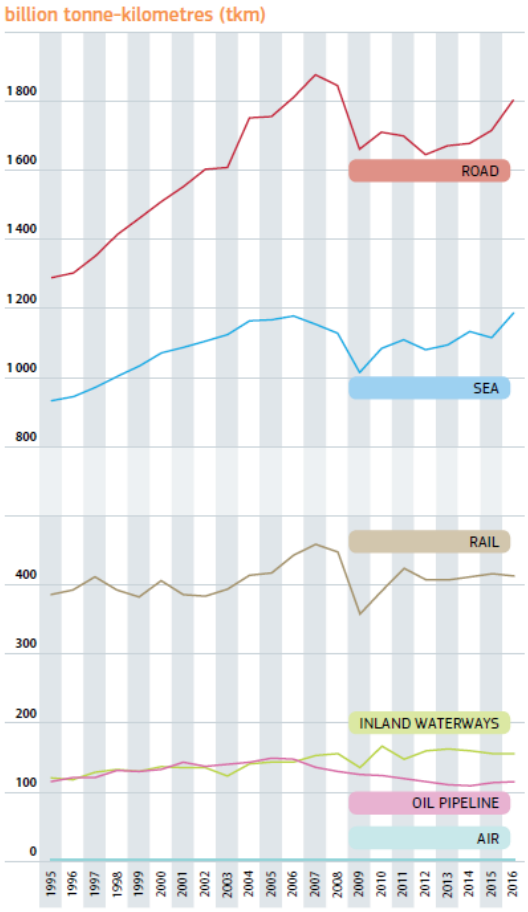

Fig. 7: EU-28 Performance for Freight Transport 1995–2016 – BY MODE[9]

[9] Statistical pocketbook 2018: EU Transport in Figures, EU Commission, 2018.

2.2.2 Port of Rijeka commercial cargo activity and trends

The main types of goods transported by rail in Croatia in 2018. were metals, coal and metal ore. Total traffic volume on Croatian railways in 2018. amounted to 13.444.000 tons, of which 6.949.000 tons (unloading and loading) in international traffic, 3.238.000 tons in national transport, and 3.257.000 tons in transit traffic.

Furthermore, comparing Q1/2019. and Q1/2018., indices demonstrate growth of 33,7 % in international loading, 52,3 % in international unloading, an increase of 10,6 % in transit and 24,9 % growth in total traffic volume.

The most recent and available railway transport data for Q1/2019. is shown in the following table.

RAILWAY TRANSPORT								
	Unit of measure	2018.			2019.	Indices		
		I-III	X-XII	I-XI	I-III	$\frac{\text{I – III 2019}}{\text{X – XII 2018}}$	$\frac{\text{I – III 2019}}{\text{I – III 2018}}$	$\frac{\text{I – XII 2018}}{\text{I – XII 2017}}$
Passengers carried	´000	5 206	5 573	20 271	5 155	92,5	99,0	102,2
National transport	´000	5 150	5 490	19 942	5 106	93,0	99,1	102,2
International transport	´000	56	83	328	49	59,4	87,5	102,7
Passenger kilometres	Mln.	180	201	756	177	88,5	98,4	101,4
National transport	Mln.	177	195	726	175	89,6	98,8	101,9
International transport	Mln.	4	6	29	3	49,9	81,8	91,8
Goods carried	´000 t	2 755	3 881	13 444	3 440	88,6	124,9	110,4
National transport	´000 t	500	999	3 238	575	57,5	114,9	95,4
International transport - loading	´000 t	1 212	1 780	5 919	1 621	91,1	133,7	153,6
International transport - unloading	´000 t	218	276	1 030	332	120,1	152,3	95,1
Transit	´000 t	824	826	3 257	912	110,5	110,6	84,7
Tonne kilometres	Mln.	583	795	2 743	682	85,7	117,0	105,8
National transport	Mln.	159	275	893	167	60,9	105,0	95,6
International transport - loading	Mln.	209	278	960	251	90,3	120,2	139,9
International transport - unloading	Mln.	56	70	242	78	112,4	140,8	83,5
Transit	Mln.	159	172	648	185	107,3	116,4	95,1
Of total goods transport - transport of dangerous goods	´000 t	354	498	1 787	381	76,5	107,7	96,0

Table 1: Railway transport statistics for Croatia[10]

[10] https://www.dzs.hr/Hrv_Eng/publication/2019/05-01-01_01_2019.htm (accessed 03.08.2019.)

The total cargo traffic of the port of Rijeka in the part of Rijeka Port Authority management in 2018. amounted to 13,404 million tons, mainly related to the current load at JANAF Omišalj port, where 8,629 million tons were recorded (an increase of 8% compared to the previous 2017.), which makes up 64,4% of the total cargo traffic in the port of Rijeka. Janaf Plc. has continued its intensive business activities by contracting valuable long-term jobs, which will surely result in continued good business performance in 2019., as demonstrated by the available data for Q1/2019.

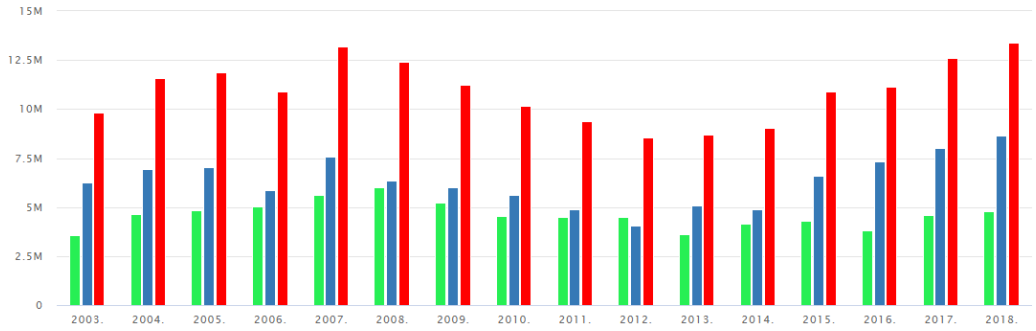

Fig. 8: Dry cargo (green), liquid cargo (blue) and total cargo (red)[11]

Dry cargo traffic is also increasing and in 2019. there are two concessionaires, Luka Rijeka j.s.c. and Jadranska vrata j.s.c., that together transported 4.776 million tons in 2018., which is 3,4 % more than in the previous 2017.

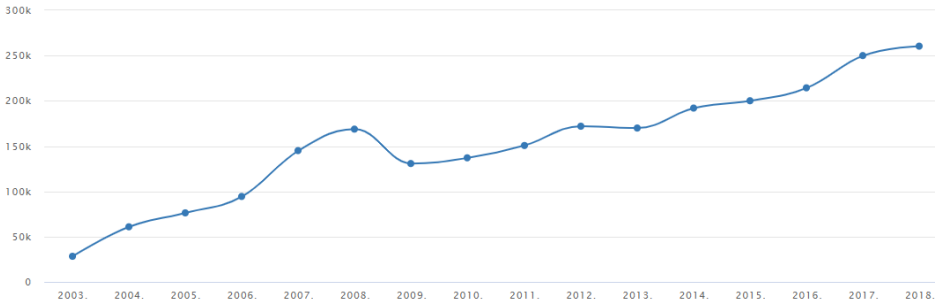

Fig. 9: Container traffic (TEU)[12]

[11] https://www.portauthority.hr/statistike-i-tarife/ (accessed 15.08.2019.)
[12] Ibid.

General and bulk cargo is also on the increase. In 2018., 1,655 million tons were handled in the port of Rijeka, representing an increase of 7 % in comparison to previous year, while 2,769 mil tons of general cargo was processed, also demonstrating a moderate increase of 2,3 %.

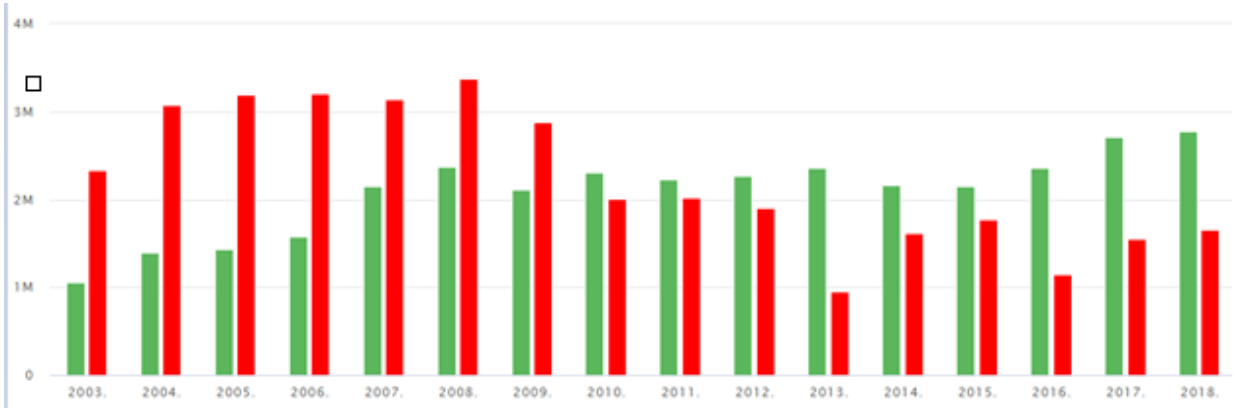

Fig. 10: General cargo (green) and bulk cargo (red)[13]

Wood cargo operations are the only category showing a decrease of 2,3 % year-on-year, and an absolute value of 351.621 transported tons.

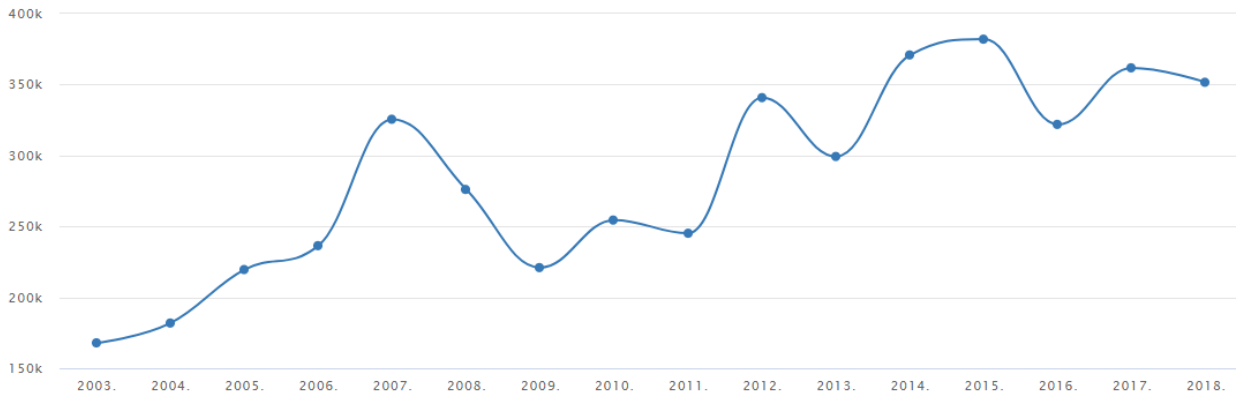

Fig. 11: Wood (tonnes)[14]

[13] Ibid.
[14] Ibid.

Regarding the situation of the HŽ Cargo Ltd. state railway operator, due to reorganization and long inherited inefficiencies, it does not offer the long-term security required by the beneficiaries, meaning the guarantee that rail transport from Rijeka to the interior territories can be carried out in more acceptable and consistent terms. It is a positive fact that the railway services market is liberalized as of 1st July 2013. and that there are several new private rail operators, which has resulted in increased service reliability, price competitiveness, creation of new transport means (block train compositions) and better service provision satisfaction for the customers in multimodal chain.

Market share of HŽ Cargo Ltd. is on the decline, as demonstrated by the latest data available for railway operators from 2017., shown in the following figure.

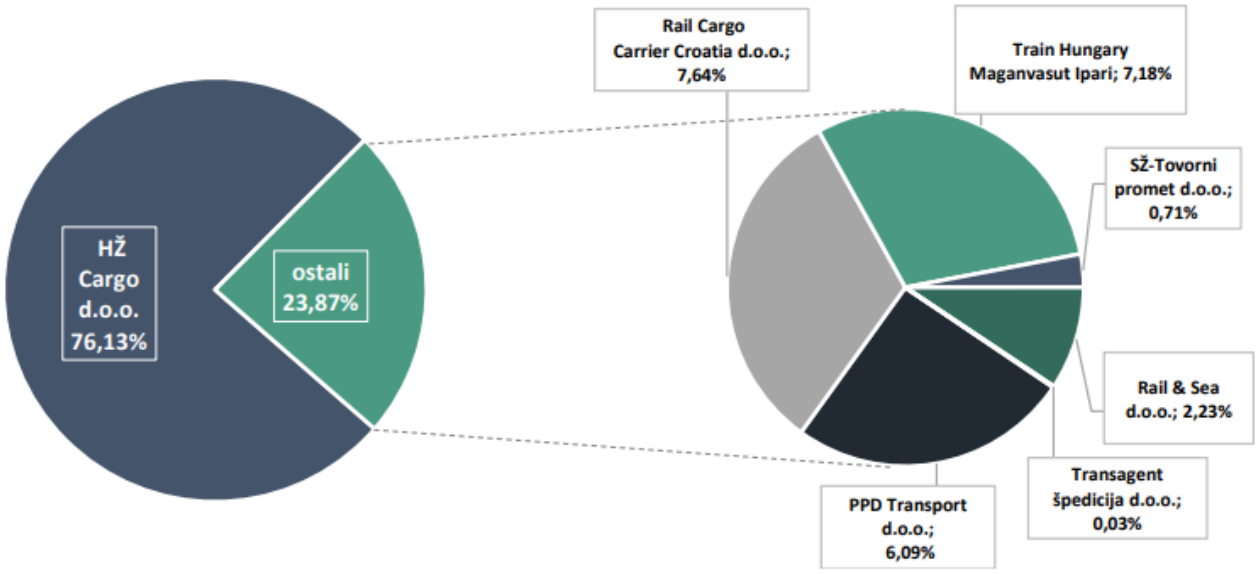

Fig. 12: Market share of railway operators in Croatia based on share in train-kilometres[15]

Analysis of available data shows that turnover in Luka Rijeka j.s.c. was 1 % lower in 2018. in comparison to 2017. General cargo decrease was 12 % while dry bulk cargo was on the increase for 7 %. Container traffic at the port of Rijeka including traffic at the port terminal and back-up depot, amounted to 227.375 TEU in 2018., representing a record high and an 8% increase

[15] http://www.hzinfra.hr/?page_id=8787 (accessed 15.08.2019.)

compared to 2017., continuing the trend of increase already set in 2017. that saw increase of 18 % compared to 2017.

Cargo traffic in Luka Rijeka, j.s.c. in 2018. is shown in the following table on the next page.

CARGO TRAFFIC	Realization 01.-12.2017.	Realization 01.-12.2018.	Index 2018/2017
Luka Rijeka d.d.	**2.547.238**	**2.534.422**	**99**
General cargo (tons)	999.441	879.161	88
Dry Bulk Cargo (tons)	1.547.797	1.655.261	107
Jadranska vrata d.d.			
Containers (tons)	2.069.992	2.241.776	108
Containers (TEU)	*210.377*	*227.375*	*108*
TOTAL (tons)	**4.617.230**	**4.776.198**	**103**

Table 2: Cargo traffic in Luka Rijeka, j.s.c. in 2018. [16]

Q1 of 2019. demonstrates the same overall registered cargo traffic as in Q1 of 2018., with increase in container TEU and general cargo and further decrease of 12 % in dry bulk cargo.

Further increase of cargo manipulations in port of Rijeka can be expected with introduction of a new concessionaire for the Zagreb Deep Sea Container Terminal, the most important capital project in the Rijeka Gateway Project II, worth 112,5 million Euros, of which 84 million Euro is from a World Bank loan, while 28.5 million Euros is financed by the state.

However, in addition to those already available sources of financing, the Port of Rijeka Authority has continued to invest more than 40 million Euros in its own investments. When this part will

[16] https://lukarijeka.hr/wp-content/uploads/2019/03/LUKA-RIJEKA-nerevidirano-kosolidirano-Q42018.pdf (accessed 15.08.2019.)

be completed, individual discussions are expected after July 2019. when potential concessionaires will present their respective terminal management concepts.

It's certainly not excluded that the interest for the second phase of the construction of the terminal will gain traction, and for which permits have been prepared.

The expected term for the signing of a contract currently stands at the end of September 2019.

2.2.3 Attraction forces for external demand served by port of Rijeka

Port of Rijeka Authority in its strategic documents and current investments has given the biggest emphasis on the development of container transport, which is justified, bearing in mind that containerization is the dominant process in the development of traffic in the world. For this very reason, emphasis will be given on the container transport and handling. Volume of traffic in seaports depends on a number of factors, and the most important are:

- geo-traffic position,
- size of the land gravitational area,
- development of the port (port connection with the world's overseas markets),
- the size of the near (over) marine gravitational area (for transverse traffic),
- the development of land connections (road, rail and river) with the land gravitational area in the hinterland of the port,
- infrastructural port capacity,
- super structural port capacity,
- promotional and sales activities in the gravitational field,
- quality of port services, and
- port service price.

Analysing the conditions affecting the competitiveness of Rijeka traffic direction, the current state and conditions will be explained in more detail in subsequent chapters:

1) Service types served by port of Rijeka,
2) Brief analysis of competitive ports,
3) Status of the railway corridor,
4) Conventional road corridor status,

5) Sales network in gravitational area, and
6) Customs status analysis.

2.2.3.1 Service types served by port of Rijeka

The overseas gravitational area of the port of Rijeka is the whole world, and the size of the traffic will depend on the development of ship connections, and especially the established lines, with a large number of overseas ports and countries.

In container transport, the ship's connection can be achieved using two types of line services:

- "*End to End*", direct service to ships with mother ships (ships connect directly two overseas regions, eg. China and the North Adriatic port)
- "*Hub & Spoke*" service: mother ships unload cargo from an overseas region (for example, China) in one of the ports of the Mediterranean (Malta, Gioia Tauro, Piraeus, Damietta), and it can be driven by *feeder* ships to the final port of landing (for example, Rijeka).

The following Figure 13 shows a direct liner service from the Far East for the North Adriatic, which is maintained by the „Ocean Alliance“ (shipping companies: CMA CGM, COSCO, Evergreen, OOCL and APL).

Figure 13: Direct line service from the Far East to the North Adriatic [17]

[17] http://www.cma-cgm.com/products-services/line-services/flyer/BEX2) (accessed 03.08.2019.)

Fig. 14 shows the transport of container by the "*hub & spoke*" concept of transport. Direct line service from the Far East to the West Mediterranean transported on himself and containers to the North Adriatic. Containers for northern Adriatic ports are transhipped to the large Damietta port of Dukes, and other *feeder* services (Fig. 15) are transported to ports in the Northern Adriatic.

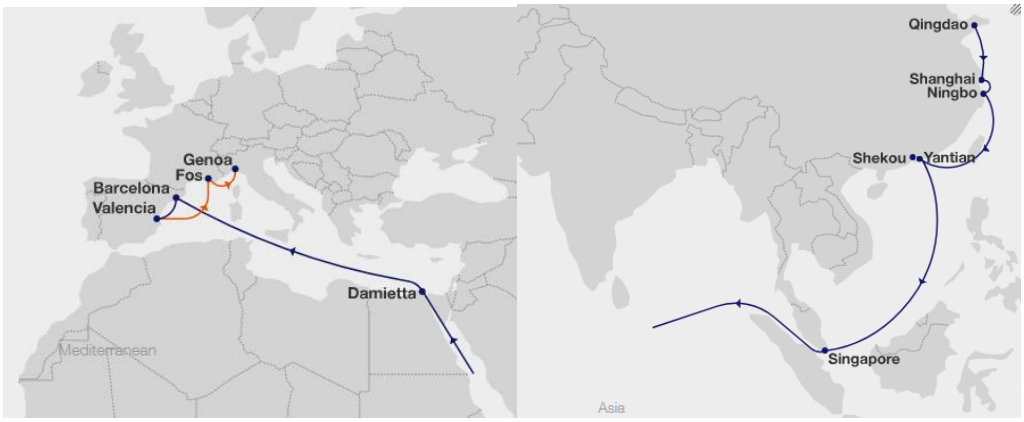

Figure 14: Direct service from the Far East for the ports of the Western Mediterranean[18]

Figure 15: Service from the transhipping port of Damietta for ports in the Northern Adriatic[19]

[18] Ibid.

[19] https://www.hapag-lloyd.com/en/service-finder/bydeparture.html#!_=&from=mediterranean&to=mediterranean&service=ADX&direction=back (accessed 03.08.2019.)

Given the possibility of transhipment traffic with containers in the concept of "*hub & spoke*" liner service, closer to the overseas gravitational area are the smaller Adriatic out-ports, that are not able to accept large container ships in the direct service. For this reason, large container ships, 2M (Maersk and MSC) and Ocean Aliance (CMA CGM, COSCO, Evergreen, OOCL, APL) deal directly with the port of Rijeka, but not Split, Ploče, Bar, Durres, Ancona and Ravenna. There is a realistic possibility of developing transhipment traffic by charging them from Asia (and for Asia) from shipping hubs to hub ports on *feeder* ships that would dispose of containers for these out ports.

Figure 16. shows a *feeder* service used to transport containers that are shipped from Trieste port to Venice, Ravenna and Ancona.

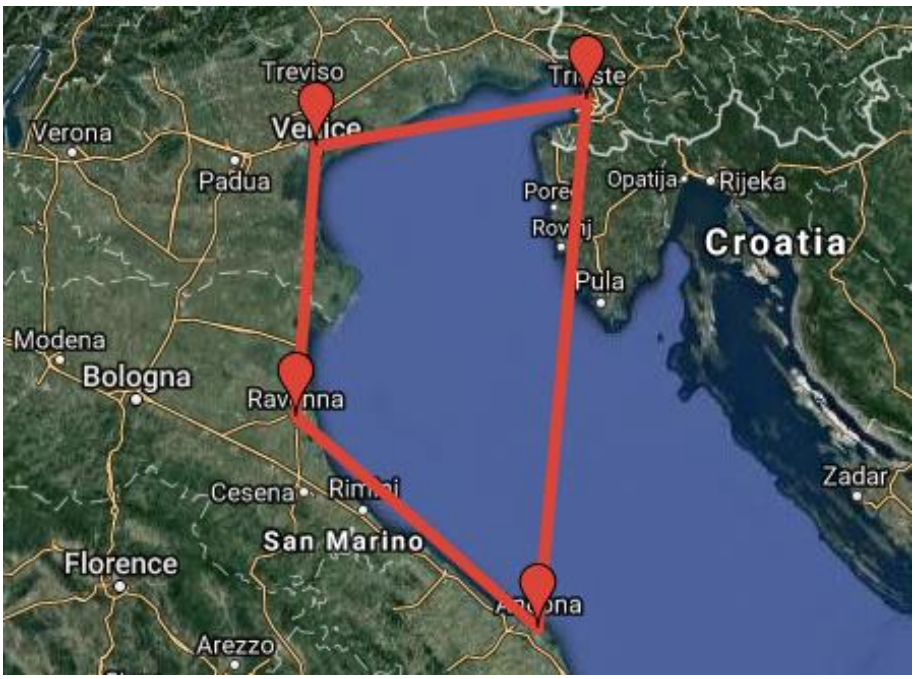

Figure 16: *Feeder* service from Trieste port to the ports of Venice, Ravenna and Ancona [20]

Figure 17 on the next page shows the land gravitational area in which traffic is realized by road and rail transport, and closer to the overseas gravitational area where the traffic is realized by transhipment operations from the mother ships on the *feeders* and vice versa.

[20]http://www.todelta.it/service/feeder-services (accessed 03.08.2019.)

