Integrated and Sustainable Transport in Efficient Network - ISTEN

DT1.1.8 – Local context analysis for Bar

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Document information

Abstract

The goal of this report is to provide a detailed analysis of the port-hinterland chain of Port of Bar, current state of the art of the port, challenges faced as well as elaborated development plans and actions for future. This analysis brings a general overview of all bottlenecks in the Port of Bar, their possible solutions and plausible mid-term scenarios of local context and their impact.

Keywords

Local context analysis, port-hinterland, bottlenecks, scenarios

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* Abbreviations of editor/contributor name

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1 INTRODUCTION

General goal of this deliverable is to analyze state of the art of the cargo port in Bar as this is the main cargo port in Montenegro. In addition to the current status of the port infrastructure, port operations, port development perspectives and its links with the hinterland, the document reflects current status of digitalization in port community in Montenegro (Port of Bar leads a process of implementation of the Port Community System in Montenegro).

As a port, Port of Bar have a daily contacts with its stakeholders (freight forwarders, agents, Custom administration, etc.) and a permanent themes of this communication are as follows:

- close coordination and common efforts of all transport sector actors, modeled in an adequate manner (these are important prerequisites for concretization of any improvements)
- increasing degree of logistic integration between transport system
- simplification of administrative procedures
- improving level of offered services quality
- further research on potential market (for all types of cargo)
- etc.

In this context, Port of Bar have identified several main stakeholders:

- Ministry of transport and maritime affairs of Montenegro
- Custom administration of Montenegro
- Maritime Safety Department of Montenegro
- Harbour Master Office
- Interlog (Maersk agents in Montenegro, etc.)
- Logicar (Grimaldi representative in Bar)
- Occean Montenegro (pilotage, mooring and tug services)
- Jadroagent (freight forwarder)
- Etc.

The contributions of the stakeholders were added in followings parts of this document

2 CHARACTERISTICS OF THE LOCAL ENVIRONMENT

2.1 Port-hinterland chain overview

The Port of Bar was founded in 1906, when construction started following the design of Coen Caglia, the Italian expert in maritime construction, who had at that time designed the port for an annual turnover of 3 million tons of cargo. Out of all what was planned in that period, only the 250 meter long breakwater was constructed and put into operation on October 23, 1909. Towards the end of World War II (1944) almost complete port was mined and destroyed. Its reconstruction started in 1950, and construction works for a large port started four years later. The first phase was completed in 1965.

Bar is the main cargo port in Montenegro and area of the port covers 200 ha (including port aquatorium with cca. 90 ha and its depth up to 14m). According to the Spatial plans for the port area, additional 400 ha are dedicated for further development of port area. The Port of Bar is situated at the entrance to the Adriatic sea, precisely at 42˚05' of the North latitude and 19˚05' of the East longitude, at a distance of 976 nautical miles (nm) to Suez canal and 1190 nm to Gibraltar. The Montenegrin sea ports system is managed according to landlord port model introduced by law on ports which was put into force in the year 2011. Currently, at the area of the port of Bar two principal operators are functioning, “Port of Bar” H.Co. and “Port of Adria”. Both companies are shareholding companies. In the “Port of Bar” H.Co. major percentage of shares are owned by the Government of Montenegro (54,05%) and in the “Port of Adria”, major shareholder is Turkish company “Global Ports Holding”, owning 62% of shares.

Geographic position of the Port of Bar is presented with the next figure (Figure 1.).

Figure 1: Railway and road distances from the Bar to the main regional centres

Port of Bar is one of the essential elements of transport, and therefore the economic system of Montenegro, through which almost complete trade of goods is carried out overseas. By indicative extension of the basic regional transport TEN-T network on the area of Western Balkans, the Port of Bar is included in the list of ports of regional significance (Figure 2.).

Figure 2: Indicative extension of the basic regional transport TEN-T network (source:ec.europa.eu)

Integrated with the Belgrade - Bar railway and road traffic network, the Port represents a very important link in the chain of intermodal transport. The Port is a junction of the trunk road M–24 Herceg–Novi – Bar - Ulcinj and the road Bar – Podgorica - Belgrade. The Bar is a point of departure of the railway line Bar - Belgrade. Podgorica airport is cca. 45 km far away whereas Tivat airport is cca. 50 km far away from the Bar. Bar has great potentials as a regional importance port. The quality of the port infrastructural links with its hinterland has a strong influence on the current port capacity utilization rate.

The Montenegrin sea ports system is managed according to landlord port model introduced by law on ports which was put into force in the year 2011. Currently, at the area of the port of Bar two principal operators are functioning, “Port of Bar” H.Co. and “Port of Adria. Both companies are shareholding companies. In the “Port of Bar” H.Co. major percentage of shares are owned by the Government of Montenegro (54,05%) and in the “Port of Adria”, major shareholder is Turkish company “Global Ports Holding”, owning 62% of shares.

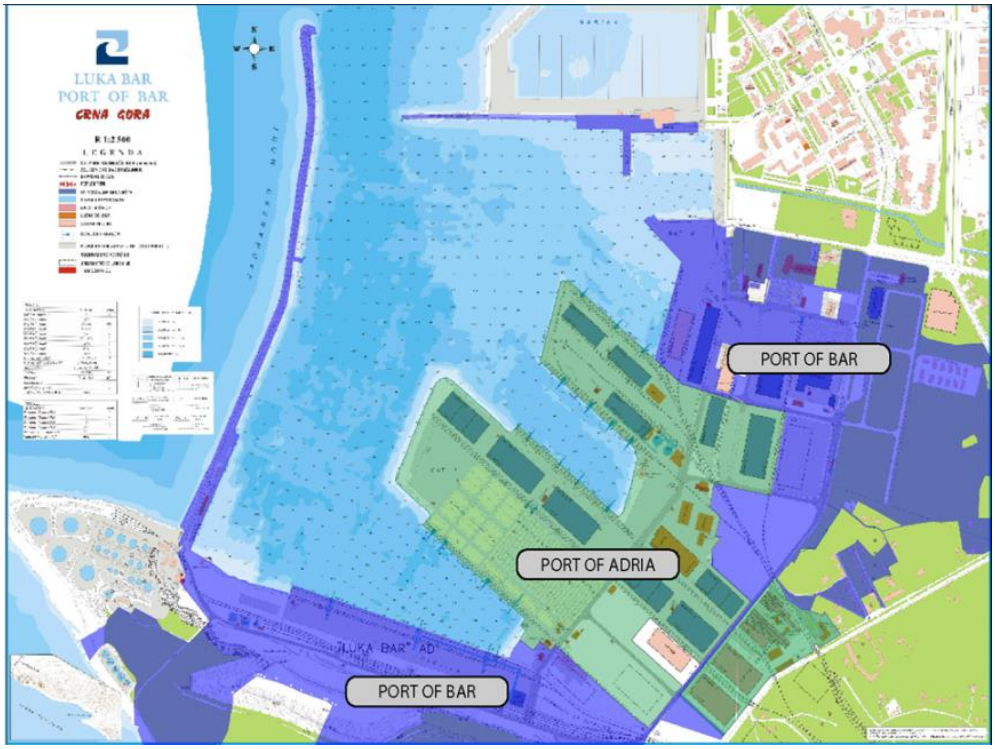

Figure 3: Map of the area of the 2 main operators in the port

“Port of Bar” H. Co

As mentioned before, Port of Bar is a holding company in which the State of Montenegro holds the majority of shares – 54,05%. The stakeholders of the remaining 45,95% shares are citizens, employees of Port of Bar, different legal entities and privatization funds. The main activity of “Port of Bar” H. Co. is handling and storage of dry bulk cargo, liquid cargo, special cargo, Ro-Ro and general cargo, passenger traffic and stuffing and stripping of containers. In addition, Port of Bar is a Free zone at almost whole of its area, which enables the possibilities of organizing the manufacturing and other activities by using the advantages which the operation in the Free zone regime provides. Capacity of the “Port of Bar” H.Co. is ~2,7 million tones of different types of cargos, per year.