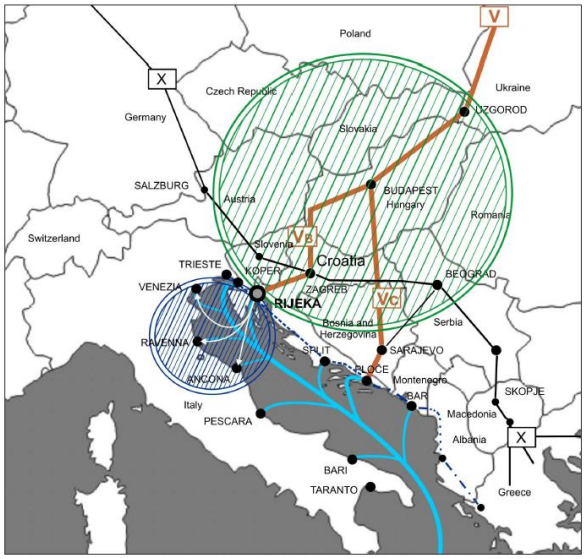

Figure 17: Gravitational areas of the port of Rijeka [21]

Port traffic in terms of geographic and gravitational area is directly correlated with the type of ship line service and the order of the port in the same line service:

1. **Traffic to the national market** through a national port where another competitor's port may have a smaller, limited impact. National market traffic can be achieved by ship's direct service by mother ships as well as by ship's *hub & spoke* service and is largely independent of the order of service of liner service. For example, the port of Rijeka is predominantly the port of traffic for Croatia, and the competitive port Koper has a subordinate competitive influence;

2. **Transit traffic** to a wider land area of gravitation is an area of great competitive battle over the ports and can only be accomplished with the mother ships. The port that is the first port in a region where several different ports compete for the same land-based gravitational area has a great advantage and is predominant for transit traffic for the wider gravitational area.

[21] Kos, S., Brcic, D., Karmelic, J.: Structural analysis of Croatian container seaports, Pomorstvo, Rijeka, 2010, 24.

For example, Koper is the port of transit for the Central European market, because it is the first port in the order of the Northern Adriatic port (Koper - Trieste - Rijeka) and thus the transit time from the port of embarkation to the final land destination is shorter for several days. This type of traffic can only be developed when the port concerns the mother ships.

3. **Transhipment** can only be achieved when shipping through a specific port develops the "*hub & spoke*" concept, i.e. the cargo transhipment in the port where the ships are connected by mother ships, to the *feeders* for the smallest ports (which cannot be approached by large mother ships). For example, the "2M" (Maersk and MSC) riders across the port of Trieste tranship from cargo ships to smaller feeders to the end port of Venice, Ravenna and Ancona, where their large container ships cannot be accepted.

2.2.3.2 Brief analysis of competitive ports

Because of its geographic position, geo-traffic connection with the hinterland, ship services to overseas markets and the fact that the land gravitational area overlaps with the gravitational area of other ports, Rijeka has the following competing ports, shown in the table 3.

Port	Competing markets
Hamburg and Bremerhaven	Germany and Central Europe
Gdansk	Southern Poland
Koper	Slovenia, Central Europe, Croatia and Serbia
Trieste	Italy and Central Europe
Ploče	Croatia and Bosnia and Herzegovina
Bar	Montenegro and Serbia
Piraeus	Greece, Macedonia, Serbia and Central Europe
Constanza	Romania, Serbia and Central Europe

Table 3: View of the main competitor ports of Rijeka [22]

Figure 18 shows 12 "*multiport gateway regions*", i.e. European Port Clusters. Among the 12 port

[22] created by authors according to Analysis on multimodal nodes efficiency and connections (NAPA), Port of Rijeka Authority, Rijeka, Croatia, 06/2018, p.20

clusters is the "North Adriatic" cluster, which includes Rijeka, Koper, Trieste and Venice. The Central European market is an "overlapping market" for several different ports, from different port clusters, or "multi-port gateway regions". For example, the markets of Central Europe compete for Northern European ports, Northern Adriatic ports, port of Constanta and port of Piraeus.

Detailed analysis shows that there are three levels of competitiveness for the same land-based gravitational area:

- competition between different port clusters (for example, between northern European ports and Northern Adriatic ports)
- competition between ports in the same port cluster (for example between the ports of Rijeka, Koper and Trieste)
- competition between terminals in the same port (for example in Hamburg port).

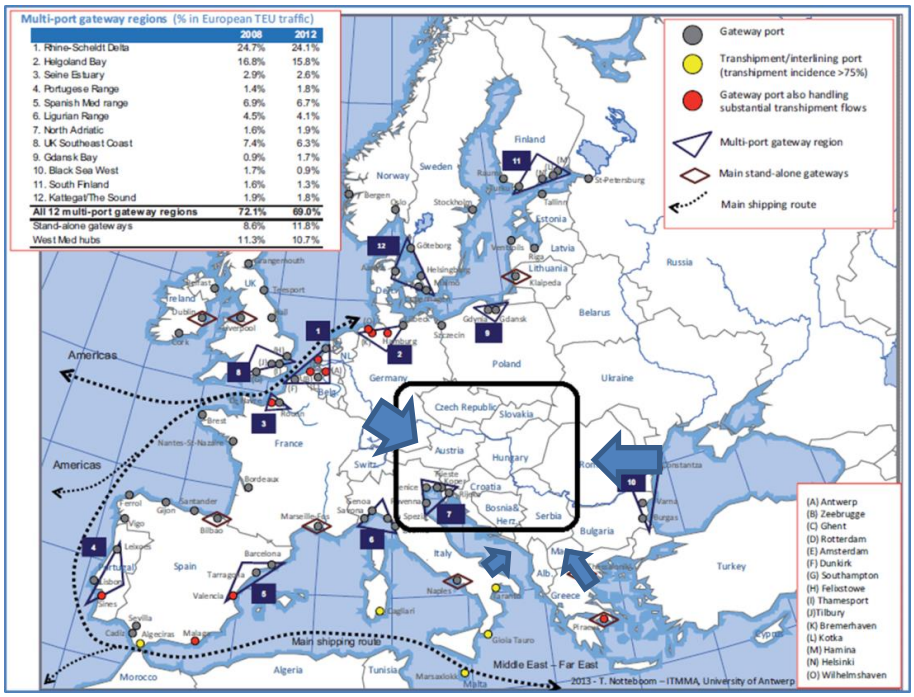

Fig. 18: Port clusters in Europe[23]

[23] T. Notteboom, ITMMA, University of Antwerpen, 2013

Table 4 provides an overview of liner container services from the Northern Adriatic ports for different overseas destinations. From different Northern Adriatic ports: Rijeka, Koper, Trieste, Venice, Ravenna and Ancona operate 13 different line services.

							A port of trenching in the northern Adriatic					
Shipping company	**Alliance**	**Name of the service**	**Type of the line service**	**Frequency of the service**	**Service area**	**Ship dimension**	**Rijeka**	**Koper**	**Trieste**	**Venice**	**Ravenna**	**Ancona**
MAERSK, MSC	2M		Direct	Week	Far East – North Adriatic	11600 TEU	YES	YES	YES	NO	NO	NO
CMA CGM, COSCO, EVERGREEN, OOCL, APL	Ocean Alliance		Direct	Week	Far East – North Adriatic	6500 TEU	YES	YES	YES	NO	NO	NO
MSC		Line A	Direct	Week	Adriatic - Israel	1520-1750 TEU	NO	YES	YES	YES	YES	NO
MSC		Line D	Direct	Week	Adriatic – Levant	1500 TEU	NO	NO	YES	YES	YES	NO
MSC		Adriakia	Direct	Week	Adriatic – Turkey	1050 TEU	NO	YES	YES	YES	YES	NO
MSC		Line C	Direct	Week	Adriatic – South Turkey/Egypt	2060-2765 TEU	NO	YES	YES	YES	YES	NO
MSC		Line H	Feeder	Week	Adriatic – Gioia Tauro		YES	YES	NO	NO	NO	NO
MAERSK		XCL	Feeder	Week	Adriatic – Malta, Algeria		YES	YES	NO	YES	YES	YES
EVERGREEN		ADL	Direct	Week	Adriatic – Levant	1300 TEU	NO	YES	YES	YES	YES	YES
HAPAGLLYOD		ADX	Feeder	Week	Adriatic – Egypt	2700 TEU	YES	YES	NO	YES	NO	YES
COSCO		AGH	Direct	Week	Adriatic – Turkey	1150 TEU	YES	YES	YES	YES	NO	YES
ARKAS			Direct	9 days	Adriatic – Levant	1140 TEU	NO	YES	NO	YES	NO	YES
ZIM			Direct	Week	Adriatic - Israel	1155 TEU	NO	YES	NO	YES	YES	NO

Table 4: An overview of liner container services from the Northern Adriatic port for overseas destinations [24]

The mother ships from the Far East join in Rijeka, Koper, Trieste and Venice (only the *Ocean Alliance* ships), but the order of the trenching port (Koper - Trieste - Rijeka) is most favourable

[24] Ibid, p.21

for Koper, and the port of Koper is predominantly the port used for transit cargo routing towards the Central Europe.

Out of total 13 regular line services, the port of Rijeka covers 6 services, Koper covers 12 services and Trieste covers 8 services, meaning relatively speaking that Koper covers 92% of the total number of services, Trieste 62%, and Rijeka only 46%.

For the port of Rijeka, it can be concluded that the service of the mother ships is in the most unfavourable position since it is in the order of trenching ports behind Koper and Trieste. This has the least potential for developing transit import traffic with regard to the longest transit time from overland ports to final land destinations in Central Europe. With regard to other services, it can be concluded that the port of Rijeka included the lowest number of shippers in their regular line service, compared to Koper and Trieste.

2.2.3.3 Status of the railway corridor

The port of Rijeka is located in the Mediterranean corridor of the TEN-T network (Fig. 19) and it is connected via Ljubljana to the Baltic-Adriatic corridor and to Zagreb using the Danube corridor.

Fig. 19: Mediterranean transport corridor[25]

[25] https://ec.europa.eu/transport/themes/infrastructure/mediterranean_en)

It is important to note that port of Rijeka is not officially part of the Baltic - Adriatic corridor, which should definitely be insisted on.

Due to the geo-traffic position of the port of Rijeka, land transport can be economically carried out using short-distance roads (Croatia, Bosnia and Herzegovina), or long-distance railway (Serbia, Hungary, Czech Republic, Slovakia, Bavaria, Southern Poland, Western Romania).

Rail transport of intermodal units at distances of less than 900 km is increasingly endangered by the truck transport. The reason is modernization of roads, trucks, unfair competition within the EU and geomorphological constraints. Railway traffic to Serbia hass virtually disappeared due to modernization of the highway and reduction of the price of road transport due to increased competition. Revitalization of the railway traffic occurred only after the liberalization of the market in the Republic of Croatia, despite previous attempts to subsidize the route.

The traffic from Rijeka to the markets of Central Europe suitable for rail cargo transport from the port of Rijeka (mainly Hungary, Czech Republic, Slovakia, Southern Poland and Northern Romania) has a modest share in the overall port traffic. The reason for this is the free movement of goods from these countries within the EU, enabling the choice between the Baltic ports, the Adriatic and recently Piraeus. Therefore, there is no more need to be directed to only one port or route. This is also a serious obstacle for the development of railway traffic from the port of Rijeka. The lack of an "adequate" market, which is at an optimum distance, has enough loads, is geographically focused on a particular port, affects the creation of a critical mass of cargo for the establishment of regular block trains towards a selected destination. Compared to the port, Kopar serves Southern Austria, which makes up 25-30% of the port's turnover, and shares all the other markets with other ports. For its part, port of Trieste has fought for the construction of a specific niche for RO-RO trucks from Turkey, for which they built regular intermodal rail services to Austria and Bavaria.

Geomorphological constraints (Alps mountains) are also very important, which restrict rail traffic from the port of Rijeka, i.e. increase transportation to destinations in Germany and Austria. This leaves two logical directions for rail cargo development: directions towards Budapest and Belgrade.

Rail transport from port to end destination can be accomplished using the following forms of transport:

1. Railway transport for individual consignments, characterized by the absences of the timetable and therefore longer transport times. This aspect has remained in use in markets with small quantities of goods transported by rail. Most rail markets use block trains in the shuttle regime (regular departures in both directions) as the only way of transporting intermodal rail units.
2. Railway transport by block trains, characterized by the regularity of the carriage with the exact time of departure and arrival and thus the known transit time, as well as the train block dimensions, which according to the European carriers is 750 meters in length and 2100 gross tonnes.

Commercially speaking, railway operators (cargo carriers) can make rail cargo services to end users as follows:

1. Common or public train consists of containers of different users / senders. The railway operator offers the transport service market to all interested users (shipping companies, forwarders, importers, exporters) at a pre-agreed tariff per container.
2. Company train - full or complete train leased by one user / sender. The railway operator offers a transport service to interested customers (most often shipping companies and large international freight forwarders) who buy the entire product only for themselves (their containers) at a pre-agreed fee for the entire composition.

The land transport organized by the railway operator implies the unification of several different business processes:

1. The lease of trains from the railway manager
2. Traction trains
3. Wagon lease
4. Organization of transport
5. Vehicle maintenance
6. Safety

Liberalization of a rigid system that has been under state administration and priority funding for centuries throughout Europe leads to the creation of complex business relationships. The legislator has partially regulated relations between stakeholders (Fig. 20), but in reality, there will be plenty of trains to complete the establishment of fair market relationships.

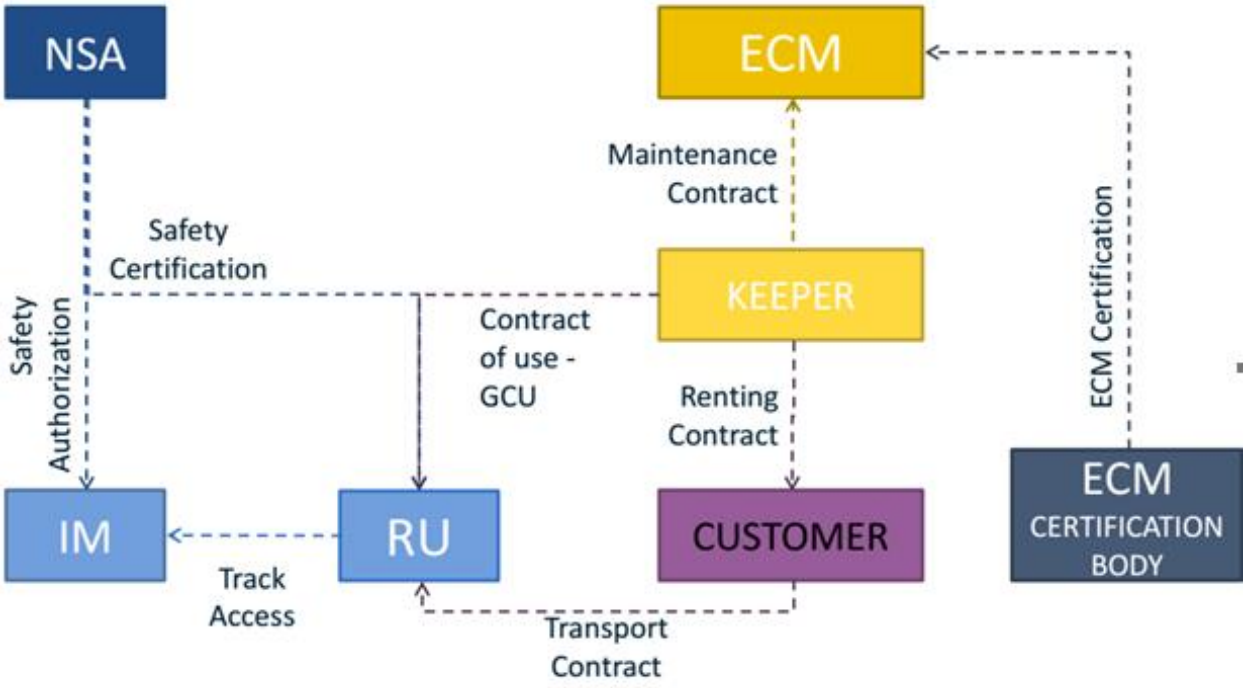

Fig. 20: Main sections and regulation of railway traffic[26]

In addition, railway operators must utilize efficient working procedures with the port and land terminal operator, Customs and other inspection services (phytosanitary and veterinary).

The modern conception of land transport calls for the rail transport operator to complete the transport service from the port terminal to the land terminal as well as the transport by truck to the rail-road warehouse.

[26] D'Agostino, A.: ECM Maintaince System, Dissemination Workshop on SMS, ECM, CSMs; Athens, March 5th and 6th 2014

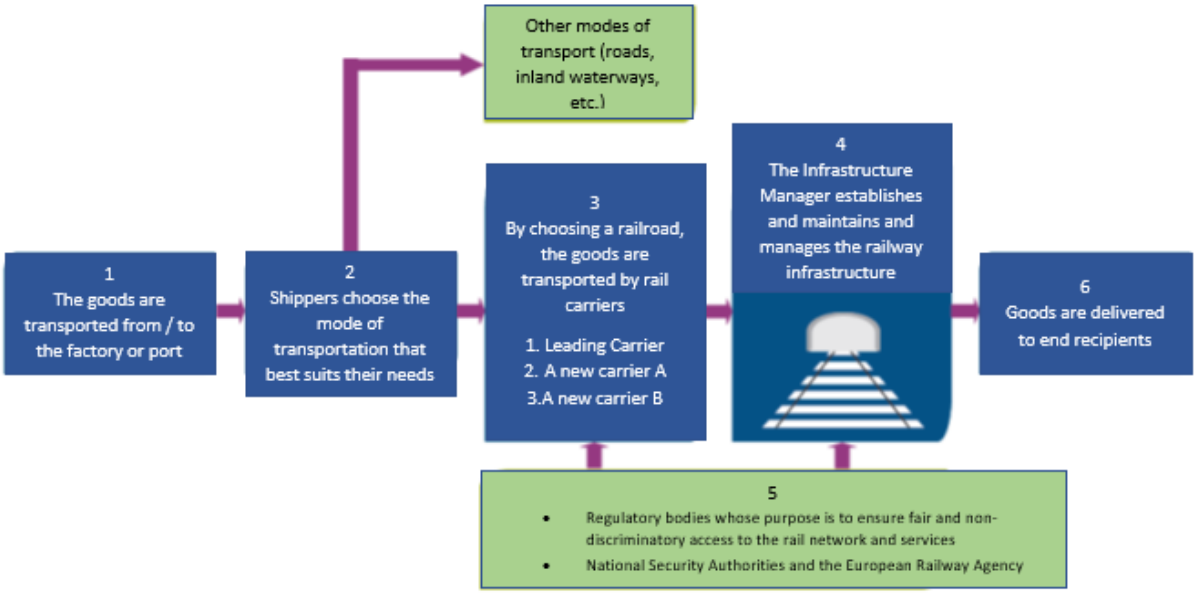

Fig. 21: The main players in rail cargo transport[27]

The railway services market in Croatia is liberalized as of July 2013., where the Infrastructure Manager or Service Operator provides railway services to applicants for the allocation of infrastructure capacity. The railway infrastructure manager in the Republic of Croatia is HŽ Infrastruktura Ltd. Railway infrastructure management is an activity of public interest. The basic functions of the infrastructure manager are allocation of train paths, including the determination and assessment of the availability of infrastructure capacities and the determination of the level of infrastructure fees, including the collection of these fees.

Providers of services on the Croatian cargo train market are:

1. Infrastructure Manager - HŽ Infrastruktura Ltd.
2. Railway operators:
    - HŽ Cargo Ltd.

[27] European Revision Court, EU rail freight transport is not yet on the right track, EU, Luxemburg, 2016

- PPD Transport Ltd.
- Rail Cargo Carrier – Croatia Ltd.
- Rail & Sea Ltd.
- SŽ Tovorni promet Ltd.
- Train Hungary Ltd.
- Transagent Rail Ltd.

Currently there is no system of central traffic management on the railway lines of the Republic of Croatia. The safety device used on the network of railway lines in the Republic of Croatia is the INDUSI inductive hitch (AS) system (I 60).

Telecommunication status is similar to signalling devices. The age of embedded cables is between 30 and 75 years, and according to the manufacturer's technical specifications, life cycle is up to 25 years. The average age of stationary telecommunication devices is between 23 and 45 years, and it requires much modernization or transition from analogue to digital platform. Telecommunication equipment is outdated (older than 30 years). Along the corridor lines, a radio-dispatcher device has been set up, whose age ranges between 10 and 40 years. The railways, along the entire network, set telecommunication cables and their own telephone connection system (the so-called ŽAT - whose age is about 30 years old), which is actually a closed communication system in the function of negotiating railway workers.

In addition to this, there are very specific limitations on the railway link connecting the port of Rijeka with the interior. First of all, there is uncommonly high slope of 28 %, which can only be avoided by building a new railway infrastructure. The rest of the restrictions below can be avoided by better traffic organization:

1. Difficulties in driving and weather conditions

During the train ride on the railway section of Sušak Pećine-Lokve there are many difficulties due to the large climb of the track, curve radius and S curves where long trains are lying in such curves and make it even more difficult to tow.

2. Railway sections and curve strips (s-curves)

The Rijeka Brajdica-Drivenik railway section is a section with a steady climb of 30 km. Already the beginning of the share represents a big challenge where between Brajdica and Sušak Pećine trains enters the tunnel that has the highest resistance to the track on that section due to constant curve. There is also a curve and section between the preliminary signals and the entrance signal of the Škrljevo station, which can create problems for the train.

3. Lack of useful track length at the stations

Due to the useful length of the track, the Rijeka Brajdica-Moravice section is also a problem for trains ranging from 450 to 500 m. It should be noted that the limits listed in Table 7 conditioned the design of ports train sections that do not exceed the length of the shortest track (348 m). Ultimately, trains with a total length of 500 m cannot be moved from the port of Rijeka without being connected to Moravice station.

Maximum length acceptable according to stations is shown in the next table 5.

NAME OF THE STATION	DIRECTION A→B		DIRECTION B→A	
	Maximum permissible train length (m)	Trains for the reception of the longest trains (m)	Maximum permissible train length (m)	Trains for the reception of the longest trains (m)
Rijeka	371	2nd and 3rd	371	2nd and 3rd
Sušak – Pećine	431	1st and 2nd	435	1st and 2nd
Škrljevo	406	2nd and 3rd	406	2nd and 3rd
Meja	365	1st and 2nd	362	1st and 2nd
Plase	426	2nd and 3rd	414	2nd and 3rd
Drivenik	416	1st and 2nd	415	1st and 2nd
Fužine	348	3rd and 4th	348	3rd and 4th
Lokve	397	3rd and 4th	410	3rd and 4th
Delnice	402	2nd and 3rd	394	2nd and 3rd
Zalesina	423	1st and 2nd	429	1st and 2nd
Skrad	399	3rd and 4th	388	3rd and 4th
Brod Moravice	539	1st and 2nd	444	1st and 2nd
Moravice	805	3rd and 4th	804	3rd and 4th

Table 5: Characteristics of the railway infrastructure on the section Rijeka-Moravice[28]

[28] Ibid, p.36

4. Slow driving and limited speed

Due to frequent work on the railway and heavy terrain, HŽ infrastruktura Ltd. often introduces the obligation of a light ride that later becomes regular speed limitations. Thus, on the part of Rijeka Brajdica-Moravica almost every station has at least one light ride or speed limit which is hampered by the movement of the trains and the cost of electricity on the rise, and on the slopes the trains have to brake where the heating of the brakes is significant and unfavorable, especially in the summer time.

5. Lack of RDV signal and mobile phone signal

Because of the lack of signal and RDV line on the railway track, it often happens that in case of need the driver cannot communicate either using RDV or the mobile phone.

6. Unnecessary stopping on the rise and launching of the train

There was a situation where the trainer receives trains from both directions and stops the train on the rise. This in practice leads to difficult movement, especially in adverse weather conditions (rain, snow) or when the track is loaded with leaves. Sometimes the crossing of the trams from the railway station due to the connection to the input signal, slow and misdiagnosis of the traffic lights, stop the train at the input signal.