The following specialized terminals exist in the “Port of Bar” H. Co.:

- Liquid cargo terminal,
- Dry bulk cargo terminal,
- Ro-Ro terminal and,
- Passenger terminal.
- In addition, in Port of Bar there are several facilities purposed for handling operations and storing general cargo (closed storage, cold storage, etc.).

Data related to the cargo throughput for the period 2015 – 2018 are given in the Table 1.

Year	Dry Bulk	Ro-RO	Liquid	TOTAL
2015	443.130,84	132.480,51	211.639,00	787.250,35
2016	798.672,53	121.567,38	253.672,47	1.173.912,38
2017	1.349.761,95	83.168,74	267.606,64	1.700.537,33

Table 1: Throughput statistic for the Port of Bar (2015 – 2017) in tonnes

Dry bulk cargo terminal

Dry bulk cargo terminal is located on the Volujica quay and equipped with:

- three gantry cranes with 12t capacity;
- mobile Harbour Crane Liebherr LHM 550 with 144t capacity;
- grain loading tower (hourly capacity 300 t/h);

Operational quay of the terminal is 550 m with water depth of 14 m. It is specialized for acceptance and dispatch of all types of ores, concentrates, as well as other types of bulk cargo. The area of the open storage space on concrete base extends to 27 000 m^2. Grain silo with capacity of 30 000 t is situated within the dry bulk cargo terminal. Closed conveyer belt, 250m long, is installed and designed for reception and dispatch of grain to/from the silo. For cargo ship unloading operations 12t gantry cranes are used while for loading operations, pursuant to technical capacities of automated silo lines, 300t/hrs loading tower is used. The silo, equipped with temperature and humidity measurement system avails with 16 silo cells as well as 9 inter-cells.

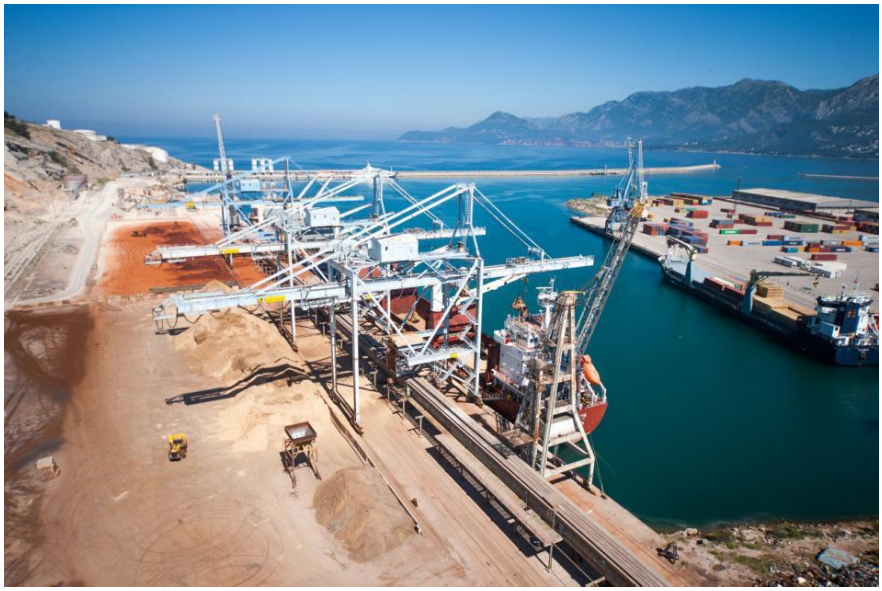

Figure 4: Dry bulk cargo terminal

Liquid cargo terminal

Liquid cargo terminal - installed storing facilities for liquid cargo are: 23 reservoirs for oil derivatives on the Volujica hill with total capacity of 116.600 m^3 owned by Jugopetrol – Kotor (Montenegro) and Montenegro Bonus – Cetinje (Montenegro);

- 2 reservoirs for leach, total capacity of 10.000 m^3 (owned by KAP – Podgorica (Montenegro));
- 1 reservoir for oil, capacity 1.400 m^3 (owned by the Port of Bar);
- specialized discharging point for acetic acid, 600 t/h capacity (owned by the MSK Crna Gora (Montenegro).

Water depth directly in front of the quay wall is 12 m.

Ro–Ro terminal

Ro–Ro terminal (Figure 5) is designed for acceptance, storage and dispatch of Ro–Ro cargo units (complete road vehicles or parts of vehicles-trailers and semi-trailers). Open storage area with asphalt-concrete paving's completely secured without contact with handling flows of other cargo. The terminal is located on the Pier 3. Handling operation is carried out through operational quay which is 270 m long (berth 26 and 31) and water depth amounts to 10 m.

Figure 5: Ro-Ro Terminal in Port of Bar

Passenger terminal

The Port of Bar possesses specialized terminal with modern facility for services to the passengers and five berths for passenger ships and ferryboats. Directly beside the terminal there is a space for road vehicles that carry out Ro–Ro traffic through this terminal. Handling operation is carried out through operational quay which is cca. 400 m long and water depth 4-5,9 m.

* * *

In the Table 2 are given data related to the modal split in the "Port of Bar" H. Co.

Year	Trucks	Wagons	Total
2015	454.564,54	224.109,41	678.673,95
2016	434.196,55	700.027,97	1.134.224,52
2017	486.998,08	980.090,02	1.467.088,10

Table 2: *Modal split in "Port of Bar" H. Co. in tones*

"Port of Adria"

Port of Adria is a multipurpose port featuring quay length of 1,440 m with dedicated terminals for container ships, general cargo ships, Ro-Ro and cruise ships. It covers the total area of 518.790 m^2 with nine berths. Whole area of Port of Adria is within the Free zone regime.

As for the Port of Adria, there are three following specialized terminals:

- General cargo terminal

- Container terminal
- Timber Terminal.

Throughput statistic for 2017 (and number of ships loaded/unloaded) in Port of Adria are presented in the Table 3 and Table 4.

Containers	Other cargo	Total
387.749,00	213.207,00	600.956,00

Table 3: Throughput statistic for 2017 in Port of Adria in tones

	TEU	Tones	No of ships
Port of Adria	49.282	600.956	219

Table 4: Statistic for the 2017

General cargo terminal

General cargo terminal with surface of 12.300 sqm is located on Piers 1 and 2 that are, in terms of space and technically, qualified and equipped for acceptance and dispatch of all types of general cargo. General cargo terminal includes closed and open storage systems, handling-operational and traffic surfaces. On the terminal there are complete horizontal and vertical mechanical equipment with 15 portal cranes with carrying capacity ranging between 3-20 t and quay that is 1 370 m long with average depth of sea up to 10 m. It is specialized for acceptance and dispatch many final or semi-final products.