2.2.3.4 Availability of railway service as a contributing factor to development of port operations in Rijeka

In the theoretical and practical sense, the role of ports or concessionaires of terminals in the organization and offering of rail transport to the final destinations on the gravitational area can be divided according to the ports / terminal's concessionaire strategies:

1. Strategy A – partnership strategy (*partner*)

   The port / terminal concessionaire maintains a neutral position, but actively participates in contacts between different stakeholders in the port involved in land transport, such as shipping, railway operators, freight forwarders and land terminals.
   The port / terminal concessionaire invests in transhipment facilities to efficiently manipulations for rail transport.

2. Strategy B – the strategy of the rail transport service provider (*player*)

The port / terminal concessionaire at the terminal offers the rail transport services on the market by becoming an authorized railway operator and, in addition, invests in transhipment facilities for efficient handling of terminals and rail transport.

3. Strategy C – passive observation strategy (*prayer*)

   In this strategy, the port / terminal operator passively observes other stakeholders how will they arrange and provide rail services to the end destinations in the gravitational area. The results of such a strategy are most often harmful to the achievement of traffic and the poor use of existing infrastructure and superstructure.

Concessionaire at the container terminal in port of Rijeka, given the aforementioned theoretical options, can be characterized as passive observers described in strategy option C because, according to the results of the rail transport offer for the main gravitational area of Central Europe, it does not connect in the best way to the stakeholders in the port participating in land nor does it independently provide rail transport services. The only fence is its investment in rail mounted gantries, but they have been immobilized for a number of years, since no "intermodal yard" was built, where such equipment could be put into function.

One of the most competitive advantages of a port is its connection to regular rail block trains with countries in the land gravitational area / hinterland. Table 6 provides an overview of weekly block trains from the Northern Adriatic ports (Koper, Trieste and Rijeka) to individual countries in the field gravitational area.

From the port of Koper, a total of 90 train blocks are dispatched per week to various destinations in the countries of the wide gravitational area, from the port of Trieste 50 train blocks, and from the port of Rijeka only 6 train blocks. These data also point to the need to take all available measures to organize from the port of Rijeka as soon as possible further regular block of trains towards the hinterland countries, making the ports more attractive for shipping and end users.

Weekly trains check out			
Country	**Koper**	**Trieste**	**Rijeka**
Austria	17	22	0
Hungary	28	9	1
Germany	8	15	0
Slovakia	25	2	0
Czech Republic	7	2	0
Poland	2	0	0
Romania	1	0	0
Serbia	2	0	5
Total	**90**	**50**	**6**

Table 6: Overview of railway block trains towards countries in the gravitational area[29]

2.2.3.5 Railway track capabilities at container terminals in ports of Rijeka and competitive ports

Effective loading / unloading operations at container terminals is of big importance for ensuring the competitiveness of the entire transport route. The effectiveness of the operation determines the operator's expertise, the condition and capacity of the transducer and the number of tracks. Additionally, the competitiveness of the traffic direction is also determined by the length of the track, i.e. whether it is possible to form a whole block train at the terminal or it is necessary to spend extra time and money to join the sections, thereby increasing the time and cost of the carriage. Data in table 7 is relevant for the port of Rijeka and refers to the status after the investment funded by the CEF program.

[29] Ibid, p.37.,38.

	Rijeka	Koper	Trieste	Venice
Length of the track at the terminal	1 x 389 m, 1 x 399 m, 2 x 420 m	5 x 700 m, 2 x 270 m, 2 x 300 m	5 x 600 m	4 x 700m, 4 x 390 m
The number of tracks on the terminal	4	9	5	4
Embarkation technology	2 RMG (Rail Mounted Gantry)	3 RMG (Rail Mounted Gantry)	3 RMG (Rail Mounted Gantry)	4 RMG (Rail Mounted Gantry)

Table 7: Overview of a comparative analysis of railway infrastructure status at container terminals in Rijeka, Koper, Trieste and Venice[30]

From the overview of the condition of the ports, it is clear that all competing ports have the ability to form standard container length trains (550 m) as well as competing Northern European ports, unlike Rijeka where it is not possible and capability will be hardly achievable because in the urban center of the city available space is missing. Therefore, it will be necessary to form an entire block of train outside the port area, thus increasing transport costs and extending the transit time from the port to the final destination in the hinterland.

2.2.3.4 Conventional road corridor status

For the competitive functioning of the container terminal, it is necessary to ensure the road traffic connection of high permeable power between the port of Rijeka and the system of Croatian state roads, and further with the system of international roads. This is enabled by the construction of the state road D-404, which provides a direct connection to the east part of the Rijeka basin on the A6 motorway and the Croatian highway network.

The state road D-404 is of great importance for road traffic in the city of Rijeka. Road D-404 has a four-way profile and direct access to the container terminal and completely eliminates truck

[30] Ibid, p.38.

traffic through the city of Rijeka. The total length of the road is 3.5 km, of which 60% is conventional road, 45% tunnels and 15% viaducts and bridges.

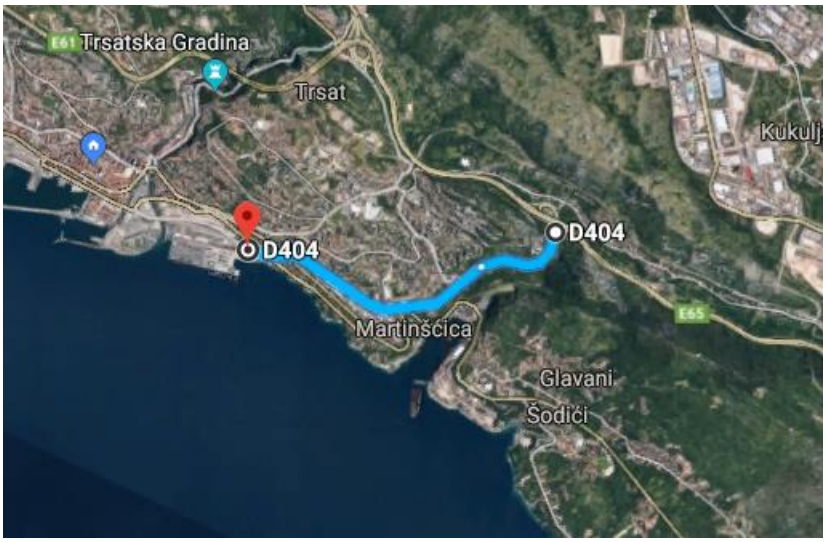

Fig. 22: View of the state road D404 on the highway and motorway network[31]

Container terminal Brajdica has also received a strategically very important road connection with with 7.5 km distant logistic terminal Škrljevo completion by means of road D-404. The road was fully completed in 2013.

2.2.3.5 Sales network in gravitational area

The sales function of the port, terminal and traffic direction is realized through numerous sales channels. One of the important sales and marketing channels is the representative network in the countries of the land and the overseas gravitational area. It is the foundation of successful marketing and positioning in the international market, which contributes to the interests of the port and logistics sector of a particular port.

Conclusions are derived using publicly available data published on the competitor's online sites.

[31] Google maps, accessed 15.08.2019.

Port of Koper has three representative offices in the countries of the land gravitational area in: Budapest, Vienna and Bratislava. The Bratislava office covers three countries: Slovakia, the Czech Republic and Poland.

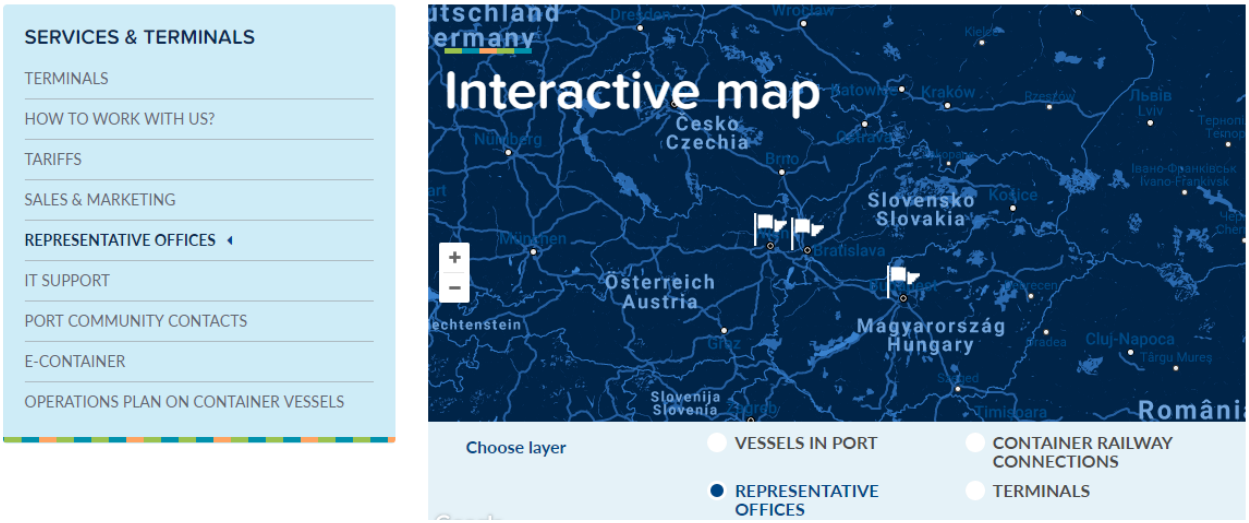

Fig. 23: Representative offices of the Port of Koper[32]

The Terminal Operator in Trieste ("*Trieste Marine Terminal*") has two representative offices ("*Sales & Customer Service / Intermodal Department*") in the gravitational areas - Munich and Budapest. Each office has two employees.[33]

Port of Hamburg has its representative offices in 11 cities of land (8) and overseas gravitational area (3): Budapest, Dortmund, Dresden, Munich, Prague, St. Petersburg, Warsaw, Vienna and Hong Kong, Mumbai and Shanghai.

From the description of the Vienna's representative office of the port of Hamburg, it is best to identify and define the activities and goals to be achieved by a port representative office:

[32] https://www.luka-kp.si/eng/representative-offices, accessed 15.08.2019.

[33] http://www.trieste-marine-terminal.com/en/contacts, accessed 15.08.2019.

Activities of the Vienna's representative office of the port of Hamburg:

"*Port of Hamburg has its representative office in Austria since 1951. It is the longest active representative office in the port. It maintains very good contacts in the transport industry, freight forwarders, shipping agencies, operators and railway companies as well as with trade associations and maritime sector institutions. Each year it organizes more than 200 meetings with the decision maker. The representation takes care of member companies interested in the Austrian market, builds networks, organizes events and provides information on Austria's latest developments in the largest German universal port and the Metropolitan region. The representation office is also the first contact point for Austrian companies or politicians who want to organize visitor tours in and around the port of Hamburg and other ports in the Metropolitan region. One of the most important activities is the Evening of the port of Hamburg with more than 300 guests, most of the high-ranking members of the Austrian naval sector. This and other activities enable Hamburg port marketing members to establish important contacts with the Austrian transport industry and to promote their range of services*. "[34]

Another example is the activity and goals of the Hamburgs' representative office in Budapest, which is due to the fact that Hungary is a typical example of "overlapping" markets for several different ports (Koper, Trieste, Hamburg):

Activities of the Port of Hamburg representation in Hungary:

"*The representative office based in Budapest since 1992 represents the interests of the maritime industry of Hamburg and the regions of Hungary. These experts work in the terrain and maintain good contacts with numerous companies in the trade and industry, the transport and logistics sector, trade associations and decision makers. They point them to the latest events in Hamburg as a universal port. Since we are regularly informed with new market and sectoral data from Hungary, our members also benefit from the continuous roll-out and expansion of such contacts. The analysis of potential customers, organization and preparation of visits and customer meetings are other useful services.*

Marketing of the port of Hamburg is organizing several gatherings annually in Hungary, including the Evening of the port of Hamburg in Budapest. This is one of the widest supported functions in

[34] https://www.hafen-hamburg.de/en/vienna, accessed 15.08.2019.

the Hungarian logistics sector. Here, the focus is on sharing market information, data and contacts between stakeholders. In addition, visitor's office on the Hamburg airport brings visitors from Hungary and follows the jobs of Hamburg in Hungary. "[35]

In the countries of the land gravitational area as well as in overseas gravitational areas, the Port Authority of Rijeka, nor the largest concessionaires in the port of Rijeka area, have their own representative offices to manage the activities and objectives mentioned in the published examples of the port of Hamburg, namely:

1. To maintain good contacts with numerous companies in trade and industry, with carriers, freight forwarders, shipping agencies, operators and railway companies in the transport and logistics sector, trade associations and political decision-makers,
2. An analysis of potential clients and organizations,
3. Preparation of visits and events for buyers,
4. Exchange of market information, data and contacts,
5. A visitor program for visiting a port of a customer from a country where there is a representative office,
6. Monitoring the port of business delegation in the country where there is a representative office,
7. More than 200 meetings with the decision maker by the representatives each year.

In addition to the representative network, an important factor for the promotion of the port traffic route is the way and the intensity of advertising of landline rail services that constitute the offer of the traffic direction. Below is a comparative analysis of advertising of regular rail services from Rijeka, Koper and Trieste. The data is downloaded from public published website of operators.

[35] https://www.hafen-hamburg.de/en/budapest, accessed 15.08.2019.

OPERATOR	COUNTRY	DIRECTION	FREQUENCY
ADRIA KOMBI	SLOVENIA	Koper-Ljubljana-Celje-Maribor	3 x daily
	AUSTRIA	Koper-Villach	do 5 x weekly
	CROATIA	Koper-Ljubljana-Zagreb	2 x weekly
	GERMANY	Koper-Munchen	3 x weekly
	HUNGARY	Koper-Budapest	8 x weekly
	SERBIA	Koper-Ljubljana-Belgrade	2 x weekly
	SLOVAKIA	Koper-Bratislava	3 x weekly
ADRIA TRANSPORT	AUSTRIA	Koper-Graz	7 x weekly
	ROMANIA	Koper-Arad	1 x weekly
INTEGRAIL KFT.	HUNGARY	Koper-Budapest (Torokbalint)	3 x weekly
		Koper-Budapest (Mahart)	2 x weekly
METRANS	AUSTRIA	Koper-Enns	2 x weekly
	CZECH REPUBLIC	Koper-Ostrava	2 x weekly
		Koper-Dun.Streda-Zlin-Prague	1 x daily
	HUNGARY	Koper-Budapest (Mahart)	up to 14 x weekly
	SLOVAKIA	Koper-Dunajska Streda	up to 14 x weekly
		Koper-Žilina	up to 7 x weekly
BALTIC RAIL	POLAND	Koper-Wroclaw-Ostrava-Koper	2 x weekly

Table 8 : Overview of railway service announcements in Port of Koper[36]

OPERATOR	COUNTRY	DIRECTION	FREQUENCY
		Trieste-Villach	5 x weekly
		Trieste-Villach-Salzburg	5 x weekly

[36] Ibid, p.42.,43.

RAIL CARGO AUSTRIA	AUSTRIA	Trieste-Villach-Wien	5 x weekly
		Trieste-Villach-Linz	5 x weekly
		Trieste-Villach-Wolfurt	5 x weekly
		Trieste-Graz	at request
T.O.DELTA	AUSTRIA	Trieste-Salzburg	2 x weekly
	HUNGARY	Trieste-Budapest	up to 9 x weekly
	GERMANY	Trieste-Munchen	5 x weekly
		Trieste-Burghausen	2 x weekly
		Trieste-Munchen-Ludwigshafen	4 x weekly
		Trieste-Munchen-Koln	4 x weekly
		Trieste-Munchen-Leipzig	4 x weekly
METRANS	CZECH REPUBLIC	Trieste-Ostrava	2 x weekly
	SLOVAKIA	Trieste-Dunajska Streda	2 x weekly
ALPE ADRIA	ITALY	Trieste-Milano	up to 3 x weekly
		Trieste-Fernetti	at request

Table 9: Overview of railway service announcements in Port of Trieste[37]

2.2.3.6 Customs procedures analysis

Customs procedures are one of the key mechanisms that the state directly impacts on the competitiveness of its port and traffic direction. Current customs procedures and factors for the competitiveness of Rijeka traffic direction are outlined as follows.

It is a customs legislation institute that allows the release of goods into free circulation in one-member country, although it is the ultimate destination of goods in another member country. This institute is most represented in ports where goods are discharged from the ship. Procedure

[37] Ibid, p.43

42 allows the importer, at the time of customs clearance, to pay only the customs rate until the VAT is declared and paid in the final destination country by the delivery of the goods. Until 2014, foreign parties had to obtain a tax number in the Republic of Croatia so that they could use this procedure. This was a big problem (obstacle) because they did not want to have a Croatian tax number. In other member countries where Procedure 42 was used, they must not have the tax number of that country. Because of this, in 2014, a regulation has been amended in such a way that it is necessary to have a tax representative in the Republic of Croatia as it is the practice in other member countries. Regarding customs regulations, Procedure 42 is aligned with all other members.

However, the difference exists in the tax sense, and economic operators often point this to the attention of the Customs Administration.

In a situationwhen the goods are discharged to the Republic of Croatia, the buyer is from one member country and the goods will end up in a third member country but at the moment of disembarkation and release of cargo (import clearance) it is not yet known which goods will eventually be sold. The Tax Code of the Republic of Croatia stipulates that at the time of release of goods into free circulation in Procedure 42, besides the above mentioned VAT number of the tax representative in the Republic of Croatia should also include the VAT number of the acquirer from another member country as well as all the evidence using which the goods are imported and further dispatched to the ultimate acquirer in the other member country (invoices, transport documents, statements of VAT payment etc.). This tax number of the acquirer is a big problem because the end destination of the goods is unknown. In other member countries, it is enough to enter the tax number of the person who is the intermediary of the goods and no matter who the ultimate (real) buyer is. It is essential that goods leave the country where goods are released for free circulation and that further tax collection can be traced through a tax agent. As for the same EU directives, in order to simplify the procedure and attract cargo to the port, it is necessary to amend the tax regulation in order to be equal in all member countries.

In addition, for Procedure 42, there is also a delay in the payment of VAT. Namely, a receipt of goods and VAT in the final destination country is carried out once a month so that the ultimate customer has an ideal postponement of one month's payment of VAT. For this reason, a number of Croatian companies have moved on to release goods to the port of Koper. Taxes must be paid immediately, but they receive a delay of 30 days of VAT payment, while in case they do so in

Rijeka, the total customs debt (customs and VAT) must be paid within 10 days. When the Republic of Croatia simplified the Procedure in 2014 and opened the same possibility that for the same reason Slovenian companies move on the release of goods in free circulation with the application of Procedure 42 in the port of Rijeka, the Ministry of Finance of the Republic of Slovenia on July 1, 2016 issues a regulation according to which (trustworthy companies) are paying 30 days' VAT and they have overcome Rijeka's use of Procedure 42 for Slovenian companies. Such a provision for deferred VAT payment of 30 days does not exist in the Republic of Croatia and this is one of the advantages of the port of Koper in relation to Rijeka. The advantage of the port of Trieste is described in the part of the free zone Trieste.

These are two main reasons why the Procedure 42 in Rijeka is not in bigger use. If there is a change in the tax regulations and the enabling of the use of the Procedure 42 although the final destination of goods within the EU is unknown, and if the Ministry of Finance in the Republic of Croatia can delay the payment of VAT for certain (regular) economic entities from the Republic of Croatia, greatly contributed to increasing the competitiveness of Rijeka's traffic direction and, consequently, to increasing traffic through the port of Rijeka.

Direct comparison of certain procedures used in free zones of competitive ports also points to certain differences, for example, difference in free zones of port of Rijeka and port of Trieste. The main difference between these two zones is in the international agreement to which they are invited in the Republic of Italy and for which, among other things, there is the possibility of releasing goods in free circulation with a six months postponement. The legal source of the relief is the International Agreements of 1947 (Treaty of Paris) and 1954 (London Memorandum). The EU Customs Code does not have a provision allowing such a customs clearance, but there is a member in which it stipulates that if the previous international agreement is otherwise regulated, it can be used. The Republic of Italy has just called upon this act and the European Commission has allowed it. For such an insignificant commodity, a bank guarantee must be enclosed to secure the debt. As such a bank guarantee is extremely expensive, there is an act of "*Credito Doganale Triestino"* from the Italian Ministry of Finance, in which it is stated that the guarantee for a customs debt in the area of Trieste banks is issued at considerably lower interest rates due to the 6 month debt relief as well as the attraction of the cargo to the port Trieste. From this it can be seen that this is a great advantage over the port of Rijeka where it is necessary to pay the debt within 10 days.

An institute of pre arrival clearence is used for the release of goods in free circulation while it is still on board in navigation at the port of disembarkation. The European Commission is currently under great pressure to do the same. Regarding the commercials of Koper and Trieste on pre-arrival clearances, the DG Taxu question has been asked whether it is allowed in accordance with EU legislation. The answer is that it is not permissible for anyone who carries out customs clearance while the vessel is in breach of EU regulations and will be sanctioned. After that, Kopar and Trieste have changed the position and stated that they allow electronic delivery of the declaration before the ship arrives and discharges the cargo and that risk analysis is carried out at that time. Only after the arrival of the ship the declarations are processed, and the goods are released.

If this topic is applied to the port of Rijeka, the procedure would not bring acceleration in processing because the ship's container terminal in Rijeka does not conduct direct manipulation, but the containers are discharged to the terminal. AGCT does not perform other goods-related procedures, however, it is important to take the same attitude as the competing ports of Trieste and Koper and to market the same customs possibilities.

Here it is necessary to mention the difference in the work of international freight forwarders. In Rijeka, freight forwarders do not submit the goods until they get "WITHOUT OBSTACLES" as opposed to shippers from Trieste and Koper who fill in customs documents and deliver them without having received "WITHOUT OBSTACLES". This is a legacy from the past and some other laws.

In port of Koper, more than 200 business entities have AEO (Authorised Economic Operator) status. All forwarders have the AEO. More than 40% of the declarations are processed for companies that have the above-mentioned status. In Rijeka, only 2 subjects currently have AEO status.

Although there is an opinion that this is not a significant factor affecting the competitiveness of the port, the fact is that AEO proves a certain level of service, professionalism, security and the guarantee of doing a particular job.

2.3 SUBSECTION A.3 – TOOLS AND MEASURES SUPPORTING MULTIMODAL TRANSPORT (POLICIES, PLANS,ETC.)

In the upcoming period, Republic of Croatia expects a large wave of investments in transport infrastructure. As presented during The Zagreb Infrastructure Summit held in May 2019., this involves the planning and development of infrastructure projects in Croatia, including the development of seaport, airport and railway infrastructure.

Major pickup in the financing of transport infrastructure required multiple sources of combined funding.

Large investment projects regarding railway, road and airport infrastructure are planned, among them the railway lines Dugo Selo - Krizevci, Zabok - Zapresic, and Gradec - Sveti Ivan Zabno. Also, Peljesac Bridge, the largest road infrastructure project is also being implemented with EU funding. After a Chinese company has been selected in the tender for the construction of Peljesac Bridge, China's cooperation with Croatia has opened up a new dimension. The bridge is a symbol of the road to a joint success and cooperation between China, Croatia and the EU. Chinese economy had risen by 6.4 percent in the first quarter of 2019. as a result of strong industrial growth and higher consumer spending. Complying with EU rules and standards, more and more Chinese companies are interested in investing in projects in Croatia, not just in infrastructure, but also in science, culture and tourism.

Some of the projects are being implemented from domestic sources, some through concessions, some with the aid of EU funding, and some based on private-public partnerships.

Furthermore, 160 million EUR is invested in Bina Istra project to upgrade the motorway network in Istria County, including the reconstruction of the Ucka tunnel. There is also planned construction of a road from Krapina to the Slovenian border and the construction of an express road from Solin through Split to Omis in southern Croatia, a project worth 300 million EUR. Other significant projects include construction of a bridge across the Sava river in Stara Gradiska and the continued construction of a motorway from the bridge in Beli Manastir in eastern Croatia to the Hungarian border.

One of the largest projects is the construction of a lowland railway from the northern Adriatic city of Rijeka to the Hungarian border, an extremely important strategic project because it develops maritime transport, trade and railway and contributes to further enhancement of multimodal transport. Current financing plan is to obtain funds from the EU and use them for a part of this project, while covering the rest through concession agreements. Strategic interest is to link up with China and other remote countries so that they can use Croatian ports and especially port of Rijeka as their gateway to the European market. However, the general problem is underdevelopment of all Croatian Adriatic ports, because of the total traffic through the Suez, only about 8 percent enters the Adriatic, while over 50 percent uses the Baltic sea. The port infrastructure should be much better if Central Europe is to be interested in changing the existing transport routes.

HŽ Infrastruktura railway company plans investment projects of 9.3 billion HRK (1.26 billion EUR), of which 60 percent would be provided by the EU.

2.3.1 The Transport Development Strategy (TDS) of the Republic of Croatia

In order to facilitate and enhance further development of the multimodal transport, policy makers need to create a robust set of formative documents. Ministry of the sea, transport and infrastructure of Republic of Croatia has brought into life mid-2017. The Transport Development Strategy (TDS) of the Republic of Croatia for period 2017.-2030., envisaging a number of tools, policies and measures aimed at development of transport in Croatia, and specifically, multimodal, sea, road and railway transport.

The TDS is based on a thorough analysis of the transport sector as well as the key drivers for transport development in Croatia (key findings). From the previous assessments done on a strategic level or project level, a number of hypothesis have been identified, which in case they have been confirmed by data or analysis and shall be turned into key findings; in case they have not been confirmed by data or the analysis they shall either be dismissed or stay on the level of hypothesis for further investigation. The key findings shall be translated into objectives, which consequently lead to measures in the area of investments, operation and organization.

Transport Development Strategy is based on the analysis of the current situation of the country having identified opportunities and problems and having analysed best solutions to accomplish

and respond to existing needs. The Strategy is a document which determines a medium and long-term development in the Republic of Croatia and constitutes a positive development in relation to the existing situation and the achievement of a new stage, which consists in increase of the quality of transport system and the transport infrastructure. For that purpose, the definition of accurate objectives is considered to be a basic and crucial stage of the Transport Development Strategy process.

As a result of EU/Croatian policies and EU/Croatian strategies the list of general objectives was set. Second list is composed of specific objectives which are resulting from the analysis of the Croatian transport system. Specific objectives are further divided by the sector to which it refers.

2.3.2 General Objectives (GO) of the TDS

As a result of EU/Croatian policies and EU/Croatian strategies the list of general objectives was set, with the following listing:

• GO1 – Developing the passenger Modal Split in favour of Public transport (PT) and 0 emission modes. This includes agglomeration PT (trams, local buses, etc.), rail transport, maritime and inland water PT (boats), regional and long-distance buses as well as pedestrians and bikers.

• GO2 – Developing the freight Modal Split in favour of rail transport, maritime freight transport and inland water transport

• GO3 – Developing the transport system (operation, organization and infrastructure development and maintenance) according to the principle of economic sustainability.

• G04 – Reducing the Climate change impact of the Croatian transport system

• G05 – Reducing the impact on the Environment of the Croatian transport system (Environmental sustainability)

• G06 – Improve the traffic safety in the Croatian Transport system

• G07 – Improve the interoperability of the Croatian transport system (PT, rail, road, maritime, inland water and air)

• G08 – Improve the integration of transport modes in Croatia (operation, ITS, P&R, etc.)

• G09 – To further develop the Croatian TEN-T (core and comprehensive) network

2.3.3 Specific Objectives (SO) of the TDS

Second list is composed of specific objectives which are resulting from the analysis of the Croatian transport system, and they are further divided by the sector to which it refers. Only those general and specific objectives are shown that are relevant for multimodal transport tied to port of Rijeka, while those that are more relevant for air or inland water transport are omitted for brevity.

2.3.3.1 Specific objectives which apply cross sectorial

o SO – To better harmonize the transport operations with neighbouring countries (BiH – Ploče Port, road and rail connections BiH, Slovenia, Serbia, Italy, Montenegro and Hungary

o SO – To complement the touristic sector development as the main economic factor in some parts of Croatia where relevant, by adequate transport development especially in favour of PT and green mobility

o SO – To improve accessibility to remote areas of Croatia (for example island, Southern Dalmatia…)

o SO – To develop on the potentials of the main logistic centres (Rijeka maritime port, Ploče maritime port, Split maritime port, Vukovar inland port, Osijek inland port, Zagreb hub)

o SO – Strengthening of Croatia as a logistic hub for the wider region with particular focus on Zagreb.

o SO – To improve the integration of the transport sector into the social and economic developments of the regions (Functional Regional Concepts)

o SO – To address the specific situation in Croatia related to the seasonality of traffic

2.3.3.2 Public transport and zero emission modes

o SO – To develop on the potential for road PT (regional and national) where other PT modes are not economic

o SO – To improve the competitiveness of the tram systems in Zagreb and Osijek

o SO – To better integrate the international/national transport system with the local and regional transport systems (passenger hubs, integrated ticketing, etc.)

o SO – To increase the efficiency and to reduce the economic impact of PT operations/organization

o SO – To increase the attractiveness of PT by improving operational concepts and modernizing the rolling stock

2.3.3.3 Rail transport

o SO – To improve the rail freight corridors from Port of Rijeka towards the markets with the biggest potential for the port (Hungary, BiH, Slovakia,

Italy, Southern Poland and Serbia)

o SO – To better utilize the Croatian railway system in the main Croatian agglomerations (Zagreb, Rijeka, Split, Varaždin, Osijek)

o SO – To improve the LOS and environmental impact of rolling stock o SO – To improve the integration of the railway system into the local transport systems (safety and security of stations, interfaces with other transport modes, etc.)

o SO – To improve the safety at level crossing with roads o SO – To improve the efficiency of the Croatian rail system (traffic management, operations etc.)

o SO – To safeguard the maintenance of the infrastructure considering economic considerations

2.3.3.4 Road transport

o SO – To improve the safety of the road system

o SO – To better utilize the Croatian road system for PT (Local, regional and national bus systems)

o SO – To reduce the environmental impact the oldest parts of the Croatian motorway network

o SO - To optimize and harmonize the different tolling systems in Croatia

o SO - To improve the technical requirements for road design addressing more economic technical solutions, safety standards, green mobility and the integration of zero emission modes

o SO – To increase the road accessibility of areas, where the existing infrastructure reached the capacity limits and alternative modes (rail, maritime PT) are not economically justifiable (touristic centres in Adriatic Dalmatia) including the introduction of a sustainable traffic concept in favour of PT and zero emission modes

o SO – To increase the connectivity to neighbouring countries in order to reach a higher level of cooperation and territorial integration

o SO – To increase the accessibility of areas in Croatia, where the capacity limits have been reached, and no alternative road infrastructure is existing (parallel motorways ect.) – Zagreb towards Bjelovar and Varaždin towards Koprivnica

o SO – To reduce congestion in heavily burdened agglomerations considering the specific requirements of protection of National Heritage

2.3.3.5 Maritime transport

o SO – To improve the development and competitiveness of Rijeka port as the main maritime port of Croatia

o SO – To reduce the environmental impact of maritime transport (development of the fleet, measures of prevention and suppression of pollution from marine facilities, environmental protection)

o SO – To improve the Modal Split of freight transport across the Adriatic sea or along the coastline in favour of maritime transport

o SO - To improve the reliability of maritime (transport PT and supply chains) in case of difficult weather conditions

o SO – To improve the level of economic efficiency of the maritime transport system

o SO – To improve the safety of the maritime transport system

o SO - Better integration of the ports into the local transport system (passenger/freight)

2.3.4 Envisaged measures classification

Based on the analysis of the current situation and in order to address the defined general and specific objectives, a set of measures has been identified in each sector. The measures propose interventions not only related to improvement of the infrastructure of the different transport systems but also in relation to the operational and organisational aspects, since isolated interventions on the infrastructure will not have a big impact on the efficiency and sustainability of the system if they are not accompanied by adequate changes in the setup of the system, and the operations are not adapted to the real demand needs. The following table shows the list of general measures and measures per transport sector including a detailed description of the measures to facilitate the understanding of their content. In order to distinguish between group of measures, considering their alignment with the Transport Development Strategy objectives, the following colour code, which is included as well in the tables below, has been defined.

	Duly aligned with the Strategy; the measure is needed and well defined, even if some further studies might be necessary.
	Missing data to determine the duly apparently alignment with the Strategy; some further studies are required to asses or verify the eligibility of the measure.
	Non-aligned with the Strategy; the eligibility is remote in terms of current and mid-term traffic forecasts. If the new studies confirm the eligibility of this investment , the measure will be reviewed.
	Measure covered by General measure

Table 10: Four distinctive categories of measures aligned with the TDS[38]

[38] Transport Development Strategy of the Republic of Croatia (2017 - 2030), MInistry of Sea, Infrastructure and Transport, p. 193.

The sector approach implies the analysis of the key transport sectors i.e. rail, roads, inland waterways, maritime and transport, regarding national and international mobility. Finally, the outcomes of the analysis of the functional regional approach and the sector analyses are used to identify the multimodal objectives and measures to achieve these objectives which are identified for each transport sector.

Other entities, including private-sector partners, have also become relevant for the implementation of a multimodal Trans-European transport network and the related investments, including regional and local authorities, infrastructure managers, concessionaires of port and airport, authorities, etc. Through a better cooperation among them, better quality and more efficiency/effectiveness will be achieved. In addition, improved cooperation and engagement with the public will improve social inclusion and ensure development of a transport system which meets the needs of its users. Improving the organisational setup of the transport system and reorganising the structure of the relevant stakeholders to optimise their resources are of crucial importance for improving the sustainability and quality of the transport systems.

Major ports (Rijeka, Šibenik, Zadar, Split, Ploče and Dubrovnik) are declared as national ports or ports of special international economic interest. These seaports have an economic potential based primarily on a favourable geographic position. The main comparative advantage of these Croatian seaports compared to other ports of the Republic of Croatia Ministry of the Sea, Transport and Infrastructure is the fact that the Adriatic sea reaches far inland into the continent which ensures the shortest and cheapest transport connection for countries located behind Croatia to the east Mediterranean, and via the Suez Canal to Asian and east-African countries. In this sense, the multimodal TEN-T corridors spreading across the Croatian territory confirm the fact that the Croatian geographic position is not only its advantage, but also a duty towards the European Union. The Mediterranean corridor, the Baltic – Adriatic Corridor, the Rhine – Danube Corridor and the planned Adriatic – Ionian motorway undoubtedly integrate the Republic of Croatia in the transport and economic system of the European Union. The majority of cargo traffic in Croatian ports is carried out in the ports Rijeka and Ploče, totalling close to 90% of the total cargo traffic of all Croatian ports of exceptional economic significance and making them the leading cargo ports of the Republic of Croatia. On the other hand, the majority of passenger transport is carried out in the Split and Zadar ports, and Dubrovnik is the port with the majority of traffic of cruising vessels. Cargo transport in the past few years clearly shows that specialised

terminals are competitive with other ports in the region, while those who are not as specialised in terms of cargo are in a gradual decline.

3 SECTION B – FUTURE SCENARIOS

Future scenarios chapter describes measures planned for the future or already in implementation along with implications, overview of future developments and impact of the identified measures.

The Government of the Republic of Croatia, in cooperation with the International Bank for Reconstruction and Development (IBRD), has initiated the Rijeka Gateway Project. Rijeka Gateway is the most comprehensive project since the founding of the Republic of Croatia, which has led to a comprehensive revitalization of part of Rijeka's coastal area.

Pursuant to the Guarantee Agreement signed on 12 July 2003. between the Republic of Croatia and the International Bank for Reconstruction and Development and the Loan Agreement between the Port of Rijeka Authority, Croatian Roads and Croatian Motorways as the Borrower and the IBRD, funds were provided for the implementation of the Project.

The total value of the port component of Rijeka Gateway Project I and II amounts to 187 million EUR, of which 144 million EUR relates to the World Bank loan funds (IBRD) and 43 million EUR to the domestic share from the Republic of Croatia budget funds. The Rijeka Gateway program is not intended solely for the construction and modernization of the port but also as a support to the Croatian economy, making it more dynamic and more competitive.

The first projects that were fully realized from the World Bank loan were the reconstruction of the Vienna Pier and the construction of the new road bridge on the breakwater that preceded the construction of the maritime passenger terminal.

3.1 RIJEKA GATEWAY PROJECT COMPONENTS

This chapter briefly describes most important parts of the Rijeka Gateway recent, ongoing and future developments underlying growth and development scenario of port of Rijeka.

3.1.1 Construction of the maritime passenger terminal

The Port Passenger Terminal was completed on October 6, 2009. Located on the Rijeka breakwater, it was designed to improve service to domestic and international maritime passenger traffic. In addition, it has created a beautiful image of the city and enabled citizens to see and experience their city from a different perspective. The construction of a passenger terminal building as well as the reconstruction of the operational pier and the complete arrangement of promenade were not the only purpose of reconstruction. With the launch of the connecting motorway, the quality of the maritime passenger terminal and touristic services increased significantly. An important component of the passenger terminal is a modern equipped port control center for vessel traffic monitoring. Terminals funding through Rijeka Gateway project amounted to HRK 95 million.

3.1.2 Extension of the Adriatic Gate Container Terminal.

The most important values created by the expansion of the The Adriatic Gate Container Terminal at Brajdica relate to the increase of sea depth along the pier to 14 meters, the possibility of servicing container ships of up to 370 meters long and the maximum capacity of the 600,000 TEU. The second stage of construction of the Adriatic Gate Container Terminal has enabled the mooring of significantly larger ships, while simultaneously increasing the efficiency of container transhipment. In order to increase the capacity of the Adriatic Gate Gateway terminal, according to the planned increase in traffic, the 2nd stage of the terminal was built, including the extension of the pier for another mooring, an adequate increase of the storage areas and the construction of a new entry-exit point. The terminal extension goal was also to enable the reception of significantly larger ships and the doubling of the transhipment capacity. With the same goal, the concessionaire Adriatic Gate j.s.c. installed new coastal and storage equipment and installed cranes for the carriage of wagons. Works on the construction of a new pier were completed in May 2013.

In 2013, container transport equipment worth EUR 23 million was delivered to the container terminal Adriatic Gate. The new equipment includes two Panamax high-capacity cranes, six container bridges and two container freight trains, making the Adriatic Gate container terminal fully equipped to meet the modern standards. The new equipment has allowed a significant increase in the speed of goods disembarkation, after Croatia's entry into the European Union and the time of transport to the final destination within the Union, as all border and customs controls will be carried out at the terminal. The Port of Rijeka Authority invested in the extension of the terminal for as much as 320 meters and the increase of the available storage space for containers thus increasing the capacity of the terminal ot 600,000 TEU per year.

A Border Inspection Point (BIP) was built as part of the Container Terminal since Port of Rijeka is one of the seven border crossings that is to be used to control products entering the EU from third countries. Its obligation is to apply a border traffic regime in accordance with EU regulations for which a container terminal at the port of Rijeka must have a veterinary, sanitary and phytosanitary control station at its disposal.

The value of completed investments in construction – works on the expansion of the container terminal Adriatic Gate in the framework of the Rijeka Gateway Project (RGP I & II) reached EUR 30 million.

3.1.3 Project implementation of video surveillance

The project encompassed the implementation of the video surveillance system. The project aimed to increase the safety of the port area under the management of the Port of Rijeka Authority, and to provide better access control facilities and the possibility of reconstruction of events through video and access control databases. The purpose of the new modern control system, comprising continuous video-control over all major points as well as control of the vehicle and persons entering the port area, is to provide for an improved control of the port area – in fact, the marine border crossing. The control of the port area is effected from the modern control centre which, with the help of patrol car (0-24 h), ensures prompt intervention in case of any unforeseen events.

The control of people and car traffic within the port area is performed using modern system whose main elements are RFID cards and corresponding software. The vehicle entrance to the

port is equipped with electrically driven ramps activated by the card reader devices. The railway port entrance is provided with metal doors also opened by the card reader devices. All pedestrian entrances are provided with turnstile that are also RFID card activated. The implementation of the control system, as described above, has considerably contributed to the improved safety and protection within the port area.

3.1.4 Construction of state road D-404

Two most important preconditions of the development of the Rijeka transport route is the construction of state roads D-403 and D-404 in order to connect the western (D-403) and eastern (D-404) part of the port basin Rijeka and Sušak to the Croatian motorway network. Road D-404 connects the center of the city of Rijeka from Delta to the eastern part of the Rijeka Bypass and provides connections with the motorways towards Zagreb, Ljubljana and Dalmatia. There are two tunnels, one bridge, five viaducts, one exit to the shopping center, and two exits for pedestrians. The state road was released in 2013.

Road D-403 will connect new Zagreb Deep Sea Container Terminal with the western part of Rijeka Bypass. The Grant Agreement for the DC-403 State Motorway Construction Project provides funds for the construction of a new state road that will connect the future Zagreb Deep Sea Container Terminal and the port of Rijeka directly to the main Croatian road corridors further towards Europe. This link to the port in Rijeka, defined as the core port of the Trans-European Transport Network TEN-T, connects with the rest of the transport network, which, along with the rail linkage with the hinterland, is an important prerequisite for its efficiency and competitiveness. the construction will be completed until 2022. It is funded by Hrvatske ceste ltd, Ministry of Sea, Transport and Infrastructure and Central agency for financing EU programs and projects.

3.1.5 Construction of the new Zagreb Deep Sea container terminal

In order to achieve competitiveness, the Port of Rijeka Authority has initiated the realization of the new Deep-Sea Container Terminal, which guarantees new modern port facilities. This is the most important component of the Rijeka Gateway Project, a terminal designed as a straight pier with a final length of 680 m and an average width of 300 m. The planned depth of the sea at the pier is at least 20 m and allows for the reception of container ships of all sizes. The terminal is

built in two phases, with the first phase involving the construction of a 400 m long pier and the second phase the construction of an additional 280 m. At the end of both phases, the Port of Rijeka will boast a pier with a total length of 680 m. The construction of the first phase of the pier is in its final stage, and parallel to the construction of the pier the railway interface of the terminal will be reconstructed and the connecting road D-403 will be built. The continuation of construction of the remaining terminal phases is the obligation of the future concessionaire. The concessionaire, selected in an international tender, will receive a concession for the management, construction and use of the new container terminal.

The Zagreb Deep Sea Container Terminal (ZDSCT) will cover a total surface area of approximately 20 hectares (680 m long and 300 m wide). Part of the area is occupied by the existing working areas of the port (piers, roads, tracks, warehouses, installations, energy facilities, facilities for employees, etc.), with a total area of approximately 10,3 ha. The second part of the terminal area of approximately 7,2 ha is obtained by building the new pier and backfilling the sea.

With the construction of the new pier in full length, a 680 m long and 20 m deep wharf can be obtained, with the possibility of mooring container vessels of more than 165,000 DWT and of lengths over 366 m (last generation ships with a capacity of more than 14 000 TEU). Additionally, the pier length of 680 m allows simultaneous mooring of a smaller ship up to 50,000 DWT and up to 250 m in length (vessels with a capacity up to 4 000 TEU).

The new pier is made of reinforced concrete caissons, founded on a submarine stone embankment. The ground beneath the embankment is reinforced by gravel pillars and jet grouting. The general height level of the pier (pier zone about 40 m wide) is +4,05 m. This is the boat mooring and container cranes operation zone (35 m track gauge). By backfilling the stone material into the zone behind the pier structure, the operating and storage surface of the terminal is arranged, all the way to the boundary of the project i.e. to the marshalling tracks in the north. The storage area with the associated roads is 680 m long and 170 to 250 m wide. The warehouse plateau descends from the pier to the north, where it fits into the surrounding operational area of the existing port and marshalling tracks (+3,55 m).

The container terminal will be connected to the new state road D-403 linking the Port of Rijeka, namely the Zagreb Deep Sea Container Terminal, to the Škurinje junction, currently under construction. This way, the Zagreb Deep Sea Container Terminal will be connected to the network

of Croatian motorways i.e. the main TEN-T corridor network. The length of the road D403 from the Port of Rijeka (ZDSCT) to the Škurinje junction on the Rijeka bypass is approximately 3 km with a branch for connection to the network of city roads.

At the same time, European Project "Upgrade of the Rijeka port infrastructure – Zagreb Deep Sea Container Terminal (POR2CORE-ZCT)" is to contribute to the development of the Port of Rijeka as one of the core ports in the Mediterranean through ensuring the efficiency, sustainability and multimodality of freight transport. The project was applied to the second call of the Connecting Europe Facility (CEF) Traffic 2015, Cohesion envelope. Grant Agreement no. INEA/CEF/TRAN/M2015/1138367 was signed on 18 November 2016 between the Innovation and Networks Executive Agency and the Port of Rijeka Authority, thus ensuring 85% of co-financing from the European funds. The total value of the project is 31,6 million EUR.

The significance of the construction of the container terminal on the Zagrebačka obala (Zagreb Deep Sea Container Terminal) was recognized by the Government of the Republic of Croatia, which at its session in May 2014 adopted the Decision on the designation of the container terminal on Zagrebačka obala . It is the most significant investment in transport infrastructure in the Rijeka area at this time and one of the largest in the Republic of Croatia.

Specific objectives include renovation and modernization of the port area, improvement of the financial status of the port of Rijeka, improvement of the port / urban infrastructure and improvement of the environmental conditions in the port of Rijeka. Major construction works, reconstruction of terminals, moorings, reconstruction of operational, road and railway areas and other construction works are planned. With these investments and European projects, we have accessed, port facilities will be modernized, the private sector in port will be modernized, the financial management of the Port Authority Rijeka will be improved, and Port of Rijeka will be integrated into the international traffic corridors.

The contract for the design and construction of the dock on Zagrebačka obala was signed on April 17th, 2012 with the joint venture Grandi Lavori Fincosit - Nuova CoEdMar - Impresa Costruzioni Giuseppe Maltauro. Under this contract, EUR 70.6 million worth will be built for a 400-meter-long dock. The project encompasses a wider area of the future container terminal with the possibility of extending the coastal wall to a maximum length of 680 meters. Supervision over the implementation of the contract, stipulated by FIDIC rules, over designing and in the next stage of

construction, is carried out by a business association of Croatian and Dutch consultants - Investigation engineer from Zagreb and Haskoning DHV B.V from Rotterdam.

The first stage predicts the construction of a 400 m long waterway at a depth of minimum 20 m. The mooring is dimensioned to accommodate ships of 14.000 TEU and the installation of a container STS crane with 22 and, if necessary, 23 rows of seaplane access. Because of the extremely difficult construction conditions, contracting method for design and construction was accepted, enabling the contractor to choose the cost-effective structure of the dock.

The second stage predicts the extension of the terminal up to the total length of the 680 m long port, which would result in a capacity of 400.000 TEU per year in the first stage, or 650.000 TEU per year when the terminal is fully built.

It is important to note that designing and solving property-legal issues related to the construction of the D-403 road, as well as preparations for the significant modernization of the railway infrastructure that will function as a cargo transport from the port of Rijeka, are being carried out along with the design of the container terminal.

It is anticipated that about 1.1 million cubic meters of material will be planted at the base of the future terminal, which would have 20 meters depth, that should have technical characteristics that cannot be found in any single port on the Adriatic, and allow the largest container ships in the world.

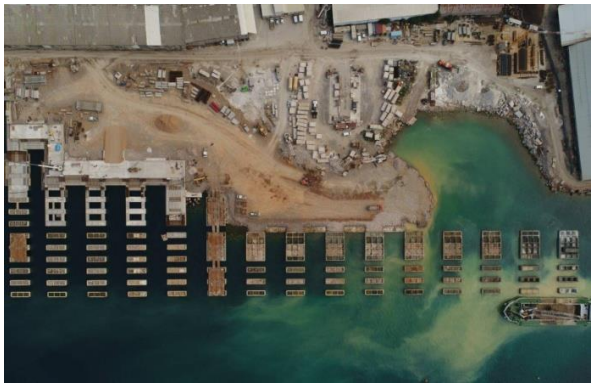

Fig 24: Zagreb Deep Sea Container Terminal in formation[39]

[39] Google Maps (accessed 15.08.2019.)