Timber terminal

Timber terminal covers the area of 5,86 ha and encompasses several subsystems for: acceptance and despatch of transportation vehicles, loading, unloading and transhipment, storing sawn wood, wood products, sorting and forming units for despatch, drying of woods and others. Capacity of the terminal ranges from 40 000 to 60 000 m^3/year, depending on type and shape of wood products. The terminal includes 23 400 m^2 of covered space.

Container terminal

The length of the operational quay is 330 m (with two berths for container vessels), the depth of the aquatorium is 12 m. The sea bottom can be dredged to the level of – 14 m. The soil below the level – 12 m consists of sandy material with layers of clay. The Terminal occupies the area of 45 900 $m^{2.}$.

2.2 Port-hinterland chain operations

Hinterland connection

Starting from the fact that development of the Port depends very much on a lot of external influential factors of different nature and intensity of influence, at first will be mentioned important national and regional development projects from the field of transport and logistic which have to be taken into account:

- Building Highway Bar – Belgrade;
- Building Adriatic-Ionian Highway in Montenegro;
- Reconstruction and modernization of the railway Bar – Belgrade;
- Building inter-modal terminals at the railway stations in Bar, Podgorica and Bijelo Polje;
- Development short sea shipping links with Adriatic ports; etc.

Railway connections

Port of Bar is a point of departure of the railway line Bar – Belgrade (Serbia). Railway network in Montenegro consists of three railroads and they are as follows: Vrbnica-Bar (part of the railroad Belgrade-Bar on the territory of Montenegro); Podgorica-Nikšić; and Podgorica-Božaj (part of international railroad Podgorica-Shkoder (Albania) at the territory of Montenegro).

Figure 6: *Railway system in Montenegro*

The Port of Bar is the final station of the Belgrade-Bar railway, completed in 1975, as one of the major engineering and construction achievements in former Yugoslavia. The railway

Belgrade–Bar is a standard gauge railway, 476 km long. Of this length, 301 km of the railway goes through Serbia, and 175 km through Montenegro. It passes through 254 tunnels of total length of 114 km and over 435 bridges of total length of 14 km.

Road connections

The total length of Montenegro's road network is 6 928 km, out of which almost ¾ refers to the category of local roads. The length of main or regional roads is 846 km or 950 km and there are 312 bridges and 136 tunnels. Contemporary road surface makes 79% of main roads, 37% of regional roads and 60% of local roads. Density of regional and main roads is 13 km/100 km^2. It is important to point out that at the moment there is no highway in Montenegro.

The network of main roads consist of the following roads:

- the border with Serbia – Bijelo Polje – Ribarevina – Mojkovac – Kolašin – Podgorica – Petrovac – Budva – Kotor – Herceg Novi (the border with Croatia) – one section of the road M-2,
- the border with Serbia – Bijelo Polje – Ribarevina – Berane – Rožaje – the other section of the road M-2,
- Podgorica – Cetinje – Budva – M-2.3,
- Petrovac – Bar – Ulcinj – the border with Albania – M-2.4,
- Šćepan Polje – Plužine – Nikšić – Danilovgrad – Podgorica – Božaj – M-18,
- Nikšić – Vilusi – M-6,
- Gradac – Pljevlja – the border with Serbia – M-8,
- Kolašin – Andrijevica – M-9.

600 km from the total length of the main road network belongs to the international E – road network. Main road M-2 is a part of the roads E65 and E80, while M-18 belongs to the road E762. Main road M-21 belongs to the European road network labelled as E763 and it connects Bijelo Polje with Belgrade. The existing road E763, roads E65 and E80 up to the border with Croatia represent the corridor of the planned highway Belgrade – South Adriatic.

Development of road transport and transport infrastructure implies the construction of several key roads, i.e. highways and main roads which with their transport-exploitation fiscal and technical conditions would provide integration of Montenegrin transport network into the TEN-T network.

Port Community System

Port of Bar has recognized importance of digitalization in the processes in the port and within EU support through the CBC and Transnational cooperation, Port of Bar has introduce a first phase of Port Community System (PCS) in 2014.

The overall objective for implementation PCS (Figure 7) in Port of Bar are:

- to ensure efficient and secure exchange of working documentation for all subjects in the port community;
- reduction of the service costs;
- transparency of services for public authorities and service users, according to their role;

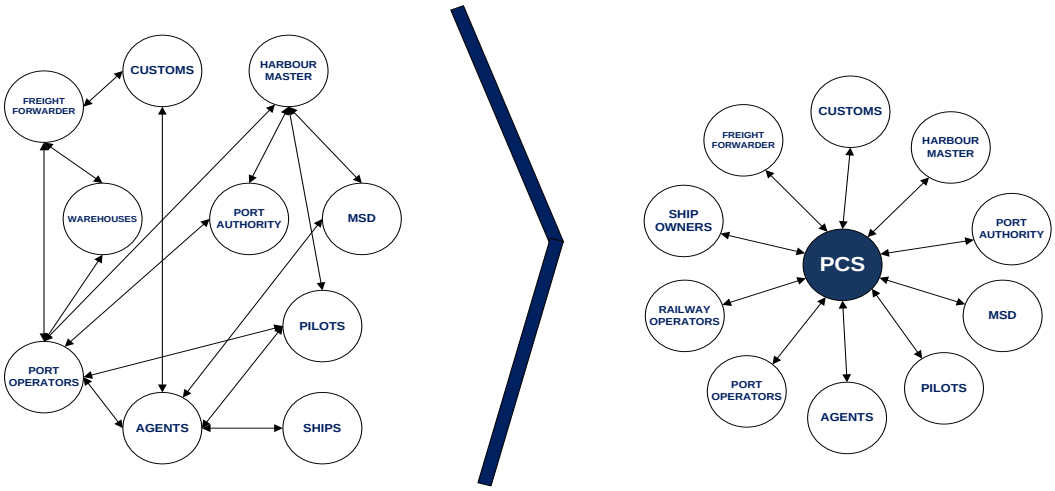

Figure 7: Past and current connection (with and without PCS)

Port Community System is a centralized and automated system for exchanging of information and documentation between organizations and marine transport authorities.

- Receipt of messages from senders or sender systems in real-time:
- Verification of conformity of messages
- Sending replies to the sender
- Transformation of messages into a format, which is expected by receivers
- Platform independence
- Recording of messages into a database - “message repository”
- Sending messages to receivers (xml format, un/edifact, flat file messages, etc.)

It is important to point out that:

- PCS is in line with EU Directive 65/2010;
- PCS improved port operations and increase competitiveness of the Port of Bar;
- PCS enable quicker logistic processes and operations in Bar;
- Integration of Port Community Systems or Port Single Windows with national and international web portals

- PCS will enable integration of Port Community Systems with national and international web portals;

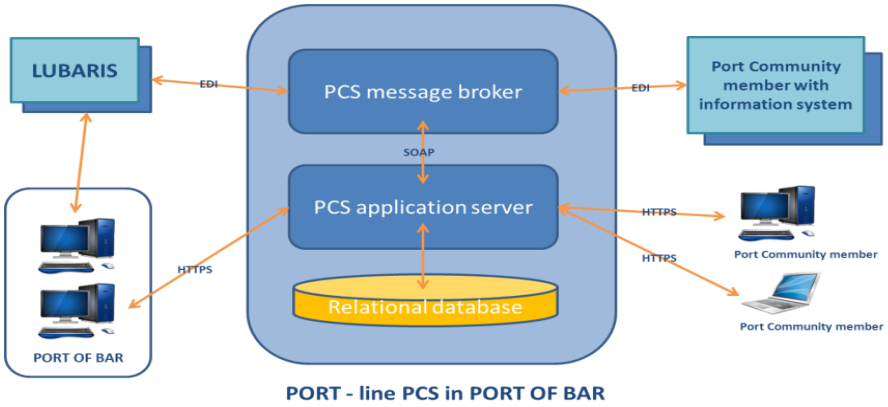

Figure 8: *Structure of the PCS in Port of Bar*

In Port of Bar, there is information system called "LUBARIS" which cover all working processes in the port. This system was introduced in 2001. As one of the main disadvantages of this ICT system was recognized lack of communication with other ICT systems (ICT systems of the Customs, agents, forwarders, rail companies...). Within the 2014, Port of Bar has introduced Port Community System (PCS framework and module Disposition) and in this first phase PCS has established connection with Customs, forwarders and other stakeholders of the port.

In 2015 and 2016, new module Vessel has been introduced in Port Community System and necessary LUBARIS upgrade to the new conditions of functioning in the situation when PCS (Port Community System) is being introduced (electronic delivery of ship announcement, order forms for commissioning pilot, time of mooring and unmooring as well as submission of requests for approval for line handling of ships, etc.). These improvements involve all stakeholders (in particular passengers, state authorities, forwarders, agents, etc.) in the port and new functionality in the PCS (system of notification) will enable better info mobility in the port community.

2.3 Port-hinterland chain governance

The Montenegrin sea ports system is managed according to landlord port model introduced by Law on ports which was put into force in the year 2011. Montenegro has advanced legislation integration in Maritime, having harmonized Directive 2002/59/EC and parts of Directive 2010/65/EU on the single-window system.

In the field of Rail Transport, only about 15% of the EU legislation has fully been transposed. With respect to Road Transport, Montenegro has transposed 49% of the Treaty Rules. With

respect to Maritime Transport, Montenegro has transposed 70% of EU directives and legislation. (source Transport Development Strategy Report 2017).

Basic legal document regulating special regime of conducting economic activities in free zones is Law on free zones in Montenegro (Official gazette of the Republic of Montenegro no. 042/04 dated 22.06.2004; Official gazette of Montenegro no. 011/07 dated 13.12.2007, no. 076/08 dated 12.12.2008, no. 073/10 dated 10.12.2010, no. 040/11 dated 08.08.2011, no. 040/16 dated 30.06.2016.)

The Free zone law contains provisions for setting up and termination of operation of free zones, governance of free zones, as special conditions of doing business (benefits) according to which zone users conduct an economic activity:

- Free zone is defined as section of the customs territory of Montenegro on which economic activities are conducted under special conditions laid down by this Law,
- Founders of zones may be one or several domestic and foreign legal and natural person,
- Zones are founded subject to previous approval of the Government, on motion of the Ministry in charge and on the basis of submitted feasibility study for setting up of such zones,
- The Zone is managed by the entity defined by the deed of association (operator),
- Customs administration issues certificate on start up of business operation of the zone if conditions for conducting customs supervision on its area are fulfilled,
- User of zone is domestic or foreign legal or natural person who conducts an aconomic activity on its territory.

“General rules of practice in the Free zone Port of Bar”, adopted by “Port of Bar” H.Co., constitutes the internal legislation of the Zone and make an integral part of each contract on conducting business operations in the Zone.

General rules regulate procedure and conditions for setting up and conducting activities, general conditions for use of the land and facilities and internal code of practice in the Free zone Port of Bar. It is regulated that potential user approach with written request to the Port-Operator upon which follows the procedure of decision making by the responsible level of management of the Port of Bar” H. Co.

The Operator (“Port of Bar” H.Co.) gives preference and special benefits to users whose programs are qualified by virtue of the amount of invested capital, rise in handling volume of goods through the Port of Bar, duration of business deal, number of employees, export effects, rented space and similar. Additional benefits are granted to users that invest funds in infrastructure and development of the Zone.

The free zone regime, according to the Decision of the Government of Montenegro adopted in March 2000, covers the entire territory and facilities of the Port of Bar, excluding passenger terminal - Pier V and part of the area of the Pier III. This territory includes Terminal for bulk,

liquid and special cargo, Grain terminal, main breakwater, open-air storage area, some of service-repair facilities and administrative facilities.

The Port of Bar H.Co. holds authorization of free zone operator for the territory of Container terminal and general cargo company as well. The entire area of the territory of both companies that is qualified for conducting business operations under free zone regime extends to over 130 ha, with firm orientation to develop this area and extend it further inside the area of Barsko polje, in accordance with requests of potential users and upon fulfilling technical preconditions.

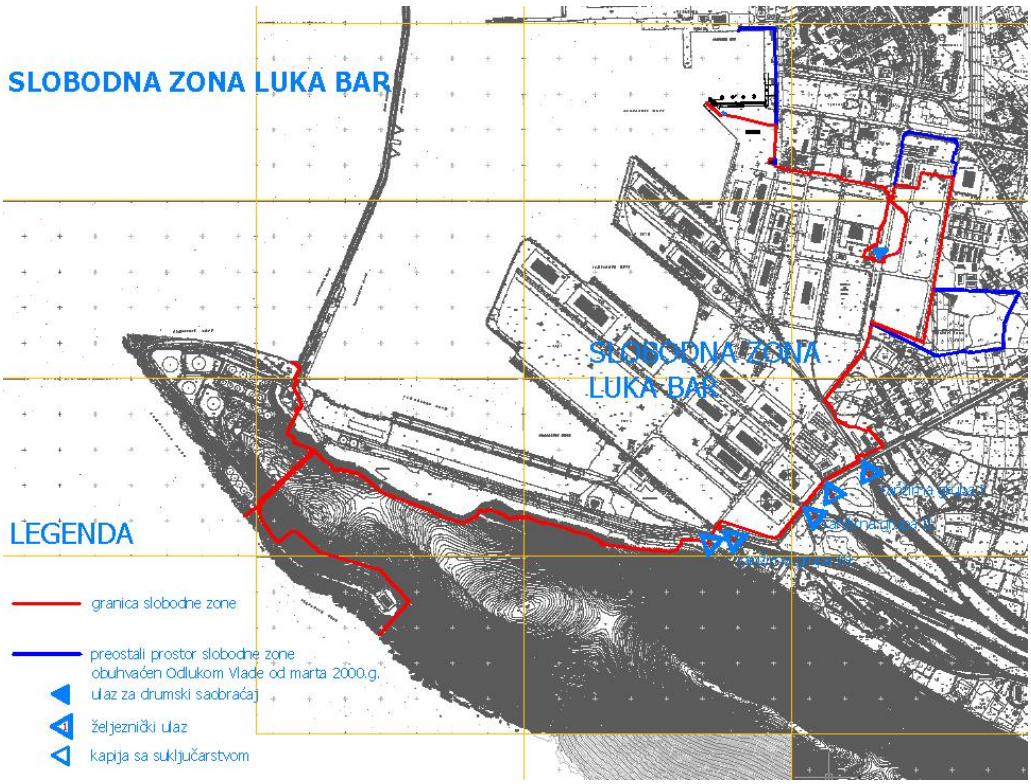

Figure 9: Border of the free zone in the port (red line)