Fig. 25: Display of work after completion of stage 1[40]

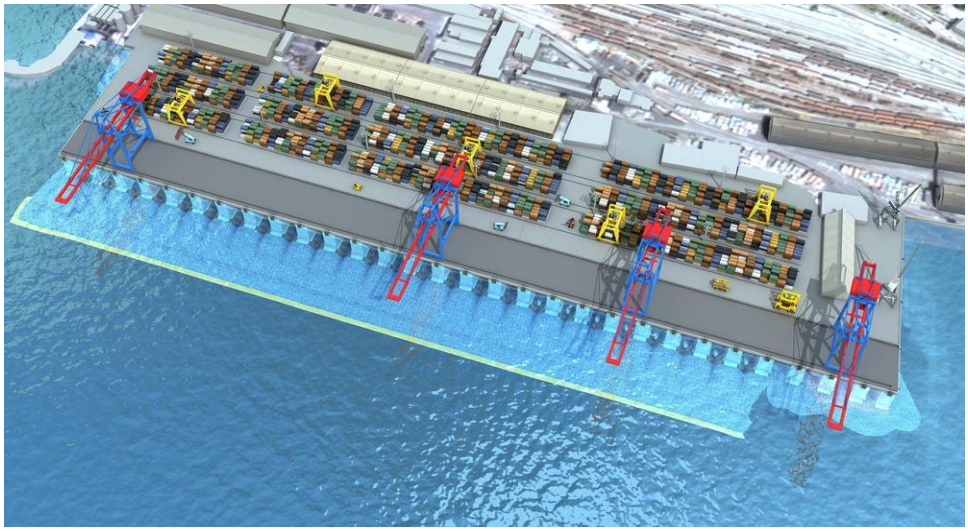

Fig. 26: Display of work after completion of stage 2[41]

[40] http://www.fm-ingegneria.com/project-detail.php?id=112 (accessed 15.08.2019.)

[41] Source: http://www.fm-ingegneria.com/project-detail.php?id=112 (accessed 15.08.2019.)

Long-term plans for stage 3 predict the maximum length of the terminal of 1.250 m. The entire project is planned to be financed by the World Bank loan, private investors' funds (future concessionaires), as well as European Union funds.

3.1.6 Building of the new main state road D-403 and railway terminal

The project involves connecting the terminals with the E61 highway by building a new road D403.

Fig. 27: View the future road D403 and the link to the highway network[42]

Considering that the full functionality of the container port requires a railway with the appropriate characteristics, the project also plans to build the required railway infrastructure. The second rail terminal will be directly connected to the container terminal on the Zagrebačka obala.

[42] http://www.mojarijeka.hr (accessed 03.08.2019.)

3.2 VISION 2020.-2030. FOR THE PORT OF RIJEKA

By completing a series of capital projects that include infrastructure projects for the construction and improvement of the railway infrastructure at the port, Rijeka will become a strong intermodal centre in the northern Adriatic and one of the most important transit ports for European markets that naturally gravitate toward it, thereby improving the connectivity of the port and the hinterland and increasing intermodality in the Rijeka transport route.

Fig. 28: Artistic 3D render of Delta and Porto Baroš[43]

By the end of 2020, the period of the investment cycle in the Port of Rijeka will end with the realisation of six development projects funded by the European Fund CEF in the total value of

[43] http://novilist.hr:8090/Vijesti/Rijeka/Arhitektonski-krugovi-o-rjesenjima-za-Deltu-i-Porto-Baros-To-je-urbicid (accessed 04.08.2019.)

115,5 million EUR. The whole investment cycle will include not only the realisation of European projects, but also the realisation of ongoing capital projects.

Firstly, by 2020, the Port of Rijeka Authority will complete the construction of the Zagreb Deep Sea Container Terminal within the Rijeka Gateway Project, start the works on the road D403 by combining funds from European funds and the state budget, and finally, enable a tender for the future concessionaire at the new container terminal, which will have a major impact on the capacity and efficiency of the Port of Rijeka in the transhipment of containers and a significant increase in the share of rail transport of containers on the railway line.

One of the subcomponents of the Rijeka Gateway Project is Port City Interface: Redevelopment of Delta and Porto Baroš, with the goal to develop this area into a modern business-residential and public space. Due to the difficult implementation of the project as a whole in an area with a maritime property status, the project is divided into two parts. The area of Porto Baroš is separated from the port area and has acquired the status of a port of special purpose, thus aligning with the Spatial Plan of the City of Rijeka, which anticipates the development of a nautical port is in this area.

In accordance to the plan, at the beginning of 2019, the Ministry of the Sea, Transport and Infrastructure will launch the concession procedure for this area and the development of a modern marina in the very centre of Rijeka.

By 2030, the Port of Rijeka will preserve the role of the most important intermodal centre and the main entry/exit port for Central and Eastern Europe in the Republic of Croatia. The port will exploit its potential and advantages of its position on the Mediterranean and Baltic-Adriatic TEN-T corridors, remove bottlenecks and upgrade the previously identified infrastructure projects within the European Union transport sector. By 2030, new opportunities for gradual expansion and construction of the container terminal on the island of Krk will be explored, as well as preservation and development of the projects implemented to improve the existing port infrastructure and the extension of port facilities to build a new infrastructure for the reception of large cruise ships.

4 SECTION C – MAPPING OUT STAKEHOLDERS

This chapter will map all involved stakeholders in port of Rijeka and multimodal cargo operations and administrative bodies that are also taking interest in commercial operations, along with analysis of the level and impact of their involvement in the project.

The key players in the development of the traffic direction are all stakeholders operating in the port of Rijeka. Through their work, following the set of business strategies, they affect the achievement of the competitiveness of the traffic direction.

Key stakeholders in the port of Rijeka will be identified as they affect project activities and outcomes. The list of stakeholders, and their power of influence and interest is prepared and shown in table form according to their influence on the project, while additional columns map stakeholders according to their role and the benefit (or conflicts) their involvement could bring. This is fully in line with TNA requirements requesting two separate tables that have been in this study joined together for better data overview and consistency of analysis.

Comprehensive mapping of stakeholders identifies 36 distinctive stakeholders, where some of them are for brevity and practicality reasons shown as groups of stakeholders (for example, ships' agents and visitors to port area). For all stakeholders, type of organization, description, level of power of influence, interest in involvement, role and potential benefit/conflict are identified.

Analysis shows that all stakeholders can be grouped into several categories: port authority, several ministries or their agencies and derived institutions (Maritime Police, Customs and others), railway infrastructure provider, port operators (terminal concessionaires), commercial stakeholders (including truck hauling service providers), non-commercial stakeholders, railway operators, governmental agencies, professional associations, scientific community (university), and other commercial and non-commercial stakeholders including occasional commercial or non-commercial visitors to the port area.

Out of all identified stakeholders, the most important role is that of Port of Rijeka Authority as the project leader, Ministry of the interior (Maritime police) and especially Ministry of the Sea, Transport and Infrastructure, managing the project leader. There are just a few stakeholders having medium power of influence (the most prominent being Ministry of Finance - Customs

Administration), and among them, all other exert their power through lobbying, informal influence and scientific endeavour. Most of the stakeholders have lower power of influence over the project.

For all stakeholders, an identification of interest in involvement was performed. Most of the stakeholders are potential project deliverable users and just a few of them are not directly or indirectly involved in the project.

Role has been identified for all stakeholders, and the same has been done for potential benefit or conflict. Interestingly, no conflict of interest has been spotted, and all stakeholders will benefit from pronounced increase of port efficiency and increase of safety.

Therefore, the final conclusion is that stakeholders in port of Rijeka will almost in entirety benefit from the project proposal and subsequent execution, a few of them have high influence over the project, guaranteeing successful coordination and execution, and those with medium influence exert it in informal ways. Most of the stakeholders are users and all of the stakeholders derive direct or indirect benefit.

All data related to stakeholder identification is systematically shown in Table 11 as annex 1, the table was created by the authors.

Comprehensive feedback has been obtained in direct contact **with the stakeholders** in relation to the merit of the project. In the following paragraphs, brief summary of the findings follows.

1. *Port of Rijeka Authority (PP2, internal users of the stakeholder*). Currently, internal users experience inefficiencies caused by obsolete procedure and inadequate IT systems supporting entry permits and clearance issuing procedures. Used system requires a separate room for acceptance of customers requiring permits, usage of obsolete software to take pictures, filling out paper forms by hand, manually creating swipe cards including printing on the colour ID card printer, and filing paper forms for storage. There is no possibility of systematic system-wide search or analysis. The system requires two back-by-back persons fully assigned to this task and a dedicated space close to the vigilance service at the entry, so the parties requiring ingress passes do not need to enter the Port of Rijeka Authority's building. Used hardware and software are old and inefficient, prone to malfunctions and use a simple Web cam to take pictures. Filing receipts for payments for entry is manual and entry forms still need to be manually signed and stamped requiring physical presence of the person asking for entry permit.
2. *Truck carrier's association* has been contacted in regard to their requirements and they have expressed need for faster and better integrated system to oversee entry into the area under control of Port of Rijeka Authority. Partially, there is a new system that oversees entry based on QR codes and previous registration, however, for special categories of persons requiring access, the control is still performed using legacy system.
3. With liberalization of the *railway cargo operations* market in Croatia mid-2013, seven different cargo operators emerged, and discussions were ongoing with several of them, most prominent share in the Port of Rijeka being held with HŽ Cargo Ltd. and Transagent Rail Ltd. They have expressed the need for faster processing of the entry permits for their personnel occasionally visiting the port area. With the recent changes in economic situation in Croatia and GDP growth experienced and caused by accession to EU funding, there is also an issue in employee turnover, and most contracts are not on permanent but temporary basis, so employees and personnel often changes requiring additional permits issuing, so they are experiencing stop and time losses, when waiting for permits processing.
4. Feedback has been obtained also from the stakeholder belonging to the category of „other users". For example, a *company providing digital identity, marketing and visibility*

services including filming promotional videos has been contacted and their managing director has expressed the opinion that access to other port areas for filming purposes where they conducted business was very simple. A Web form application was used to fill out requested data, and upon check and confirmation, the permit could be purchased and paid for online, and a QR code was issued. The film crew would have QR code on their mobile phones and would easily get access at the entry gate to the dedicated area. Film crews are often entering the port area in order to film footages for motion pictures, documentaries, tourist and other promotional videos.

5. *Croatian Chamber of Economy, office in Rijeka* has been contacted and a feedback has been given on the ICT systems available to members of the Chamber conducting business in the Port of Rijeka. Among IT systems whey mentioned could be of relevance for them, three were mentioned. First, they said they would benefit of a direct API access to statistical dana related to cargo and port operations, without having to go through Croatian Statistical Bureau, that typically provides data quarterly, half-yearly and annually. Second, the Chamber mentioned open data paradigm and possibility for the Port of Rijeka Authority to evaluate are there some data lakes that could be provided for open access. Finally, they have mentioned cumbersome way used at the moment in the Port of Rijeka to obtain physical access for their members that have to enter the port area on an occasional basis to attend business meetings. For example, when IT equipment vendor has to deliver some IT equipment, he needs to obtain described permits first using traditional process. This creates costs, delays and inefficiencies in the processes of the Chamber's members.
6. *Association of Ship Brokers and Agents of Croatia and Association of international freight forwarders and custom shippers* were interviewed as a part of activities related to development of the PCS system in Rijeka and the occasion was used to raise the topic of improvement possibilities within Port of Rijeka Authority's ICT systems. Both associations are members of the steering committee for implementation of the PCS in Port of Rijeka and have been closely involved in the PCS introduction project, so they are fully aware of the digital initiatives in the port. The interlocutors were instructed to declare any inefficiencies they notice in the territory, but that are not already covered by the ongoing PCS introduction project. They have expressed two major obstacles in their daily work. The first one is related to mismatch in the working hours of the various stakeholders in

the port, causing stops and need to wait (for example, customs officers, police, etc.) This particular fact was already a topic of discussions and even scientific research. As a second suggestion, representatives of both associations have put out the request for simple permit issuing, as they are necessary for all their employees conducting business in the port, and those attending daily coordination meetings.

7. As a final step, during process modelling for the PCS, information was gathered from *Ministry of Health (Department for Sanitary Inspection*), that is providing services to ships in the port area. They will be users of the PCS system, yet all third parties needing their administrative oversight, need permits in order to access RGP (inspection point). This causes delays, because customers first need to apply for paper permit process in the Port of Rijeka Authority, and then appear physically at the inspection point for further process.

Generally, there seems to be **consensus among seven stakeholders and their groups** whose involvement and feedback has been gathered as a part of the presented activity.

As the new PCS, to be completed by the end of 2020., does not include digitalization of the permits issuing, entry procedures and entry permit payments integration, for several reasons and fast-track execution and consequential concentration on core activities being the most important ones, all contacted stakeholders and groups of them have expressed interest in this system, among select other systems. No expression was done in relation to need for other customer-oriented ICT systems, and **lack of modern and transparent entry and permit control was stressed as main pain-point by all contacted stakeholders that emphasized they would benefit from digitalization and modernization of the process.**

5 SECTION D – ANALYSIS OF IT SYSTEMS

Analysis of IT systems consists of IT architecture models, IT systems implementation stage description and analysis of usage and impact of identified IT systems on freight agents. Overview of these topics is outlined in subsequent three chapters.

5.1 SUBSECTION D.1 - ARCHITECTURE MODELS

This chapter contains description of architecture models deployed for various IT systems implemented and used in the port of Rijeka under supervision and oversight of Port of Rijeka Authority. Listed are only those that are most relevant and candidates for significant overhaul and upgrade.

5.1.1 Office work automation and port management efficiency tools

Port of Rijeka Authority and identified stakeholders utilize standard Ethernet 10/100/1000 MBps network and WiFi for connectivity in office areas and areas where operative business is conducted. Rules for access, authentication, information security and identity management are managed using Microsoft Windows server Group Policies and Active Directory. Data sharing is achieved using shared network storages and Sharepoint document management system. Systems are regularly upgraded to new versions as the old ones expire and updated, under maintenance contracts. Architecture uses mixed on premise, hybrid cloud and cloud solutions and development and management of IT systems is achieved both by using internal resources and IT subcontracting and external consulting, when possible, as a part of co-financed projects and initiatives. There is a separate organized and funded IT department employing several full-time employees and head of department directing initiatives, budget, providing project management services and escalations towards Board of directors, when necessary.

5.1.2 VTS system

VTS system operated by Port of Rijeka Authority is upgraded regularly and the most recent upgrade of legacy system was performed in 2015. Legacy AIS system is made by developer Kongsberg Norcontrol IT, existing radar was product of Consilium, VHF system was made by

Elman while meteo system was product of Vaisala, and all those products were integrated using 3D VTS aggregator component, that consist of the following items:

1. Radar processor, used to process radar image, convert it to digital form, detect objects with required minimum position accuracy of 10 meters and speed accuracy of 0,5 knots, follow detected objects and measure dynamic parameters, compress received signals, manage radar antenna, detect stationary reflections, and dead reckoning.

2. VTS server program package, using vector maps of the area, data recording and reproduction, data reproduction using existing systems (AIS, Meteo, VHF, radar). It integrates AIS base station, meteo sensors and VHF system. VTS server can be upgraded by entering and storing data on new VTS objects, and it uses Web interface for interaction with the operator. It has the capability to lead and manage several searches and rescue operations in the area of responsibility of the Port of Rijeka Authority, represented as an additional layer on the map. VTS server program can create 3D situational maps and possess changeable point of view.

3. Operator work station, that consists of two workstations and displays and has the ability to use vector maps of the area and manage radar antenna, overview of the data from other systems, simultaneous data reproduction using AIS, VHF and radar data, configuration of the desktop area for multiple operators, ability to create virtual and synthetic ATON objects and selection and classification of objects according to several parameters (object length, speed, etc.)

Final layout of the system consists of the VHF and radar antennas situated at grain silo in Rijeka grain terminal in the center of the city, connected to the radar processor over network switch that connects the sensing equipment with VTS operator center located in the passenger terminal central building.

The second location houses VTMIS operator's workstation connected to VTS server and VTS data storage. Legacy ELMAN VISUS VHS subsystem and VAISALA meteo subsystems are used. Two locations are connected using existing network infrastructure and 8-port standard switches.

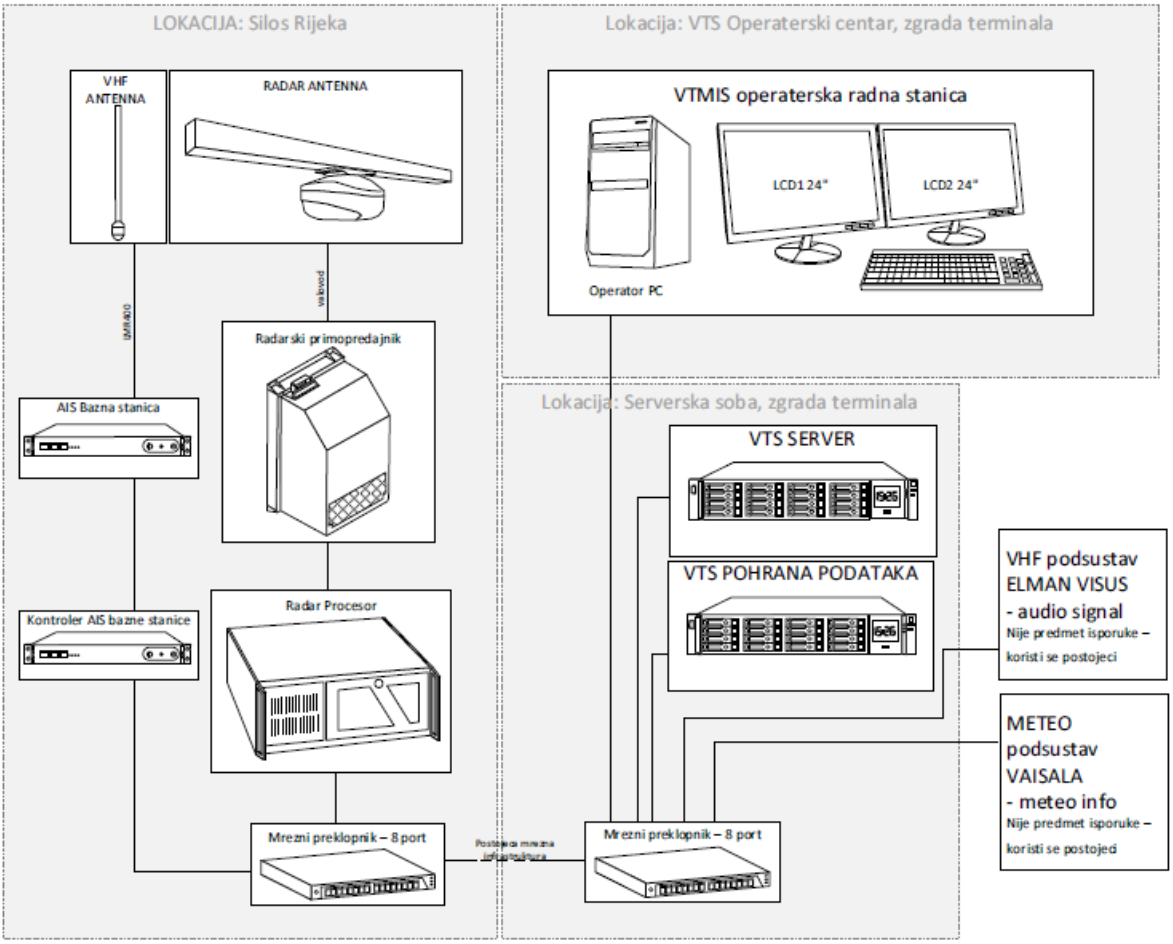

Fig. 29: VTS server architecture (operated by Port of Rijeka Authority)[44]

Hydrographic, meteo and wave data services are achieved using two separate buoy units, namely Aanderaa Hydrographic & Met Station with VHF radio system, while wave system is Datawell Direction Wave System with HF radio system, both provided and integrated by RS Aqua ltd.

[44] Maracic, M: „Radar subsystem upgrade“, Maritech Adriatic Llc, Rijeka, Croatia, 2015.

5.1.3 VHF system

Port of Rijeka Authority also operates VHF system with antennae installed at the top of the grain silo in the grain terminal situated in the center of the city. The system has been expanded late in 2018. for piloting purposes (external stakeholder) by means of additional base station and additional operator's station. Added value of the upgraded system is direct and private data and voice connectivity with port control center without using radio channel and added ability to play audio recordings. Port of Rijeka Authority has given approval to use location under their area of remit to install the upgrade equipment and also use underlying network infrastructure. This project has enabled direct connection of the pilot with the Port of Rijeka Authority and further enhancements in the process, among which are the most important:

- Overview of the radar situation
- Overview of all available sensor information (AIS, meteo)
- Transfer of the information to tablet devices using preinstalled Navi-Pilot application

Embedded VHF FM IMM receiver/sender, model RTV-1124, is configured to support RF operative band 156-162 MHz, works with maximum power of 25W, has DSC functionality and VoIP subsystem. It is connected to VISus operator's terminal.

Schematic drawing of the upgraded system is shown in the following figure on the next page. Black items are existing, legacy parts of the VHF system while red items show additional upgrade using existing network infrastructure.

At the moment of the TNA assessment, there are ongoing plans to deploy TRANSAS Pilot Pro comprehensive solution for pilots, that includes software, tablets, independent pilot sensors with Wi-Fi interface (or TRANSAS Pilot AIS Wi-Fi Interface with Pilot Plug), 3rd party Bluetooth GPS sensor for backup positioning purposes and waterproof Pilot Bag and Power Supply. Main benefits of the proposed system are easy setup and use, pilot requested specific functions for professional daily work, wireless freedom and mobility on the bridge, light weight and small size and long battery lifecycle for tablets. Discussions with the pilot service providers are ongoing regarding deployment of the TRANSAS Pilot pro IT system.

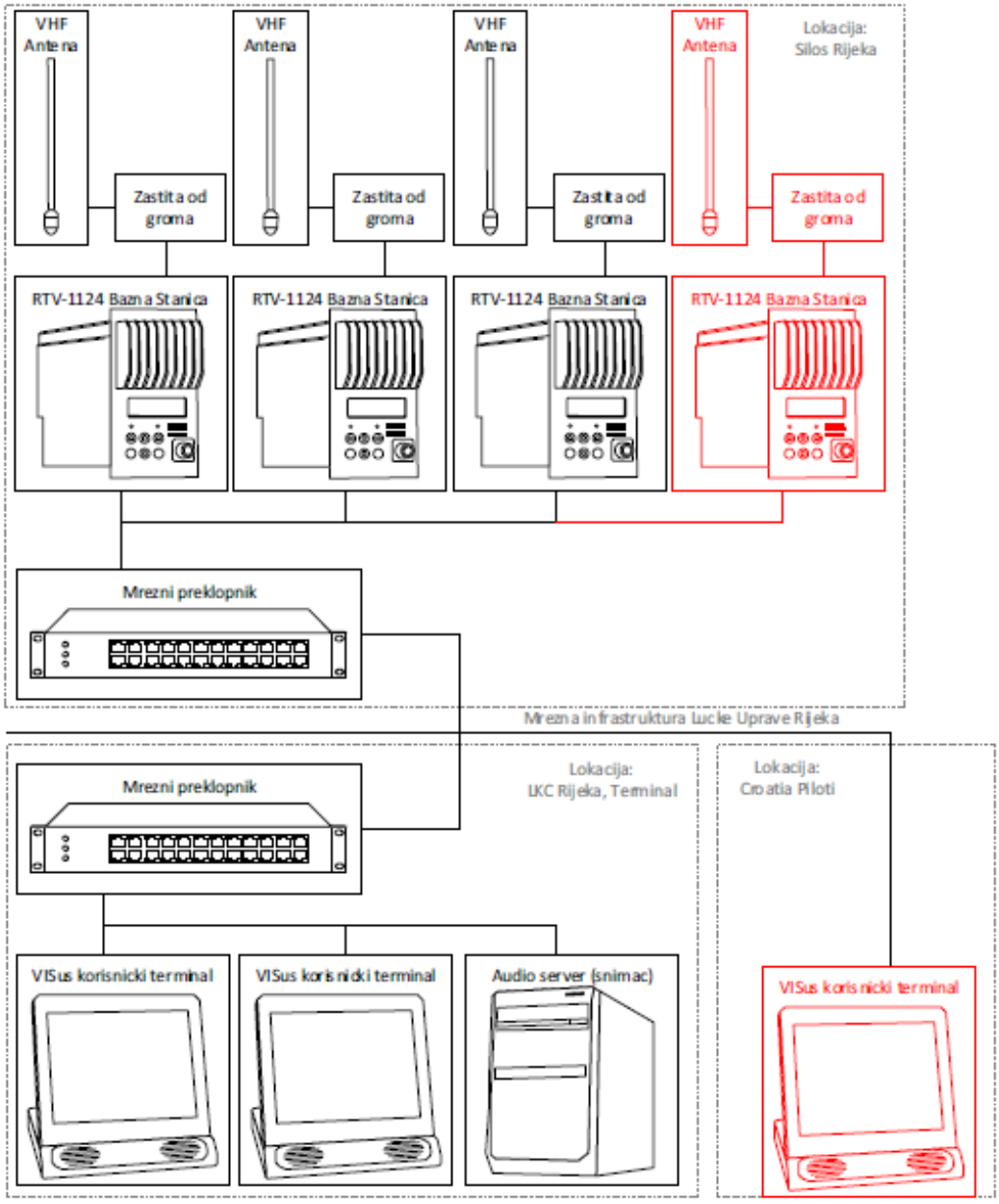

Fig. 30: Upgrade of the VHF infrastructure – layout after completion[45]

[45] Maracic, M: „070618-MM1-PILVHF“, Maritech Adriatic Llc, Rijeka, Croatia, 2018.