3 BOTTLENECKS TOWARDS BECOMING AN INTEGRATED HUB

3.1 Market bottlenecks

3.1.1 Market bottlenecks identified

Economic growth in the Western Balkans has strengthened to an estimated 3.5%. In most of the region, growth projections for 2018 have been revised upward. Kosovo and Albania are expected to grow at 4% this year. At 3.8%, Montenegro's growth is projected to be 1 percentage point higher, although still lower than last year. Growth in Bosnia and Herzegovina continues to be stable at an estimated 3.2%. Serbia's economy has rebounded to 3.5% growth after last year's weather-related slowdown. Macedonia's growth also rebounded to 2.5%, as investor confidence was restored (source http://www.worldbank.org)

The low level of the economic activities in port hinterland is a main identified bottlenecks related to the market of the port (current level of the economic activities are not near of the level in Yugoslavia). In addition, sometimes political issues have caused the problems. At the moment the stakeholders have noticed lack of integration of the port hinterland system.

Figure 10: Market of the port

3.1.2 Impacts of market bottlenecks

As all countries try to became EU member level of integration in the Port of Bar hinterland will be better in the future.

3.2 Infrastructural bottlenecks

3.2.1 Infrastructural bottlenecks identified

Railway connections

Besides elements given in the previous segments of this document (Chapter 2.2), here are given some more details related to the bottlenecks related to the railway connections of the Port of Bar with Its hinterland.

When the railway Bar – Belgrade was built, a train took approximately 7 hours to go from Bar to Belgrade, while now it takes 11-12 hours, due to speed restrictions, as the railway cannot safely sustain the projected speeds prior to thorough reconstruction. Bar – Vrbnica (the latter at the Montenegro – Serbia border) is the most important section of the Montenegrin rail network (Figure 11). As a whole, rail is an important part of the Montenegrin economy, accounting for almost 60% of all freight and 10% of passenger travel (source: WBIF - Orient/East-Med Corridor (R4): Montenegro – Serbia Rail Interconnection). At present, Bar-Belgrade railway does not meet modern rail transport requirements with regard to railway transport, speed, service level and reliability. This situation has led to efforts to start rehabilitation of the railway infrastructure.

Figure 11: *Railway system in Montenegro (source Montecargo)*

According to the plans on railway infrastructure, which should contribute to the development of economy, in particular transport infrastructure, the mentioned will help in more clear positioning of Montenegro as an intermodal transport centre, thus enabling faster integration of Montenegro into the European Union. According to the Transport Development Strategy and in line with the needs of better utilization of railway capacities and the Port of Bar as well, works on rehabilitation of Vrbnica-Bar railway track started in 2009. The part of the railway track from Bijelo Polje to Kolašin was repaired in the length of 43,4 km of open railway track or 26% of the total length from Vrbnica to Bar (167 km). Moreover, 22 000 railway sleepers were replaced and 13,8 km of rails were installed, and six tunnels, three landslides and six slopes were rehabilitated as well.

For the needs of the reconstruction and rehabilitation of the railway infrastructure, in May 2011., the Infrastructure Management Plan was prepared by the Railway Infrastructure of Montenegro. It includes the main line "Vrbnica-Bijelo Polje-Podgorica-Bar" (167.4 km). It will be funded from international financial institutions and grants -IPA funds *(source: Railway Infrastructure of Montenegro - AD Podgorica ... www. zicg.me*.

Road connections

In order to reduce to minimum bottlenecks from the domain of road connections, the definitive priority is development of the Montenegrin Highway Network.

The planned highway network consists of:

- Highway **Belgrade** – South Adriatic through Montenegro: Boljare – Mateševo – Bratonožići - western bypass of Podgorica – **Bar**.
    - Connection of the highway Belgrade - Bar with Kosovo, the part through Montenegro: Andrijevica – Murino – Bjeluha (the border with Kosovo).
- Section through Montenegro of the **Adriatic-Ionian highway**: the border with Republika Srpska in the area of Trebinje – Čevo – Podgorica – Božaj (the border with Albania).

The highway from Bar to Boljare is 169.2 kilometers long. Almost over 40% of the total length consist tunnels, bridges and viaducts. This highway construction is the greatest engineering construction project in Montenegro. The route will require the construction of 42 tunnels, 92 bridges and viaducts.

Works on the construction of Bar-Boljare Highway started officially on 11 May 2015. The construction of the priority section Smokovac – Uvač – Mateševo will last four years.

On the following image (Figure 12), highway Bar – Boljare (border with Serbia) is red colored and Adriatic – Ionian highway is blue colored.

Figure 12: Indicative extension of the TEN-T road network to the Western Balkan (source SEETO)

Port infrastructure

The Volujica quay is the largest quay/pier in the Port of Bar. In addition, it contains 3 berths with total length of 554m and sea depth of 14m (on others piers the sea depth is 6-12m). Due to aggressive environment and low level of the maintenance, corrosion of the construction has been noticed. Accordingly, surveys from the Faculty of Civil Engineering from Podgorica (1999) and the Civil Engineering Institute from F.Y.R.M. (2012) stated that the condition of a part of quay was critical and an urgent rehabilitation was proposed.

The proposed infrastructure project will eliminate significant existing risks of different nature and will enable the fulfillment of conditions for maintaining the level of the existing capacity unchanged – if the existing part of the operational quay (554m in length) is not rehabilitated, the existing capacity would be endangered.

Figure 13: Quay Volujica damages

When one looks at damages by the constructive elements the conclusion is that secondary longitudinal girders are the most damaged, while main transverse girders and deck are in relatively good condition. Reinforced-concrete pylons were not a subject of this study.

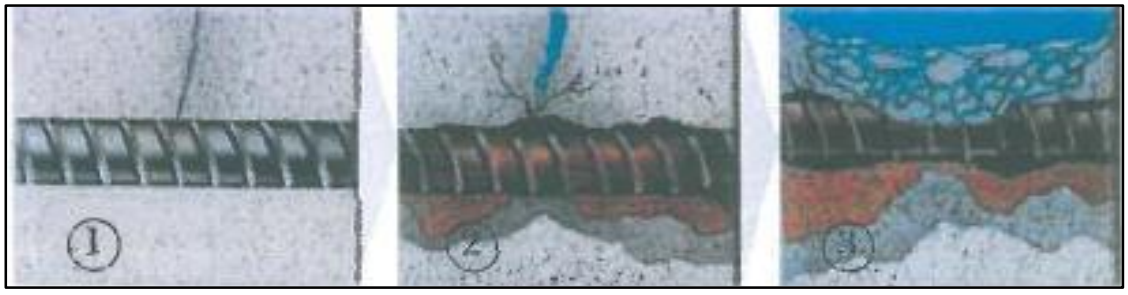

Figure 14: Corrosion on the construction of the quay Volujica

Proposals of rehabilitation solutions are given based on the damages of transverse and most of all longitudinal girders of reinforced-concrete construction of the quay Volujica, as well as based on the load capacity of certain props. These solutions are given based on the degree of construction damages, as well as the need for increase in load of certain construction elements, therefore the overall construction.

***

In this analysis main bottlenecks are covered, bottlenecks related to the port infrastructure and bottlenecks related to the hinterland connections (railway and road infrastructure). Currently, the main bottleneck in the port is related to the quay Volujica and its construction structure (due to progressive corrosion of the construction elements) which is in a state of visible vulnerability, implying insufficient stability of piers and safety of berths on them.

The already started infrastructure project (Reconstruction of the construction of the quay Volujica) will eliminate significant existing risks of different nature and will enable the fulfillment of conditions for maintaining the level of the existing capacity unchanged (it means that parameter safe working load on the quay construction will have original value after completion of the infrastructure project). In addition, as bottlenecks to the port development, hinterland connections and their low quality were also recognized but as these bottlenecks are out of the port jurisdiction.

The Transport Development Strategy predicts reconstruction of infrastructure objects in Port of Bar (quays/piers).

According to the new sustainable development concept, financing of the infrastructure development must be provided, in a way that eliminates bottlenecks in the traffic and achieves a balance between the use of maritime and rail traffic in relation to the road traffic.

In order to implement such possibilities, construction of new and reconstruction of existing terminals for combined transport at railroad stations Bar, Podgorica and Bijelo Polje is planned. Terminals will stimulate further development of combined (truck-railroad) transport at most important lines.

Improving accessibility of the Port of Bar for medium/large passenger ships, favoring the new maritime connections in Adriatic region is one of the priorities in the development plan of the Port of Bar. Currently, limitation at the Passenger terminal is the depth of the sea and length of current quay and new infrastructure for medium/large ships is needed.

For larger vessels with more draft, it is necessary to enlarge the Passenger terminal. The depths in this area are sufficient to accommodate larger vessels with deeper draft. Additionally, this enlargement is in line with spatial plans for the port area. Length and depth at available berths of the Passenger terminal are given in following table (Table 5).

Berth	44	51	52	53	54
Length (m)	97.5	97.5	20	107.5	107.5
Depth (m)	4.5	4	5.8	5.5	5.9

Table 5: Lengths and depths at the berths of the passenger terminal

Infrastructure improvements (Figure 15) will be an additional step forward to the improvement of the accessibility of passenger/ferry ships in Port of Bar. In addition, these activities are strongly connected with development possibilities in the tourism related to the passenger/ferry market. In particular Adriatic market may provide opportunities for growth of passenger traffic through the Port of Bar as in Montenegro tourism is accorded the highest development priority of all industries.

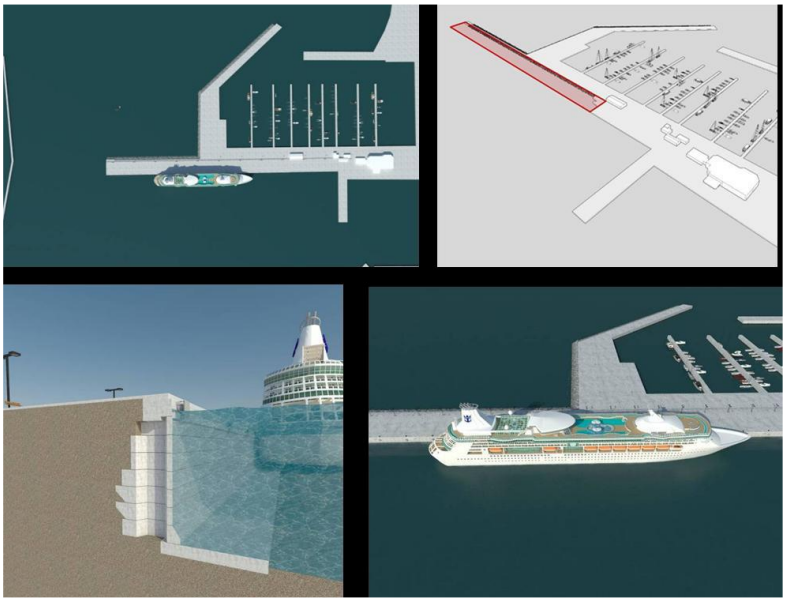

Figure 15: Development of the Passenger terminal in Port of Bar

3.2.2 Impacts of Infrastructural bottlenecks

The infrastructural bottlenecks have a great impact on the port market position.

3.3 Operational bottlenecks

3.3.1 Operational bottlenecks identified

The key operational bottlenecks are identified in the following domains:

- available workforce (number of qualified port workers, qualification structure of port workers, ...);
- available port machinery (operational readiness, reliability, capacity, ...);
- operative planning;

- implementation of defined working technologies;
- organization of the port machinery maintenance; etc.

3.3.2 Impacts of operational bottlenecks

The port services users noticed that sometimes these operational bottlenecks have certain impact on some parameters of the port services quality.

3.4 Institutional bottlenecks

3.4.1 Institutional bottlenecks identified

Results of analyses showed that, sometimes, involvement of the relevant institutions in the process of resolving recognized problems from different domains (management of port infrastructure, etc.) can be recognized as an institutional bottleneck.

3.4.2 Impacts of institutional bottlenecks

The port service users view on these issues are similar to the operational bottlenecks as institutional bottlenecks have clear impact on the services in the port area.

3.5 Innovation bottlenecks

3.5.1 Innovation bottlenecks identified

Innovation in the port related domains are not at the satisfactory level in Montenegro, in general.

3.5.2 Impacts of innovation bottlenecks

Mentioned inadequate level of innovative activities have negative impact on the port development dynamics. By the development activities done by the Port staff previous problem is reduced significantly.

4 MEDIUM-TERM SCENARIOS

The group of projects connected to growth of Port capacities is determined by basic criteria: one of them is that specific location for completion of a project is earmarked in the spatial-planning documentation for the Port area and that specific projects have reasonable justification in terms of current and expected demands by port users. It is emphasized that before these projects are launched, detailed analysis of feasibility pursuant to relevant methodologies must be conducted, and it is implies necessity of continuous scrutiny of priorities (and possibly, expansion of group of projects) taking into account principles of port development and key criteria of evaluation of projects (development, economic, financial, technical and impact to environment so on).

The main document for the future infrastructure development is Spatial plan for special purpose for coastal area of Montenegro and it was put in force on 1st October 2018. In accordance with this Plan and port development plans the main infrastructure and development projects in Port of Bar are:

- **Extension of the quay Volujica and reconstruction of the existing quay at dry bulk cargo terminal**
  In accordance with the spatial planning documentation for the port area, the project implies the extension of the quay at the Terminal for dry bulk cargo for 166m, 30m width (4.980m2). At the same time, the open yard would also be extended for 166m and 50m width (8.300m^2). At the same time existing quay need to be reconstructed and it is a first priority in all plans of the Port of Bar.
  The proposed infrastructure project (Reconstruction of the construction of the quay Volujica) will eliminate significant existing risks of different nature and will enable the fulfilment of conditions for maintaining the level of the existing capacity unchanged (it means that parameter safe working load on the quay construction will have original value after completion of the infrastructure project). Within the **NEWVRAIN (ADRION Programme) project**, technical documentation (Main design of the reconstruction) will be prepared and it will be a first step to the realization of this infrastructure project.