5.1.4 Landside ISPS support IT technologies

This chapter is dedicated to description of two ISPS support IT technologies, namely IT systems supporting access control of cargo, vehicles and persons and CCTV surveillance systems deployed in port of Rijeka locations to enhance security and traffic flow.

5.1.4.1 Access control system – business personnel, vehicles, drivers and containers

Access control for persons in business premises and areas of oversight of Port of Rijeka Authority is achieved using Siemens Granta access control. This is a proven industry standard solution that has been on the market since 1992 and typically used for high criticality access control venues like hospitals, universities, ports, government buildings, educational facilities and multi-tenanted buildings and campuses.

The system is designed to be used by security professionals and not only IT specialists. Based on Microsoft SQL database, the system is modular and enables growth of the port facilities, locations and concessionaires. Access control can be expanded to include proximity, smart card, magnetic stripe and biometric technology readers, including third party equipment. It can also integrate digital video management systems, CCTV, intruder alarms and other systems, all accessible via Port Authority's internal network from regular desktop or mobile workstations.

The system uses customizable software that can be used by operators having different privilege levels set according to their function and seniority. Distributed monitoring and reporting are also among default options. It is connected to controllers that can be readers (two offered options) and modular controllers (eight possibilities). Reading head technology is integrated with the controller.

A dedicated system is also installed to suit the needs for control of vehicles, drivers and containers entering port of Rijeka / AGCT j.s.c. container terminal.

Before first entering the area of Port Rijeka, each vehicle driver is obligated to come to the predicted point (terminal Škrljevo) where operator issues and/or activates his card. For the first card issuing, operator enters the data into the database, based on a valid identity card or passport, where they remain permanently stored.

Operator enters the data (ID reader scans):

- Name,
- Date and place of birth,
- Address of residence,
- Citizenship,
- ID card or passport,
- Transportation company – where the driver is employed,
- Area of validity, and
- Type of cards by type duration (permanent or disposable).

Software is also storing a driver's photo taken by the webcam and relates it to the document number, into Port Rijeka ISPS application, making it available via the associated ID card. After the population, if the card type is permanent ID card, it is issued, and it remains associated with the driver permanently.

Before entering the port area, driver checks in to terminal Škrljevo where operator activates his card for the current day, enters (according to the driver's statement) vehicle's licence plate number (for the vehicle which will be used for entering the port area) and licence plate of the trailer, according to the Custom's operative procedures.

When activating the card, operator performs verification of card holder by his ID, verification of vehicle licence plate and makes the changes in database, if there are some. All registered data is transmitted to Navis TOS operated by AGCT j.s.c.

The resulting software is integrated into Port Rijeka ISPS application from which it takes all the necessary data:

- Name,
- Date and place of birth,
- Address of residence,
- Citizenship,
- ID card or passport,
- Transportation company – where the driver is employed,

- Area of validity,
- Type of cards by type duration (permanent or disposable), and
- Driver's photo.

The following Fig. 31 shows the graphical user interface. Scanned documents in Škrljevo warehouse location are transferred to **resulting output visible in the software on entrances and exits.**

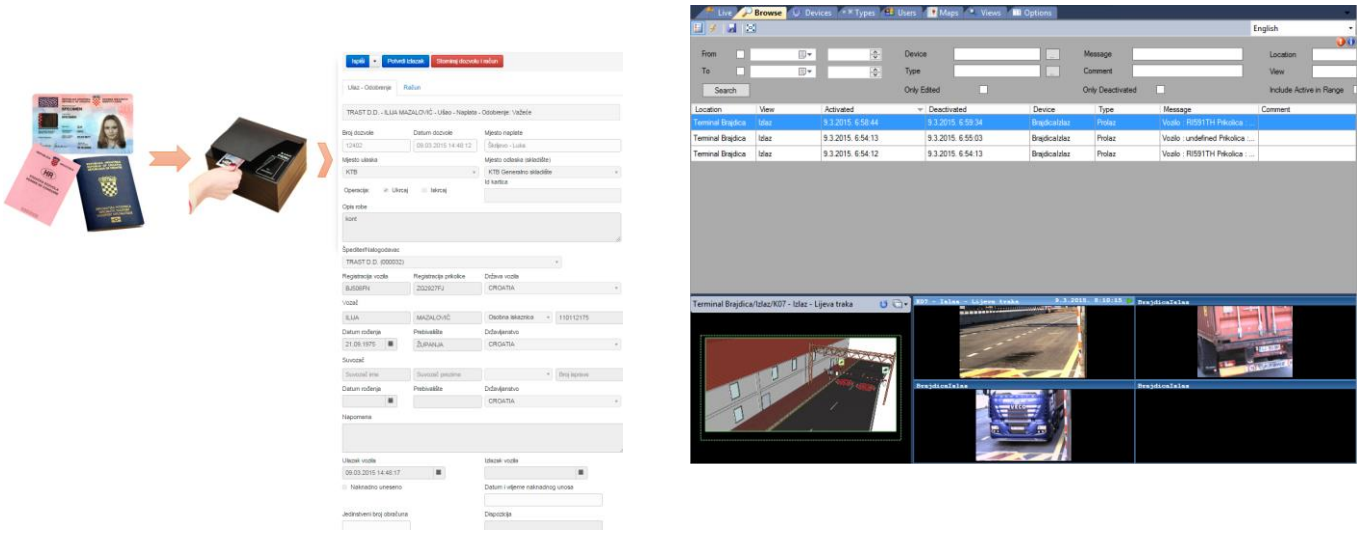

Fig. 31: Scans of documents in Škrljevo enter database as visible entries on entrances and exits[46]

In the entrance to port area (AGCT or other entrance), driver inserts ID card in a card reader. At the time of card reading, following processes are automatically started in software:

- Card checking – is it activated, i.e. is it activated for the day and for the port area?
    - Cameras placed at the entrance are recording and reading following (via ANPPR protocol) licence plate number of the vehicle (towing vehicle), registration marks of trailers and label of the container if the container is on trailer

[46] Internal documentation, Port of Rijeka Authority, 2019.

- Verification of card and camera reading of the licence plate number of vehicle (towing vehicle), matching with data stored in the database at Škrljevo
- Storing data about time of entry, registration marks of trailers, container labels in the database of ramp system
- Saving images from all cameras in that moment for a possible subsequent verification
- Communication with NAVIS and sending data about registration marks of trailers and label of the container if the container is on trailer

In case of properly activated card, "*green*" status is issued for the properly announced vehicle, and the ramp opens.

In case the card is not activated, or data verification does not match, "*yellow*" status is issued, and as a consequence the ramp does not open, and verification has to be done by operator.

When exiting the port area, driver nears the card to the reader to perform the following processes:

- Depending on the type of card, card takeover or only card reading
- Cameras placed at the exit record and read the following (via ANPR protocol) license plate number of vehicle (towing vehicle), registration marks of trailers and label of the container if the container is on trailer
- Verification of card and camera reading of the licence plate number of vehicle (towing vehicle), matching with data stored in the database at entrance
- Storing data related to exit time, registration marks of trailers, container labels in the database of ramp system
- Saves images from all cameras in that moment for a possible subsequent verification
- Ramp opening

There is a pronounced and noticeable gap in implementation of IT systems that control ingress/egress and the procedures used in Port of Rijeka Authority. Deeper analysis has shown that Port of Rijeka Authority applies in daily work Regulation on issuing the permits for persons and vehicles entering and moving in the port area of port of Rijeka, issued on 30th May 2007.

Article 10 of the Regulation defines several categories of physical ID cards issued to persons:

1. **Red colour**
   - Employees of Port of Rijeka Authority
   - Internal security personnel
   - External security personnel (vigilance)
   - State employees (police officers, Customs officers, employees of Harbourmaster's office, employees of the State inspectorate)
2. **Blue colour**
   - Concessionaires using port infrastructure and superstructure
   - Concessionaires not using port infrastructure and superstructure
   - Ship agents, with previous permit for work
   - Shipping agencies in the area of port of Rijeka
   - Cargo agents
   - Subcontractors of the concessionaires
3. **Light grey colour** – temporary vendors and contractors
4. **Green colour**
   - Visitors
   - Commercial activity parties (recording of marketing materials, documentaries or TV shows)

ID cards are furthermore divided into three top-level categories:

1. Permanent
2. Temporary Daily

While daily permits for cargo vehicles and a driver who operates embarking/disembarking at the area of border crossing under management of the Port of Rijeka Authority are issued using online system and Web service[47], all other permits are issued in a paper form using template provided on Web pages of the Port of Rijeka Authority under section "requests and forms" (in Croatian

[47] Web service for issuance of these permits can be found at the following URL: https://www.portunus.hr

language only)[48]. The process is not digitalized in no way, and there is no connection whatsoever with other IT systems. Also, no systematic analysis is possible, including statistics, cross-referencing and data import or export for categories of users other than those accessing port areas using cargo vehicles.

This lack of complete informatization of access control process can be identified as an evident bottleneck, and especially in relation to ISPS requirements and port security procedures.

Within the scope of TNS, a brief assessment of steps to be undertaken is performed. During this analysis,

Entry and exit terminals, are to be designated as positions where the ID cards are checked in order to allow entry that are identified. They should initially include at least the following locations, as outlined in the next figures – Terminal entry (Mlaka) and exit (Žabica), entry and exit of AGCT j.s.c.'s container terminal at Brajdica location, and entry and exit at locations in Bakar and Raša, all shown in the subsequent images.

[48] Word template for the forms can be accessed using the following URL: https://www.portauthority.hr/zahtjevi-i-obrasci/

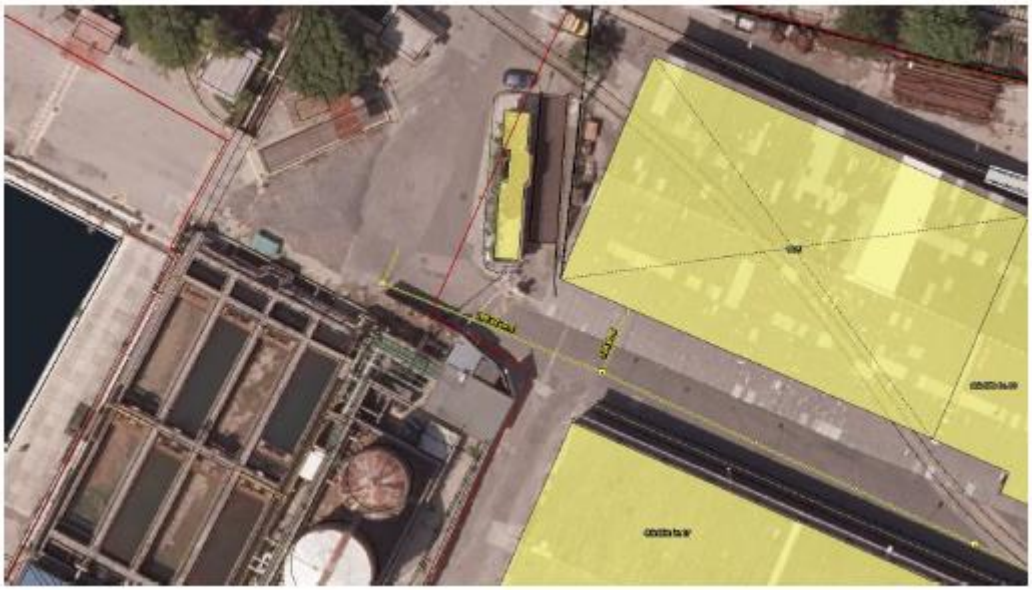

Fig. 32: Terminal entry (Mlaka)[49]

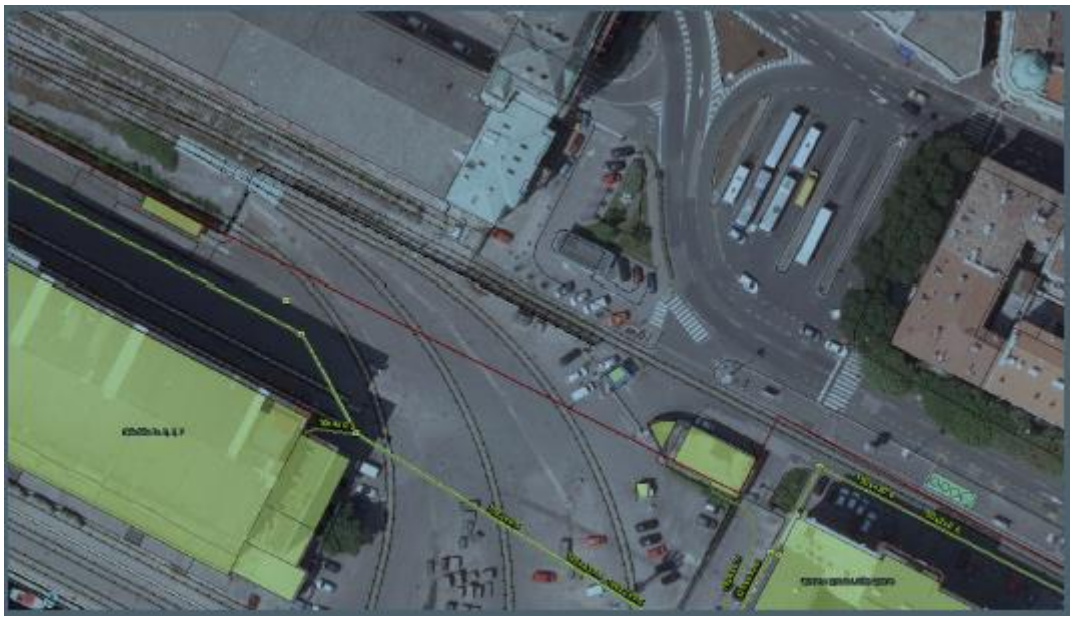

Fig. 33: Terminal exit (Žabica)[50]

[49] Internal documentation, Port of Rijeka Authority, 2019.
[50] Ibid.

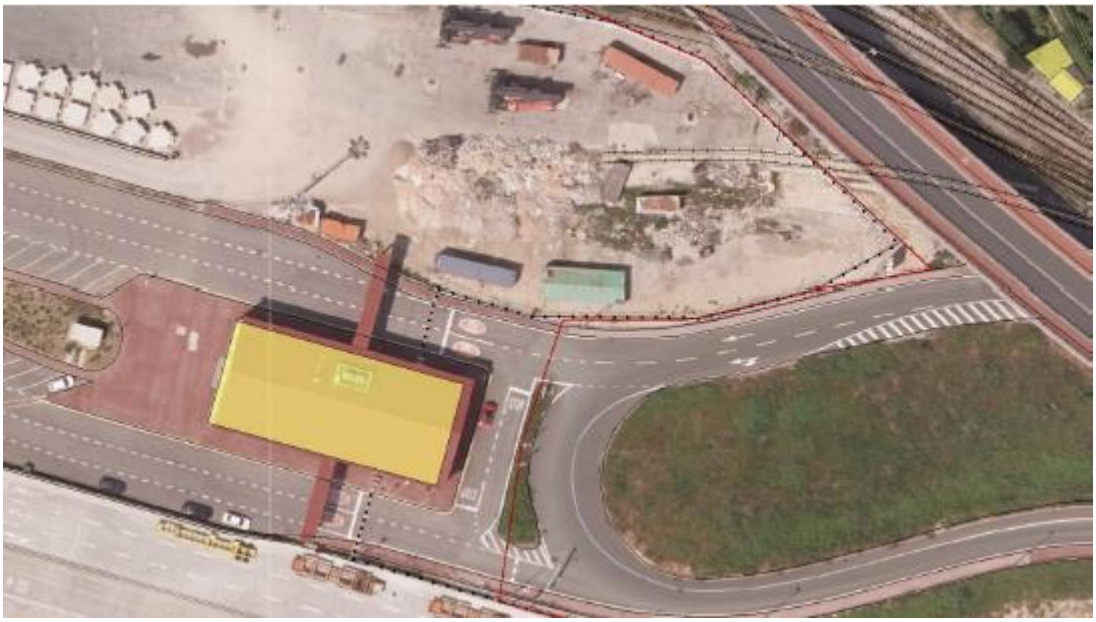

Fig. 34: Entry-exit terminal (Brajdica – AGCT j.s.c.)[51]

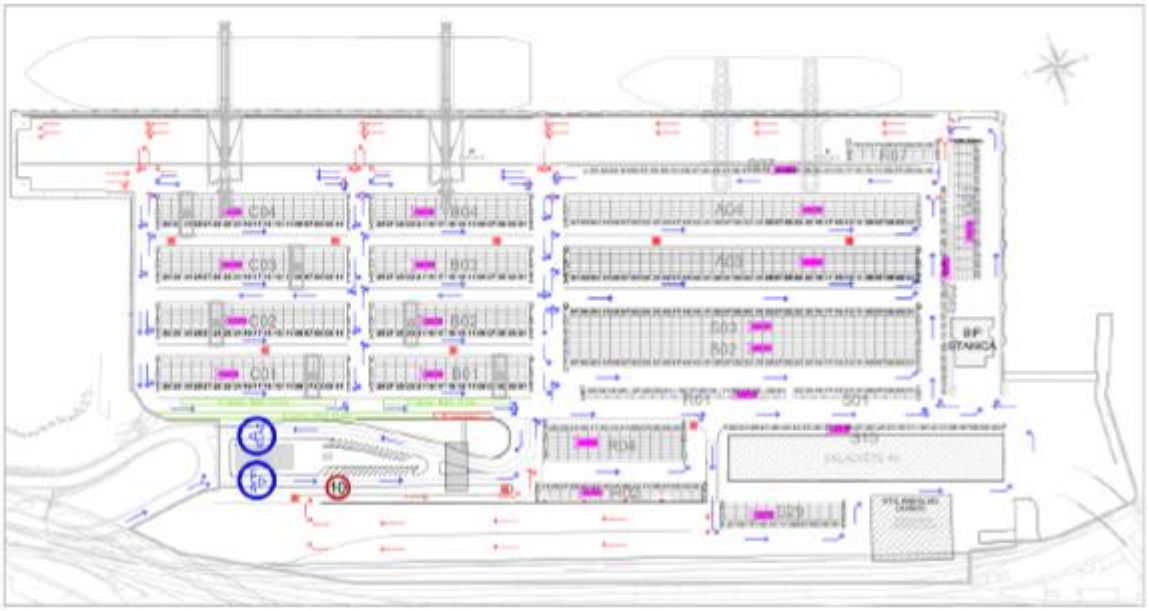

Fig. 35: AGCT Brajdica outline, with indicated entry and exit[52]

[51] Ibid.
[52] Ibid.

Fig. 36: Entry-exit terminal Bakar[53]

Fig. 37: Entry-exit terminal Raša[54]

[53] Ibid.

[54] Ibid.

Some useful guidelines for successful implementation of the ID card and permits issuance will also be identified:

1. *Changes to current Regulation*: They should be relatively minor and include primarily change in description of ID cards (colour and composition), and recognition of virtual ID cards (especially applicable for "daily" category of usage) that are represented by a valid and properly processed database entry.

2. *Technology*: Affirmative experience gained with implementation of QR codes for entry and exit from container terminals forms a positive guideline also for virtual ID cards – permits for physical person ingress-egress control. QR codes can be created in a way to contain useful information like location, first and last name and vehicle's license plate. IT system should be robust and follow all modern ICT and cybersecurity requirements.

3. *Payment possibilities and end-user (stakeholder) satisfaction*: Considering that ID card and permit issuance carries payments for certain categories of private and legal persons and vehicles, integration with payment gateways supporting various means of payment (subscription, credit cards, PayPal, prepaid) would also be highly advisable and trivial for integration, and it would results in high levels of satisfaction for identified stakeholders (end-users).

4. *Integration:* Considering that entry and exit gates are located also in the area of AGCT j.s.c. operated terminal, integration will ned to be achieved with their TOS (product of NAVIS), in order to use input data. Furthermore, a module for maritime police will have to be included with entry function enabling police officers in charge to deny entry to a particular terminal.

5. *Other:* Access using mobile or Web application with adequate usability for mobile phones or tablets is advised, especially if used by the police, or for field control purposes.

5.1.4.2 CCTV

CCTV in oversight area of Port of Rijeka Authority is achieved using commercial solution provided by Geutebrueck G-Core Security Management Software.
G-Core is the management software of the G-Scope. It has three integrated wizards:

1. *Connection Wizard* – used to create, manage and verify connections to the media servers
2. *Media Channel Wizard* - Used to monitor, report and manage all available CCTV networks in the system installed in the port of Rijeka
3. *Event/Alarm Wizard* – Used to create and manage triggered events and alarms

G-Scope system uses G-View as a playback client, a uniform user interface for all system components and supports all functions of picture playback, from the reaction to alarm events to support of recorded picture sequences.

CCTV system supports also continuous (permanent) recording and live streaming.

5.1.5 Single window systems and TOS

In the following subchapters, topics related to single window systems and TOS (Terminal Operator Systems) in use in port of Rijeka will be described. This includes latest available information on development of Port Community System (PCS) that started in 2018. and will be ended by end of 2020., Croatian national MNSW (Maritime National Single Window) and development of NSW, and also, brief overview of TOSs used by port operator (concessionaires): NAVIS TOS, Combis and F4B.

5.1.5.1 Port Community System (PCS) in port of Rijeka

There is an ongoing CEF-cofinanced project of PCS implementation in the port of Rijeka that started in April 2018. and will be fully completed by end of 2020.

Using electronic data exchange, the PCS is an effective real-time information system; fast, focused, flexible and multi-faceted, it aims to improve efficiency at all stages of the process of manifesting, through vessel discharge and loading, Customs clearance, health and phytosanitary

control. PCS offers also improved security, cost reduction and potentially more competitiveness for each user.

Therefore, PCS is a platform that allows smart exchange between public and private operators in a port, by creating efficient processes, reducing procedure time and minimizing the use of paper documents. PCS is also a digital solution for the optimization of port's commercial activities, and in Croatian context, it should represent an intermediary between all the users, CIMIS (Croatian Integrated Maritime Information System) and the Customs system of the Republic of Croatia, if it is given the role of local Single Window under prescribed conditions and with appropriate authorization and certificates for such purpose. The definition of PCS determines the role of the system in port activities as support to all the commercial processes and activities within given process regulations. Its utilization generally increases the use of electronic communication in port cluster's business. The PCS's role is not management or administration by nature, in fact, it provides support to the commercial aspect of all stakeholders involved in seaport business. The final goal of the PCS implementation is enhanced exchange of information, maintaining set standards of quality, reliability and timeliness. Implementation of PCS results in significant improvements to the time consumption of ship’s arrival to port that can be expected after process reengineering and especially after introduction of Port Community Systems that would result in increased efficiency and variable labour cost reduction. For example, scientific research in Croatia, using real administrative processes in the port of Rijeka, has shown that only administrative labour savings related to ship processing can amount to 48,5 % if proper reengineering is used and PCS is implemented.

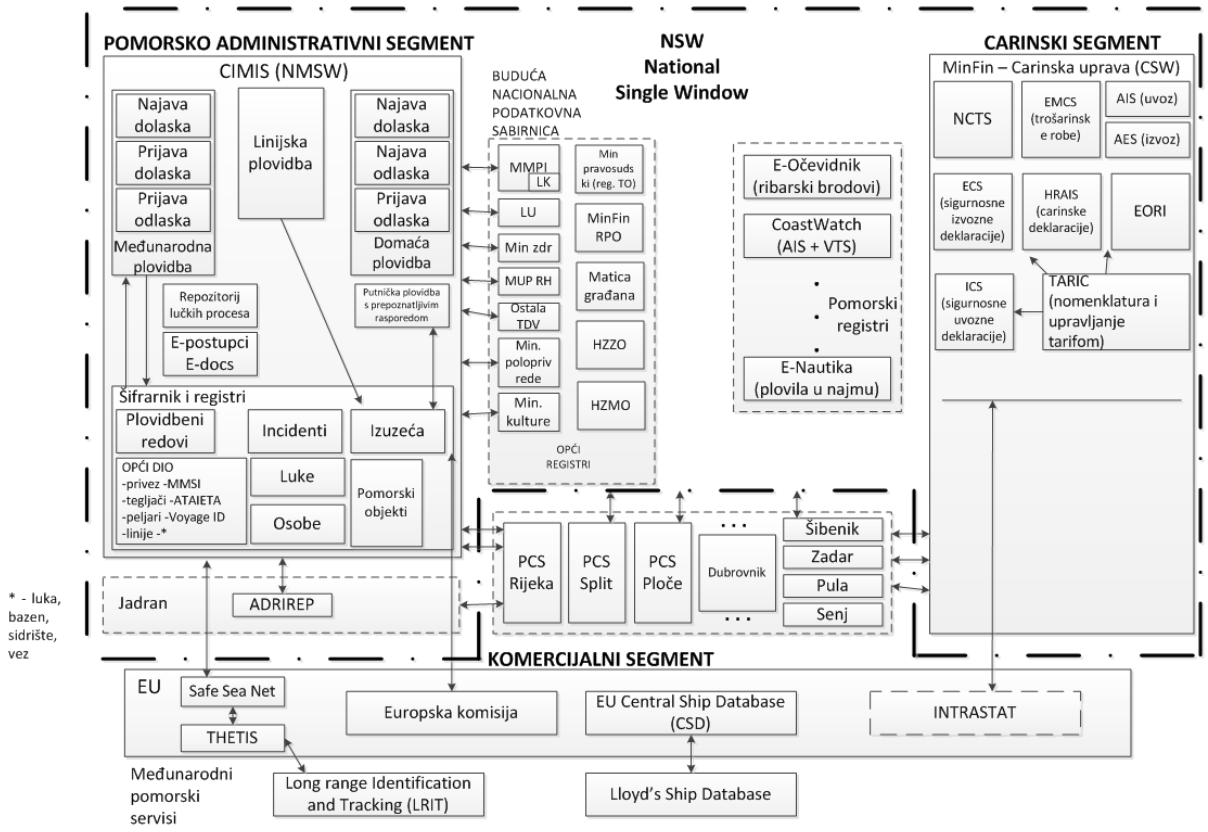

Fig. 38: Interaction of national and supranational stakeholders and SWs in Croatian ports[55]

Complete overview of PCS in Croatian ports within NSW, including interaction with other national and supranational IT systems of involved stakeholders is shown in Figure x on the previous page.

PCS needs to be connected to the surrounding systems (such as CIMIS) with underlying goal being avoidance of multiple data entry and facilitation of data exchange between stakeholders. Along with all the other systems enabling electronic communication in maritime traffic, PCS forms an important constituting and participating element of the NSW platform. The "Project of setting up a single national Port Community System" is currently underway, with the Ministry of the Sea, Transport and Infrastructure being the bearer of the project. Cooperating parties in this project

[55] NSW Study, Faculty of Maritime Studies, Rijeka, 2018., p. 134.

are, among others, Port of Rijeka Authority and Port of Ploče Authority. Once the mentioned project is completed in early 2021., all the Croatian port authorities will have a fully functional PCS system at their disposal that will be adaptable to all Croatian cargo ports with minor changes and adaptation dependant on local characteristics of each individual participating port. Port of Split Authority, managing the second largest port in the Republic of Croatia (traffic of over 3,1 million tons of cargo), is currently not actively involved in the development of this project.

Stakeholders and users of PCS system can be divided into two groups:

1. Stakeholders controlling the entered data, and
2. Commercial data users and providers.

Supervisory part of the application, i.e. agencies controlling the data entered are:

1. Harbour Master's Office,
2. Port Authority,
3. Border police,
4. Phytosanitary and veterinary inspections,
5. Sanitary inspection, and
6. Custom office.

Commercial users providing the data are:

1. Waste disposal concessionaires,
2. Mooring, piloting and tug service providers,
3. Ships' agents,
4. Freight forwarders,
5. Cargo terminal concessionaires, and
6. Land transport companies.

At the moment, PCS is not yet implemented in the Port of Rijeka, even though implementation was initially planned for 2008., and an international competition request for quotation was announced that received four valid offers and vendor was selected and started with initial analysis and implementations. Project was temporarily suspended in 2011, partly due to the development of the CIMIS system and change of focus. The effectuation of PCS has been

continued mid-2017. with preparations for the involvement of the project Technical assistance (TA) and the full implementation is planned for the early in 2021. The project is financed with support of Connecting Europe Facility, in the amount of 1.6 million EUR. The Government of the Republic of Croatia will provide 15% of that amount.

The project is well underway and executed on time. Contract for Technical assistance for design and implementation of PCS in Rijeka whose value is 2.97.312,50 Croatian kunas was signed on the 19th April 2018. and the Technical assistance team comprised of subject matter experts from Sarda LLc, Aksentijevic Forensics and Consulting, LLc, Faculty of Maritime Studies Rijeka and Kiss Patterns has started immediately with activities whose final goal is to produce required PCS tender documentation including involved port stakeholders' process description, required hardware, system software and information security levels, rules for transfer of intellectual property and business continuity. Public counselling process was announced on time at 24th December 2018. and after comments of interested public members were incorporated, the public procurement announcement was issued on 31st December 2018. Currently, offers are being collected, requests for clarifications are being issued and offers are technically and financially evaluated within rules set by public procurement legislation rules according to which Port of Rijeka Authority has to abide, with final goal being to select economically most viable offer for implementation of PCS in Rijeka, that will serve as a base for nation-wide implementation of PCS after specific adjustments.

Contract for PCS implementation was awarded in April 2019. to a group of vendors comprised of Aktual IT LLc (Slovenia), Aktual IT LLc (Croatia) and Integra Group LLc (Croatia). At the moment, process analysis is underway with the final goal to createa a functional specification of the first PCS module.

For the purposes of Port coordination, Port Call Synchronization and the concept of "just in time arrival" of vessels and related planning of port logistics, PCS in Rijeka shall have capability to receive estimated time of arrival of the ship, to evaluate ships time of arrival against port and port actors availability, to agree upon improved arrival time for ship, to send recommended time of arrival of the ship, to receive estimated time of departure of the ship, to receive planned time of departure of the ship, to evaluate ships time of departure against port and port actors availability, to agree upon improved departure time of the ship, to send recommended time of

departure. The above will be implemented at least through the following standards in the latest version available:

1. STM REQ 1.0 Capability to connect and act within security domain SeaSWIM and Maritime Connectivity Platform (MCP),
2. STM REQ 1.1 Capability to receive Voyage Plans in RTZ format according to IEC61174:2015 and S-421 standard on Port Call Synchronization, and
3. STM REQ 1.2 Capability to compose and send recommended time (RTA) and ETA using the Schedule in RTZ format according to IEC61174:2015 and S-421 standard.

One interesting trait of PCS implementation in the port of Rijeka is that it does not anticipate financial resources or module dedicated to ingress and egress. Functional specification does mention integration, but only in terms of procedures. Reason for this is fast developing project with fixed ending (end of 2020.) due to CEF rules of funding, so the integration related to access control is missing from the project.

5.1.5.2 Use of CIMIS (MNSW)

As of mid-2013., CIMIS has been used as the Croatian Maritime National Single Window (MNSW) that is according to accompanying law to be used by all ports for administrative tasks related to ship's notification of arrival, arrival and departure. CIMIS is also daily used by stakeholders in port of Rijeka to fulfil legal requirements related to ship.

NSW study created for the Ministry of Maritime Affairs, Transport and Infrastructure from 2011. describes the contents and methods of integration of the national single window system. Chapter 3 describes in detail the integration of NSW and PSC systems. The basic assumption is that the same data is delivered to the system only once. Figure 8. shows in general the NSW orchestration and message exchange.

CIMIS is the unique MSW (Maritime Single Window) system that implements all national level processes related to the administrative aspect and aspect of navigation safety. The role of the CIMIS system is to manage, store, and provide master data (MDMs) such as ship code (NIB and IMO numbers), ports, berths, anchors, agents, shipping, and so on. Croatian Ministry of the Sea, Transport and Infrastructure (MMPI) has developed advanced IT platform CIMIS (Croatian

Integrated Maritime Information System) in order to enhance electronic delivery and exchange of data about ships, cargo and passengers in official administrative procedures related to ship's announcement, arrival and departure.

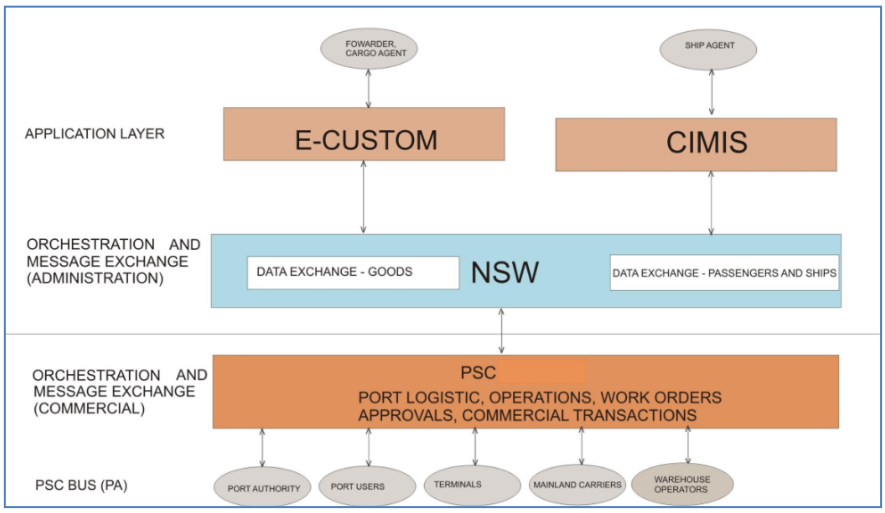

Fig. 39: Envisaged high level NSW orchestration and message exchange[56]

In order for CIMIS to be able to exchange data with external systems (PCS, police information systems, customs and others), and exchange data and information, CIMISNet XML data exchange system has been established. CIMISNet is comprised of the following Web interfaces:

1. *CIMISNet web service* is an interface allowing end users to reach all dana and documents related to visit of a maritime object to a Croatian port that are received and stored inside CIMIS database. Except reaching the data, it also enables basic user actions over those documents,
2. *CIMISNet-eSeaFarer* web service interface that enables end user to browse and enter dana related to seafarer movements,
3. *CIMISNet-eNatNav* web service interface that enables end users to announce arrivals and departures of maritime objects to Croatian seaports

[56] Ibid, p.131

4. *CIMISNet-eShipLine* web service interface that makes it possible for the end user to declare cargo and passengers for each maritime activity and sailing schedule for each ship line under concession. Interaction between CIMIS Web interface and CimisNet WS is shown in Figure 9. on the next page.

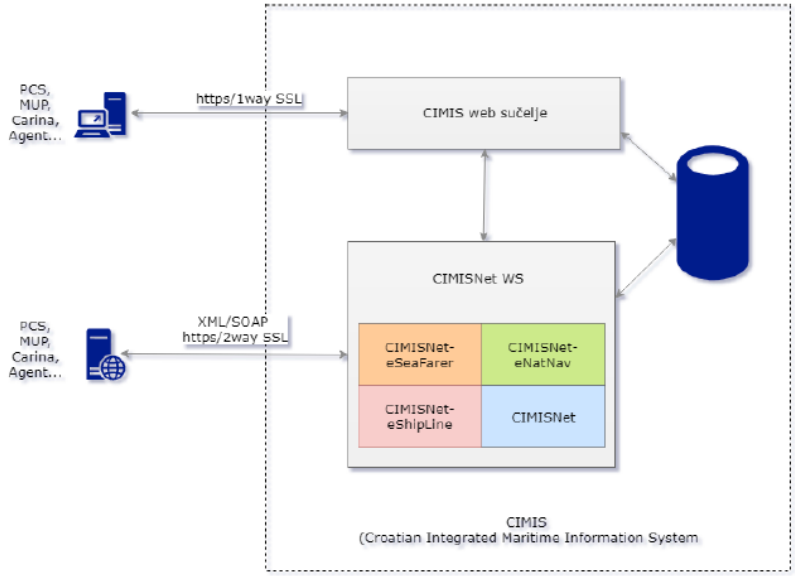

Fig. 40: Orchestration of messages within CIMIS[57]

Goals of the CIMIS system are:

1. More efficient data collection
2. Availability of detailed statistic dana on maritime traffic
3. Reliable and secure way of exchanging XML messages and underlying documents
4. Removal of administrative load in maritime traffic
5. Simplification of dana flow between all participants in maritime traffic and state bodies
6. Increase of efficiency in maritime traffic and port service delivery
7. Contribution to integration of Croatian maritime traffic routes into European traffic routes

[57] Ibid, p.132

In order to achieve exchange of XML messages and documents in a safe and reliable manner to all involved stakeholders, CIMISNet's architecture follows web service paradigm (SOAP/HTTPS) that will use Internet and HTTPS as communication channel and both-sides authentication on a communication level (2-way SSL). Envisaged data exchange methodology is technologically independent, and it will make possible for uniform communication between end

PCS is the local single window for managing all port operations (land-based processes), from when the vessel was moored until his departure.

NSW Platform mediates data exchange between CIMIS (and other national systems: Customs, Ministry of the Interior, Ministry of Health,) and PCS systems.

NSW Platform is also an administrative-service bus that will be responsible for implementing business processes, orchestrating data exchange, ensuring compliance with business rules, format conversions, and other functions required for integration into a unique system.

The platform will also include:

1. A digital archive (storing all messages in a specified time period), the valuator to check the formal correctness of the message, a message generator and interface for secure delivery of messages.
2. The repository of business processes and associated XML schemas. They will be integrated with the central authentication and authorization system that will enable the central administration of the identity and rights (roles) of all system users. Authentication mechanisms will primarily use digital certificates, but the system will also support modular add-on authentication mechanisms as well as authentication with username and password (reserve option).
3. Integration with all other components of the NSW system and connection with other national systems (Ministry of the Interior, Customs, Ministry of Health and other government bodies).

The diagram in Fig. 41 on the next page shows targeted integrative (functional) system architecture of the NSW system.

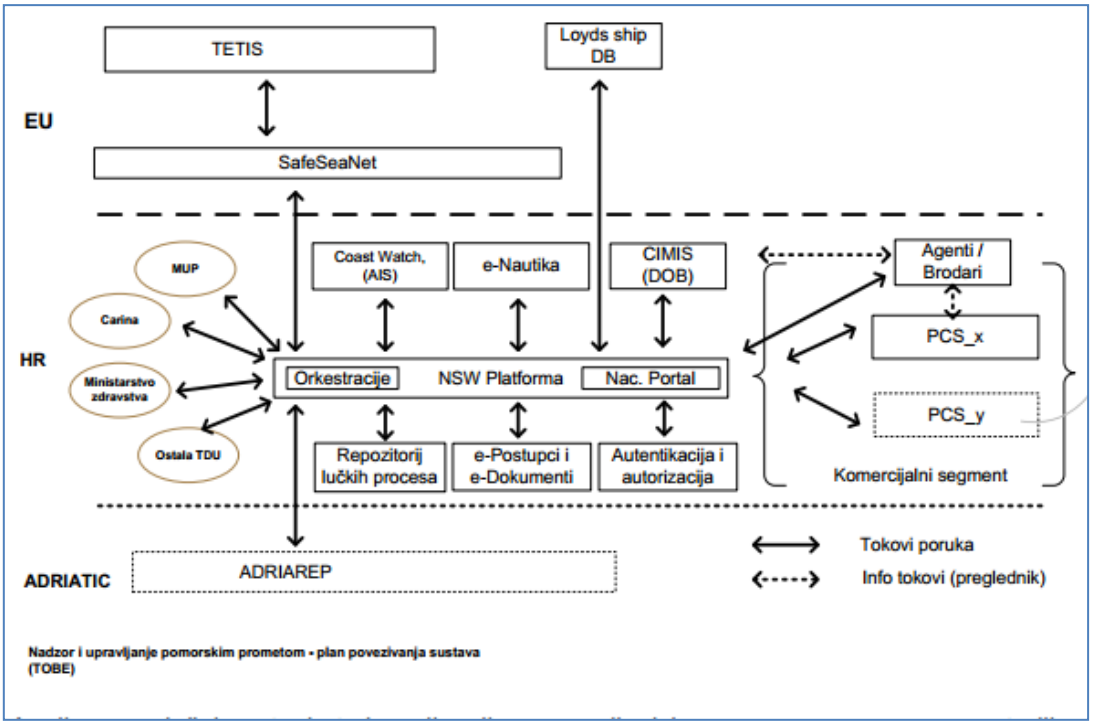

Fig. 41: Croatian NSW development - Complete functional integration architecture[58]

As it can be seen from the previous figure, PCS – or a series of PCSes developed on the basis of the "national" PCS first to be implemented in the Port of Rijeka – are an important segment of overall national orchestration within NSW area of remit.

The National Single Window (NSW) can be defined as the standalone information system operating at national level, providing connectivity and data (document) exchange with other systems by using standard and well established ways of communication, accepting information in strictly defined structure and making information available to various different stakeholders within the country in a harmonized manner. Single Windows may also be supranational or regional. According to the Directive 2010/65/EU of the European Parliament and of the Council (Directive 2010/65EU, 2010) each Member State should implement the Maritime National Single Window (MNSW) in order to optimize and facilitate the process of announcement and registration of ships which arrive to ports and/or depart from ports of the Member States.

[58] Ibid, p.129

5.1.5.3. TOS of port terminal operators

There are several TOS systems in use by various port terminal operators.

All cargo and vessel processing on the terminal operated by AGCT j.s.c. is done through Terminal Operating System (TOS) NAVIS SparcsN4 implemented on 29.01.2012. It also includes internal processes as well as interaction processes with 3rd parties needed in order to provide smooth and clear container flow through terminal. Main interaction parties are the shipping lines (local agents and vessel planners), freight forwarders and rail operators/dispatchers. As of 2014., NAVIS TOS is connected with newly implemented SAP system.

After the delivery or receipt, depending on customs status of the cargo, obligation of the principal is in next 5 days to insert a K417/K447 and the customs documentation number in the application "Online kreiranje naloga". If data is not entered in time, it may be updated by AGCT in the way that principal sends request in writing, which is subjected to administrative costs.

NAVIS SparcsN4 serves as a "local single window" for the container terminal operated by AGCT j.s.c., and among users of the system is even Croatian Customs. However, Luka Rijeka j.s.c. operates its own TOS systems created using Rathmann's F4B Framework for Business. Framework for Business (F4B) is an integrated, process-oriented business information system which comprises all the elements needed for successful information and business management in ports. Furthermore, hinterland warehouse Škrljevo uses TOS implemented by Croatian system integrator Combis.

One of the first modules of the PCS in development at the time of TNA assessment was module for procedures in container terminal. There is an ongoing cooperation between the integration vendor and AGCT j.s.c., and most of the processes are already mapped, and coding is ongoing. It is expected that this module will further enhance flexibility for the users.

Module for cargo operations in Luka Rijeka j.s.c. will soon enter process modelling stage and will be developed shortly, during first half of H1/2019. PCS development is envisaged in modular way, so users are educated for usage of developed module and it is immediately put into production. This approach will first prove beneficial for all administrative tasks, Customs office and terminal operators.

5.2 SUBSECTION D.2- IMPLEMENTATION STAGE

In this chapter, identified and selected IT systems used in port of Rijeka will be evaluated according to lifecycle stage they have achieved and more detailed analysis of their state at the time of creation of TNA. Identified IT solutions and technologies coincide with those described in subsection 5.5 – Architecture Models.

IT systems are evaluated according to four-stage implementation model, where the first stage is project initiation, and the final stage is maintenance and growth (operative exploitation of select IT systems).

Using data gathered during survey, table 12 is compiled.

	Port of Rijeka IT System	**Achieved phase**	**Mid-term improvement identification**	**Remark**
1.	Office work automation and port management efficiency tools	Maintenance and growth (IV)	N/A	Upgraded and maintained as a part of annual IT plan by port of Rijeka stakeholders, and especially Port of Rijeka Authority
2.	VTS system	Maintenance and growth (IV)	N/A	Upgraded and maintained as a part of annual IT plan by Port of Rijeka Authority
3.	VHF system	Maintenance and growth (IV)	Upgrade for pilotage stakeholders	Upgraded and maintained as a part of annual IT plan by Port of Rijeka Authority Requires enhancements. Depends on consensus with pilotage concessionaires.
4.	Access control system – business personnel, vehicles, drivers and containers	Implementation and adoption (III)	Upgrade with additional functions for all types of permits	Lacks feature, alignment with Port of Rijeka Authority's internal regulation, funding. No integration with PCS envisaged in either direction.

	Port of Rijeka IT System	Achieved phase	Mid-term improvement identification	Remark
5.	CCTV	Maintenance and growth (IV)	N/A	Upgraded and maintained as a part of annual IT plan by Port of Rijeka Authority
6.	Port Community System (PCS)	System analysis and design (II)	N/A	Completed process modelling of the first two modules in 08/2019. Beginning of coding, testing and implementation. CEF funded. Does not anticipate funds for full integration with access control system (item 4.)
7.	TOS systems			
7.b	NAVIS TOS Sparcs N4	Maintenance and growth (IV)	N/A	Upgraded and maintained as a part of annual IT plan by concessionaire (AGCT j.s.c.)
7.c	COMBIS TOS	Maintenance and growth (IV)	N/A	Upgraded and maintained as a part of annual IT plan by concessionaire (Luka Rijeka j.s.c.)
7.d	F4B TOS	Maintenance and growth (IV)	N/A	Upgraded and maintained as a part of annual IT plan by concessionaire (Luka Rijeka j.s.c.)
8.	<TOS of tentative new concessionaire – Zagreb Deep Sea Container Terminal>	<Project initiation> (I)	N/A	Concessionaire offers and negotiations should commence in Q4/2019.

Table 12: Implementation stage of identified IT systems in port of Rijeka[59]

[59] Created by the authors

Analysing result data, it is noticeable that most systems are fully implemented, in use, maintained and upgraded as a part of regular activities, either by Port of Rijeka Authority or terminal operation concessionaires. This is especially valid for office work automation and port management efficiency tools, VTS, VHF, CCTV and TOS systems of involved terminal operators.

Ongoing building of PCS will have a significant impact on all port of Rijeka stakeholders and their IT systems, and they have been involved in the process from the very beginning, even before than CEF funding was secured. PCS will have several dedicated modules for various concessionaires, and they will have to adjust their systems a part of regular planned internal growth and maintenance activities.