- **Extension of the quay at the Passenger terminal**
  The project implies the extension of the existing quay at the Passenger Terminal, for 432,85m, 30m width (Figure 16), and its realization would eliminate the existing restrictions connected with low sea depth on existing operational berths (the maximum depth of the sea is currently on the berth 54 - 5.9m). Realization of the Project would enable the acceptance of medium and large cruisers, passenger and Ro-Pax ships.

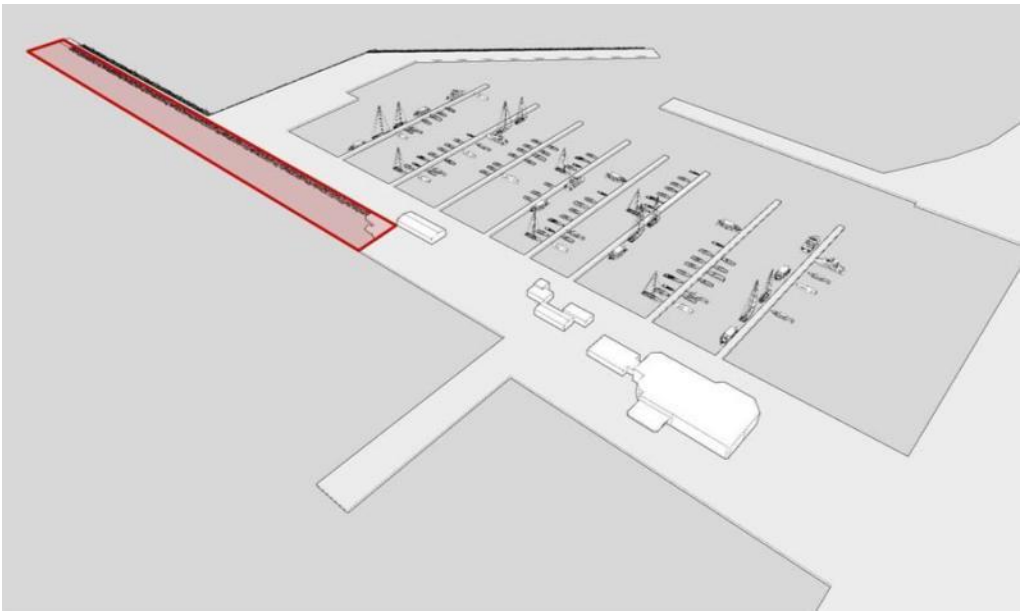

Figure 16: Extension of the quay at the Passenger terminal

- **New LNG reservoirs on quay Volujica**
  In line with new spatial plans and provided interests by investors, the reservoirs can be built in zone under south part of Volujica hill (Figure 17).

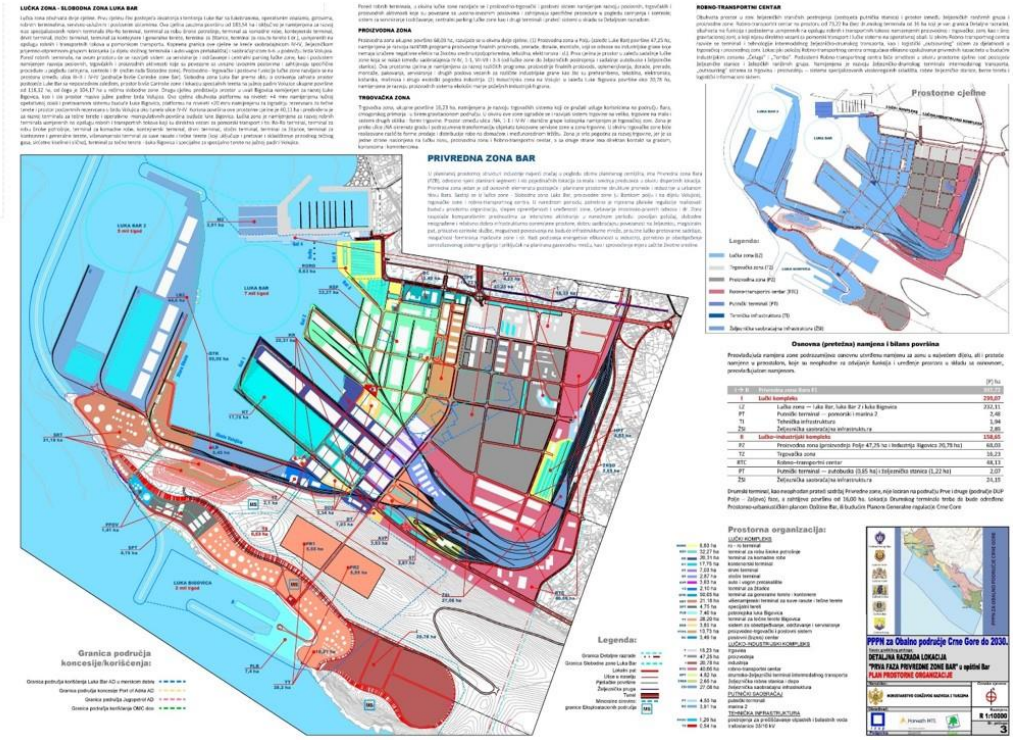

Figure 17: Spatial plan for special purpose for coastal area of Montenegro

- **Upgrade of Port Community System**

  Currently, within the **ADRION programme, project ADRIPASS** and its goals, pilot actions of the Port of Bar will be improvement of the planning capacities of transport stakeholders and policy makers concerning the multimodal transport accessibility and network efficiency in Montenegro. These will be achieved with better use of available data in PCS as a part of the pilot will be the development of the PCS which is related to the statistic data, dashboards, etc. The developed PCS can be replicated at BCPs in Montenegro or PCS can communicate with other similar systems via messages (EDI, XML, etc.). In addition, better communication between different types of stakeholders will be achieved through the end-user-oriented pilot actions (upgrade of the GUI, mobile solutions for the PCS, etc.). All activities are part of the soft measures intended to support regional economic growth and to streamline freight flows in the ADRION region.

Starting from the fact that development of the Port depends very much on a lot of external influential factors of different nature and intensity of influence, at first will be mentioned most important national and regional development projects from the field of transport and logistics which have to be taken into account:

1. Building Highway Bar – Belgrade;
2. Building Adriatic-Ionian Highway in Montenegro
3. Reconstruction and modernization of the railway Bar – Belgrade;
4. Building inter-modal terminals at the railway stations in Bar, Podgorica and Bijelo Polje

4.1 Main factors to influence future development

Based on the results of the analyzes conducted in the previous parts, Strengths, Weaknesses, Opportunities and Threats (SWOT analysis) for the Port of Bar can be identified in order to create the basis for defining the main directions of the development activities in the mid term period.