Furthermore, depending on the selection of concessionaire for the new Zagreb Deep Sea Container Terminal, several scenarios can be expected. If one of existing operators will obtain license for the new terminal, it is possible they will implement their existing solution to cover the new location and operations. If a new stakeholder will enter the arena of port of Rijeka, it will probably implement own solution, that will have to be adjusted for message exchange with the new PCS.

Finally, it is possible to identify two IT systems that require upgrade in order to achieve full functionality and integration, marked with yellow and red colours in table 12:

1. *Access control system* – business personnel, vehicles, drivers and containers: not fully integrated, not all functionalities are implemented, only partial implementation related to vehicles and drives entry and exit is implemented, but other applicable permits as envisaged by the valid Regulation of Port of Rijeka Authority is not implemented, and it is still processed in paper form, causing delays, excessive consumption of time and other resources, and diminishing integration and analytics, contrary to the ISPS requirements.

2. *VHF system* – Requires additional digitalization and enhancement. Tentative solution is already identified, but decision making depends on consensus with pilotage concessionaires.

Analysis shows that upgrade with missing functionalities and full integration of access control system is critical at the moment of TNA, especially considering lack of funding and no funds anticipated at the PCS side to cover aforementioned functionalities.

5.3 SUBSECTION D.3 - USAGE BY AND IMPACT ON FREIGHT AGENTS

With completed assessment of the architecture design and implementation stage of select ICT systems, in this paragraph, impact of ICT adoption for the stakeholders will be outlined. As required, impact of the IT systems will be evaluated in regard to freight agents.

In a first scenario, the stakeholder uses only paper documents, using conventional process, to obtain access to port area.

In the second scenario, the stakeholder has possibility to use structured IT system to obtain access to the port area.

Finally, in the third scenario, stakeholder can use PCS system to obtain access to port area.
Relevant freight agents are individually identified, while others, like track carriers, railway operators and other stakeholders are grouped for simplicity.

Stakeholder's name	Stakeholder uses only paper documents (conventional process) to obtain access to port area	Stakeholder uses structured IT system to obtain access to port area	Stakeholder uses PCS system to obtain access to port area
Adriatik Servis	X		
Alianca	X		
Anglo Adriatic	X		
Atlantagent	X		
Bandic Maritime	X		
B.w.a.	X		
Cma Cgm croatia	X		
C. Steinweg – TPG	X		
Dragon Maritime Adria	X		
Euromar plus	X		
Global agent	X		
Jadroagent	X		
Jadrolinija	X		
Liburnia Maritime agency	X		
Rea Dubrovnik	X		
Transagent	X		
Adriatikagent	X		
Damco	X		
Gate Express	X		
Log Adria	X		
Maersk Croatia	X		
Panalpina Croatia	X		
Primacošped	X		
Truck carries (group category)		X	
Railway operators (group category)	X		
Visitors to port area [60]	X		

Table 13: Usage by and impact on freight agents

[60] Group category, includes all other stakeholders – vendors, subcontractors, state agency officials

As it can be seen from evidence gathered and outlined in table 13, all freight agents operating in port of Rijeka, all railway operators (categorized for simplicity as one item) and all other occasional or permanent visitors to port area (police, Customs officers, other state agency officials, vendors, consultants, subcontractors, teams filming in the port area etc.) need to fill paper documents in order to obtain access to port area. The only group that can announce arrival and obtain permits to enter the container terminal with cargo are truck carriers. Furthermore, in the current scope of PCS, no module is envisaged to support permit issuing according to valid Port of Rijeka Regulation, due to time and financial constraints of the ongoing PCS project. It is evident that in order to increase digitization in the area of port of Rijeka for almost all stakeholders, further steps need to be undertaken in order to upgrade current system used for trucks (if possible), or build a completely new IT system to facilitate permit issuance, storage, monitoring and oversight, further underlining ISPS compliance.

6 SECTION E – SWOT ANALYSIS

SWOT analysis in this chapter will be used as a tool to describe factors involved in reaching target objectives by identifying impact of both internal and external factors influencing execution of projects affecting port of Rijeka multimodal chain stakeholders.

According to prescribed methodology, this chapter contains presentation of the main results and findings of the TNA related to port of Rijeka.

SWOT identifies the following factors stemming from previously described activities:

a. Internal factors — *Strengths* and *Weaknesses, and*
b. External factors —*Opportunities* and *Threats.*

SWOT analysis in Table 14. outlines factors involved in reaching target objectives, thus enhancing cross-border maritime and multimodal freight transport, with a focus on identified ICT solutions and infrastructure development.

INTERNAL FACTORS	
Strengths	**Weaknesses**
1. A key port in the integration of the Croatian transport system and inclusion in international traffic flows, core TEN-T port 2. Port of Rijeka Authority, instituted by Ministry of Sea, Traffic and Infrastructure, is a key solicitor of infrastructural and organizational changes in the port of Rijeka, including core and commonly used ICT systems 3. Proven record of inclusion of Port of Rijeka Authority in partnerships	1. Focus on operative tasks and lack of quality analysis and study of port concessionaires needs for commonly used ICT services 2. Caused by lack of funds and limited time available according to CEF funding rules, implementation of the new PCS system does not foresee a wholesome solution for access control and permits issuing 3. Port of Rijeka basin is very distributed geographically, covering many locations, several terminals and

INTERNAL FACTORS	
Strengths	**Weaknesses**
related to EU funded project execution, along with successful project completion 4. Ongoing project of PCS implementation using latest technologies, detailed study of port concessionaire's needs and cybersecurity / business continuity requirements, is at the time of TNA creation execution on time and within budget 5. Competent and flexible ICT implementation team	entry/exit locations, increasing complexity and implementation costs 4. Many different port concessionaires (among which are also terminal operators), and other stakeholders, some of whom need access to port areas only occasionally, along with different modalities and duration of access permits, additionally complicates access control. 5. Permit issuing is a commercial process, so it needs to be integrated with payment gateways
EXTERNAL FACTORS	
Opportunities	**Threats**
1. Permit issuing is a commercial process yielding revenue, increasing liquidity and solvency of Port of Rijeka Authority 2. Increase of revenue by introduction of new means of payment (prepaid, PayPal, credit card, SMS) 3. Modern system for permit issuing and access control enhances ISPS adherence for all stakeholders through traceability and analytics	1. Coordination and lack of cooperation of all participants, depending on current focus 2. Public procurement process for IT system implementation and upgrade may be lengthy and subject to revisions depending on appeals

INTERNAL FACTORS	
Strengths	**Weaknesses**
4. Cross-stakeholder transfer effects by provision of sub-module for access control by the Maritime Police 5. Use the European Union's financial resources and projects to fund parts of IT infrastructure portfolio requiring upgrades thus enhancing critical business processes	

Table 14: Strengths, weaknesses, opportunities and threats (SWOT) analysis[61]

[61] Created by the authors

7 SECTION F – MAIN RESULTS

As a part of TNA, **territory of port of Rijeka has been described**, including all its basins ,terminals and locations. Port of Rijeka operates in several basins, and it is geographically very diverse and dislocated.

Main trends in supply and demand of multimodal transport in port of Rijeka have been identified, including overview of competitive ports and railway, road and sales network.

Main tools and measures supporting multimodal transport have been thoroughly identified and explained. Operations and development of port of Rijeka have been explained in light of general and specific objectives of the national transport development strategy, including road transport and list of enhancement measures.

Future development scenarios have been outlined, in terms of recently completed projects, and their development on ongoing and future projects, along with vision 2020.-2030. for the port of Rijeka.

Relevant involved stakeholders have been mapped out (36 total, including grouped stakeholders).

Very detailed analysis of IT systems supporting operations in port of Rijeka, with emphasis on those systems managed and overseen by the Port of Rijeka Authority, has also been completed. This includes a selection of systems like office work automation, VTS, VHF, and landside ISPS support technologies like access control and CCTV. Terminal operator systems of the concessionaires, and their interconnection with PCS and MNSW have been described in detail. Special care has been taken to describe ongoing PCS project implementation in Rijeka. Conclusion of this part of analysis is that PCS project does not foresee access control and permits issuing module, and pilotage concessionaire requiring better communication tools.

Implementation stage and usage by freight agents has been identified, showing that almost all stakeholders other than truck carriers, use conventional paper-based process to obtain access to port areas, and this fact is identified as a bottleneck for further development of IT systems.

SWOT analysis has been performed, and considering that pilotage concessionaires' communication enhancement is a subject of further intra-stakeholder agreement and consensus is not yet reached, while **permits issuing and access control procedures** according to valid Regulation is a process overseen by Port of Rijeka Authority, it is concluded that **this particular IT system is a strong candidate to upgrade as a key pilot action within PROMARES, and definitive recommendation can be given for its digitalization and enhancement** as it can result in additional **increase of ISPS compliance and control of the port area, new revenue stream for Port of Rijeka and better experience for all involved parties**, along with identified cross-stakeholder transfer benefits.

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9 GLOSSARY OF USED TERMS

- **Bill of lading**

A bill of lading is similar to a waybill, and the two terms are sometimes used interchangeably. A bill of lading is more formal and often negotiable, giving the person with ownership of the bill of lading the right of ownership of the goods and the right to re-route the cargo.

- **Cargo**

The freight (goods, products) carried by a ship, barge, train, truck or plane

- **Cargo manifest**

Cargo manifest is s specification of all cargo transported on a ship or other means of transport. Its purrpose is management of the transport operation and it is in fact an aggregate of all applicable waybills.

- **Carrier**

Carrier is the party of a larger multimodal supply chain undertaking the physical transport of a consignment.

- **Clearance**

Clearance is rhe process of getting the necessary permits (written, electronic or informal) to allow a certain process to be performed. The following clearances are relevant for exchange between different actors participating in NSW:

1. Clearance for a ship to enter or leave national waters,
2. Clearance for a ship to berth. It usually includes clearance for the cargo to proceed to import control,
3. Clearance for the ship to load or offload cargo,
4. Clearance for the ship to leave berth, and
5. Clearance for cargo to be imported or exported.

Other types of clearances are also in existence, for example clearance to enter ship reporting areas, port fairways, channels, locks or other restricted traffic areas. They are usually a part of maritime traffic management rather than NSW cargo related procedures.

- **Consignor/Freight Shipper**

Freight shipper is the sender and/or formal owner of the consignment. He is generally liable for the freight or the hire for the carriage of consignment.

- **Consignment**

Consignment is a collection of goods or merchandise that has a consignor and consignee. Ownership of the merchandise shipped on consignment remains with the consignor or freight shipper until the goods are disposed of as agreed.

- **Electronic Data Interchange (EDI)**

"EDI" is used to refer to any type of electronic data interchange. The interchange can take place using XML-formatted data, UN/EDIFACT-formatted data or any other formatted text files, e.g. as comma-separated fields produced by spreadsheet editing tools. Electronic commerce has been under intensive development in the transportation industry to achieve a competitive advantage in international markets.

- **Electronic messaging**

Electronic exchange of information is the most efficient way to perform the necessary administrative formalities related to ships before loading or discharging cargo. Considering that Convention on Facilitation of International Maritime Traffic (FAL Convention) still requires authorities to accept paper forms when presented, the definition of a single window does not preclude the use of paper documents, where appropriate.

- **Electronic Port Clearance (EPC)**

"EPC" is used to refer to a single window solution for the electronic clearance of ships arriving at or departing from a port. It generally does not normally include cargo clearance for import or export, but instead, it is connected with administrative procedures related to ship.

- **Electronic signature**

Electronic signature is data in electronic format attached to or logically associated with other electronic data that serve as a method of authentication that meets the following requirements:

1. Unique to the signatory,
2. Identification of the signatory,

3. Created using means that the signatory can maintain under his/her sole control, and

4. Linked to the data to which it relates in such a manner that any subsequent change of the data is detectable.

- **Freight Forwarder**

Freight Forwarder is the party arranging the carriage of goods including related services and/or associated formalities on behalf of a freight shipper or consignee. The freight forwarder is often contracted by the principal, the consignor or the consignee, depending on which terms of contract apply in the business relation between them.

- **Harbor**

A port of haven where ships may anchor.

- **IMO FAL forms**

IMO FAL forms are a number of paper forms defined in the FAL Convention defining reporting requirements for ships visiting foreign ports.

- **Intermodal shipment**

When more than one mode of transportation is used to ship cargo from origin to destination, it is called intermodal transportation. For example, boxes of hot sauce from Louisiana are stuffed into metal boxes called containers at the factory. That container is put onto a truck chassis (or a railroad flat car) and moved to a port. There the container is lifted off the vehicle and lifted onto a ship. At the receiving port, the process is reversed. Intermodal transportation uses few laborers and speeds up the delivery time.

- **Manifest**

The ship captain's list of individual goods that make up the ship's cargo.

- **Maritime**

Located on or near the sea. Commerce or navigation by sea. The maritime industry includes people working for transportation (ship, rail, truck and towboat/barge) companies, freight forwarders and customs brokers; stevedoring companies; labor unions; chandlers; warehouses; ship building and repair firms; importers/exporters; pilot associations, etc.

- **Port**

This term is used both for the harbor area where ships are docked and for the agency (port authority), which administers use of public wharves and port properties.

- **Port of call**

Port at which cruise ship makes a stop along its itinerary. Calls may range from five to 24 hours. Sometimes referred to as "transit port" and "destination port."

- **Port Community System (PCS)**

PCS is defined as a computerized system used to simplify information exchange between non-public authorities in a port. This may include functionalities also found in single windows, such as databases and message exchanges. The definition varies depending on the contexts, and exchange of information with governmental parties could also be part of the scope of a PCS.

- **Port Single Window (PSW)**

PSW is a system that may be connected to a higher-level NSW that provides local level information about a vessel to the authorities at port level.

- **Principal**

Principal is sn individual or organization that entrusts the execution of a carriage order to a contracting party in return for appropriate remuneration. It is a generic term for the entity that requests carriage; for example, the consignor, consignee, freight forwarder or any third party.

- **Ship's agent**

Ship's agent represents the ship's owner or charterer in port. In cooperation with the port, the ship's agent is responsible for arranging a proper berth and pilots, performing all administrative tasks related to the vessel with the port and other authorities and releasing or receiving cargo on behalf of the ship's owner or charterer.

- **Single Window**

Single window is a system that allows parties involved in trade and multimodal transport to provide standardized information and documents through a single-entry point to fulfil all import, export and transit-related regulatory requirements, avoiding multiple data entry and other redundancies in case that information is in electronic form.

Some basic models for the implementation of the single window are:

1. *A single authority* that receives information, either on paper or electronically, disseminates this information to all relevant governmental authorities and coordinates controls to prevent undue hindrance in the logistical chain,
2. *A single automated system* for the collection and dissemination of information (either public or private) that integrates the electronic collection, use and dissemination (and storage) of data related to trade that crosses the border.
3. Integrated system: data is processed through the system. Subtype of this system is decentralized interfaced system (decentralized), where data is sent to the agency for processing. In some cases, two approaches are used simultaneously in a combination.

Single window is also an automated information transaction system through which a trader can submit electronic trade declarations to the various authorities for processing and approval in a single application. Sometimes, single window *environment* term is used because single window implementations are usually a set of interdependent facilities, regulatory requirements and cross-border regulatory agencies' business processes. The establishment of the single window environment for border control procedures is considered by customs administrations as the best solution to the complex problems of border automation and information management involving multiple cross-border regulatory agencies.

- **Terminal operator**

The company that operates cargo handling activities on a wharf . A terminal operator oversees unloading cargo from ship to dock, checking the quantity of cargoes versus the ship's manifest (list of goods), transferring of the cargo into the shed, checking documents authorizing a trucker to pick up cargo, overseeing the loading/unloading of railroad cars, etc. It performs the action of unloading of cargo at a port or point where it is then reloaded, sometimes into another mode of transportation, for transfer to a final destination.

- **UN/EDIFACT**

UN/EDIFACT is the abbreviation for the United Nations Electronic Data Interchange for Administration, Commerce and Transport. It is a special format defined by UN/CEFACT and

standardized by the International Organization for Standardization (ISO) as the ISO 9735 standards.

- **Waybill**

Waybill is an agreement between consignor, carrier and consignee covering the transport of a consignment. This agreement covers the ownership and liability issues of the parties in relation to the consignment.

Annex 1 – stakeholder engagement

#	Stakeholder	Type of organisation	Description	Power of influence	Interest in involvement	Role	Benefit/conflict
1	Port of Rijeka Authority	Port Authority	Port Authority	**HIGH, PROJECT LEADER**	Directly involved in project implementation, user	Optimisation of terminal, truck railway and port efficiency	Pronounced increase of port efficiency and safety. No conflict.
2	Harbourmaster's Office	Port Authority	Port Authority	**HIGH**	Indirectly involved in project implementation, user	Inspection of navigation safety, inspection of the maritime domain	Pronounced increase of port efficiency and safety. No conflict.
3	Ministry of Finance (Customs Administration)	Ministry	State Ministry	**MEDIUM**	Indirectly involved in project implementation, user	Harmonising administrative procedures, optimisation of terminal efficiency	Pronounced increase of port efficiency and safety. No conflict.
4	Ministry of the Interior (Maritime police)	Ministry	State Ministry	**HIGH**	Directly involved in project implementation, user	Port and operations security assessment and oversight	Pronounced increase of port efficiency and safety. No conflict.

5	Ministry of the Sea, Transport and Infrastructure	Ministry	State Ministry	**HIGH, MANAGING THE PROJECT LEADER**	Indirectly involved in project implementation, user	Harmonising administrative procedures, optimisation of terminal efficiency	Pronounced increase of port efficiency and safety. No conflict.
6	Phytosanitary inspection of Ministry of Agriculture	Ministry	State Ministry	**LOW**	Not involved in project implementation, user	Harmonising administrative procedures	Pronounced increase of port efficiency and safety. No conflict.
7	Veterinary inspection of Ministry of Agriculture	Ministry	State Ministry	**LOW**	Not involved in project implementation, user	Harmonising administrative procedures	Pronounced increase of port efficiency and safety. No conflict.
8	Ministry of Health (Department for Sanitary Inspection)	Ministry	State Ministry	**LOW**	Not involved in project implementation, user	Harmonising administrative procedures	Pronounced increase of port efficiency and safety. No conflict.
9	HŽ Infrastruktura Ltd.	Railway infrastructure provider	Railway infrastructure provider	**LOW**	Indirectly involved in project implementation, user	Modernisation of railway infrastructure and procedures	Pronounced increase of port efficiency and safety. No conflict.

10	Port of Rijeka Plc.	Port operator	Biggest port concessionaire in Croatia	**HIGH**	Directly involved in project implementation, user	Harmonising administrative procedures, optimisation of terminal efficiency	Pronounced increase of port efficiency and safety. No conflict.
11	AGCT Ltd.	Port operator	Container terminal operator (member of Global Container Operator ICTS)	**HIGH**	Directly involved in project implementation, user	Harmonising administrative procedures, optimisation of terminal efficiency	Pronounced increase of port efficiency and safety. No conflict.
12	Ministry of Agriculture	Ministry	State Ministry	**LOW**	Not involved in project implementation, user	Harmonising administrative procedures	Pronounced increase of port efficiency and safety. No conflict.
13	Ministry of the Interior	Ministry	State Ministry	**LOW**	Directly involved in project implementation, user	Harmonising administrative procedures, optimisation of terminal efficiency	Pronounced increase of port efficiency and safety. No conflict.
14	Ministry of Health	Ministry	Ministry	**LOW**	Not involved in project implementation, user	Harmonising administrative procedures	Pronounced increase of port efficiency and safety. No conflict.

15	Other port service concessionaires (waste management, towing, pilotage, suppliers etc.)	Commercial	Providers of services to ships	**LOW**	Directly involved in project implementation, user	Modernisation of port infrastructure and procedures	Pronounced increase of port efficiency and safety. No conflict.
16	Ship owners	Commercial	Owner of a merchant vessel (commercial ship) involved in the shipping industry	**LOW**	Directly involved in project implementation, user	Modernisation of port infrastructure and procedures	Pronounced increase of port efficiency and safety. No conflict.
19	Ship's agents	Commercial	Subject acting on behalf of the ship owner, providing local knowledge and expertise and making sure that the ship's needs or requirements are met	**LOW**	Directly involved in project implementation, user	Modernisation of port infrastructure and procedures	Pronounced increase of port efficiency and safety. No conflict.

20	Freight agents	Commercial	Subject held responsible for handling cargo, and the general interests of its customers, at ports, on behalf of ship owners	LOW	Directly involved in project implementation, user	Modernisation of port infrastructure and procedures	Pronounced increase of port efficiency and safety. No conflict.
21	Truck carriers	Commercial		MEDIUM	Directly involved in project implementation, user	Modernisation of port infrastructure and procedures	Pronounced increase of port efficiency and safety. No conflict.
22	Visitors to port area	Commercial and non-commercial	Third-party commercial and non-commercial visitors to port area	LOW	Not involved in project implementation, user	Modernisation of port infrastructure and procedures	Pronounced increase of port efficiency and safety. No conflict.
23	HŽ Cargo Ltd.	Railway operator	Biggest state-owned railway operator	LOW	Indirectly involved in project implementation, user	Harmonising administrative procedures, systematic promotion model	Pronounced increase of port efficiency and safety. No conflict.
24	PPD Transport Ltd.	Railway operator	Private railway operator	LOW	Indirectly involved in project implementation, user	Harmonising administrative procedures, systematic promotion model	Pronounced increase of port efficiency and safety. No conflict.

25	Rail Cargo Carrier – Croatia Ltd.	Railway operator	Private railway operator	**LOW**	Indirectly involved in project implementation, user	Harmonising administrative procedures, systematic promotion model	Pronounced increase of port efficiency and safety. No conflict.
26	Rail & Sea Ltd.	Railway operator	Private railway operator	**LOW**	Indirectly involved in project implementation, user	Harmonising administrative procedures, systematic promotion model	Pronounced increase of port efficiency and safety. No conflict.
27	SŽ Tovorni promet Ltd.	Railway operator	Private railway operator	**LOW**	Indirectly involved in project implementation, user	Harmonising administrative procedures, systematic promotion model	Pronounced increase of port efficiency and safety. No conflict.
28	Train Hungary Ltd.	Railway operator	Private railway operator	**LOW**	Indirectly involved in project implementation, user	Harmonising administrative procedures, systematic promotion model	Pronounced increase of port efficiency and safety. No conflict.
29	Transagent rail Ltd.	Railway operator	Private railway operator	**LOW**	Indirectly involved in project implementation, user	Harmonising administrative procedures, systematic promotion model	Pronounced increase of port efficiency and safety. No conflict.

30	Croatian Bureau of Statistics	Governmental agency	Governmental agency	LOW	Not involved in project implementation	Provision of data for evaluation of efficiency of administrative procedures	Increased data reliability. No conflict.
31	Croatian Chamber of Economy	Governmental agency	Governmental agency	LOW	Not involved in project implementation	Harmonising administrative procedures	Increased data reliability. No conflict.
32	Council for ports	Professional Association	An association responsible for port development	MEDIUM	Indirectly involved in project implementation	Harmonising administrative procedures, optimisation of terminal efficiency	Improvement of administrative procedures and financial savings for members. No conflict.
33	Association of Ship Brokers and Agents of Croatia	Professional Association	Association of Ship Brokers and Agents of Croatia	MEDIUM	Indirectly involved in project implementation	Harmonising administrative procedures, optimisation of terminal efficiency	Improvement of administrative procedures and financial savings for members. No conflict.
34	Association of international freight forwarders and custom shippers	Professional Association	Association of international freight forwarders and custom shippers	MEDIUM	Indirectly involved in project implementation	Harmonising administrative procedures, optimisation of terminal efficiency	Improvement of administrative procedures and financial savings for members. No conflict.

35	Association of Road Carriers	Professional Association	Association of Road Carriers	MEDIUM	Indirectly involved in project implementation	Harmonising administrative procedures, optimisation of terminal efficiency	Improvement of administrative procedures and financial savings for members. No conflict.
36	Faculty of maritime studies	University	Biggest and oldest maritime faculty in Croatia	MEDIUM	Indirectly involved in project implementation	Provider of scientific methodology for harmonising of administrative procedures and optimisation of terminal efficiency	Availability of practical field for confirmation of scientific hypothesis. No conflict.