Strengths:

- A favorable geographical position (more favorable distances in relation to Suez Canal and Gibraltar compared to competing ports, ...);
- Existence of significant capacity of the Port with the possibility of their further development;
- Developed an information system that covers all business processes in the Port;
- Implemented Port Security System in accordance with ISPS Code;
- Certified Quality System in basic port activity in accordance with ISO standard;
- Long tradition and significant experience in port activities;
- Defining the space for further development of the port area;

- Lack of conflict between the development of the port area and the city area;
- Existence of specialized terminals;
- Adequate spatial disposition of elements of port infrastructure and suprastructure (the application of optimal variants of work technologies is enabled);
- The Port of Bar is on almost its entire area Free Zone; ...

Weaknesses:

- The lag in technological development compared to competitive port (technology transshipment of dry bulk cargo, ...);
- The lack of investment in the maintenance of port infrastructure facilities in the previous period;
- Unfavorable qualification structure of employees (lack of workers in basic port activity, especially with increased intensity of user demands, lack of highly specialized personnel);
- The lack of modeled cooperation with subjects of port environments;
- Insufficient level of exploitation of the potential of the Free Zone;
- Insufficient quality of the Port Bar connections with the hinterland;
- Insufficiently developed environmental management system; ...

Opportunities:

- Modernization of Bar-Belgrade railroad;
- Construction of the highway Bar-Belgrade;
- Dynamiting economic development in Montenegro and countries within the wider gravitational area of the Port of Bar;
- Development of the Free Zone Luka Bar;
- International programs for financing projects in the field of logistics, transport, environmental protection, ...;
- Connections (road and rail) with pan-European traffic corridors VII and X;
- Finding an optimal model for the development of dry bulk cargo terminals;
- Increase in transit flows through Montenegro;

Threats:

- Insufficiently developed foreign trade and unsettled goods and passenger flows in relation to the capacities and transit potentials of Montenegro and countries from the gravitational area;
- Intensive investment activities in competitive ports and on competitive routes;
- Insufficient level of quality of the corridor of the entities whose support is necessary in order to fully valorize the identified advantages and achievements of the recognized opportunities of the Port of Bar;

Possible disruptions in the development of the economy of the countries from the gravitational area of the Port of Bar and the increase in the volume of their overseas trade;

Port of Bar's port-hinterland chain is depicted in Morphological table below in which are given elements:

- columns that include possible economic state in the region;

- rows that include the main factors to influence the future development of the port-hinterland chain;

Table 6: *Morphological table of the port-hinterland chain related to the Port of Bar*

Level of economic activities	Infrastructure improvements	Operations in port	Involvement of relevant institutions	Development of innovative solutions
I.1 Economic activities in the region remain unchanged	**II.1** Infrastructures status (rail, road and port) remain unchanged	**III.1** Operations in port have a slight improvements	**IV.1** State institutions have been regulary invoved in resolving the recognized problems	**V.1** Implementation of the new tecghnologies is not a priority of the institutuons and port is leading in digitalization
I.2 Economic activities in the region have a slight increase	**II.2** Infrastructures status (rail, road and port) has a slight increase	**III.2** Operations in port have a significant improvements	**IV.2** Involvement of the state institutions remains unchanged (from time to time)	**V.2** Implementation of the new tecghnologies is one of the priority of the institutions and port is supporting the implementation
I.3 Economic activities in the region have a strong increase	**II.3** Infrastructures status (rail, road and port) has a strong increase	**III.3** Operations in port remain unchanged	**IV.3** State institutions are not interested in resolving the recognized problems	**V.3** Implementation of the new tecghnologies is one of the priority but developing costs are high
I.4 Economic activities in the region have a strong decrease		**III.4** Operations in port have a slight regression		**V.4** Implementation of the new tecghnologies is one of the priority and developing costs are acceptable

4.2 Scenarios' formulation

Scenarios related to the influencing factors

Figure 18: *Presumably scenarios for port-hinterland chain related to the Port of Bar*

influencing factors (I – V)

state of influencing factors (1-4)

I.1	**II.1**	**III.1**	**IV.1**	**V.1**
I.2	**II.2**	**III.2**	**IV.2**	**V.2**
I.3	**II.3**	**III.3**	**IV.3**	**V.3**
I.4		**III.4**		**V.4**

SCENARIO A

Economic activities in the region have a strong decrease due to insufficient investments and unstable political situation in the region. The further upgrades and quality investment would be stopped due to lack of investments and available funds. Due to that, infrastructures status (rail, road and port) would remain unchanged. If state institutions are not interested in resolving the recognized problems it would also influence port operations because Port of Bar is state owned company.

SCENARIO B

With the as-is economic activities in the region, there still would be some ongoing investments in infrastructures status (new Highway Bar-Boljare, currently under construction, and some minor investements in railway, adjustments and upgrades in PCS etc.) but bigger technological investments with the current funding would still be missing. With the current pace, operations in port will continue to have small-scale improvements in order to comply with EU regulations but with no high involvement of state institutions in processes.

SCENARIO C

Economic activities in the region have a strong increase by increasing the foreign investments as well as EU funds for IPA countries. With the increased budget and economic boost, infrastructure would be revitalised faster and it would influence faster completetion of two planned highways and better railway connection. With those investments operations in port have a significant improvements beacause the port is directly linked and connected to

hinterland by these infrastructures. With state's higher involvement in resolving potential issues, there would be no obstacles in investments in new technologies and improvement of digitalization processes.

- **Scenarios related to the cargo forecast in the port**

When cargo forecasts for the use of port planning are made, they are usually assumed to be in direct proportion with the economic development of the port's region and potential hinterland, reflected in a correlation of the real GDP and growth of cargo volumes. The situation with the Port of Bar is however more complex. A number of factors can have an influence on terminal developments in the Port of Bar that is potentially stronger than macro-economic factors and the main one is hinterland connections. Hinterland connections are of great importance to every port, but in the case of the Port of Bar this is even more true. Being located in a scarcely populated region, with very little captive cargo, the port's throughput depends highly on its hinterland connections. In fact, the present low quality of the Port of Bar's hinterland connections is one of the main reasons for the underutilization of the port's infrastructure and facilities. This means that the pace of improvements of rail and road connections to the hinterland will be decisive for the future development of the port.

The Port of Bar has a relevant potential for the strengthening multimodality. Considering its strategic position as a bridge between the Eastern Europe and the Mediterranean sea, the Port of Bar was involved in the analysis of the competitiveness of multimodal transport as viable alternative to road traffic in a route characterized by the crossing of EU and non EU countries.

In order to establish further bases for concrete activities directed to improving position of the Port of Bar as an element of the regional transport system, it was necessary to take into detailed considerations different variants of improving port infrastructure and links between the Port of Bar and hinterland logistic structures.

It was the key reason for the decision to initiate and create the Study „Development of the Terminal for Dry Bulk Cargo in the Port of Bar „within WATERMODE (SEE Programme) project activities. In this Study detailed projections of traffic volume were analyzed and 3 scenarios have been prepared (base, low and high).

Each cargo has been analyzed and in accordance with stakeholders statements /assumptions 3 projection were made (3 scenarios - base, high and low).

Base scenario

In the base scenario, quantities amount up to 1.7 million tons are expected by 2025.

High scenario

The high case shows 3.2 million tons are expected by 2025.

Low scenario

In the low scenario 1.3 million tons are expected by 2025.

The following figure depicts the total amount of vessels forecasted for each scenario (source Study Development Plan for the Port of Bar Dry Bulk Terminal / HPC Hamburg Port Consulting GmbH).

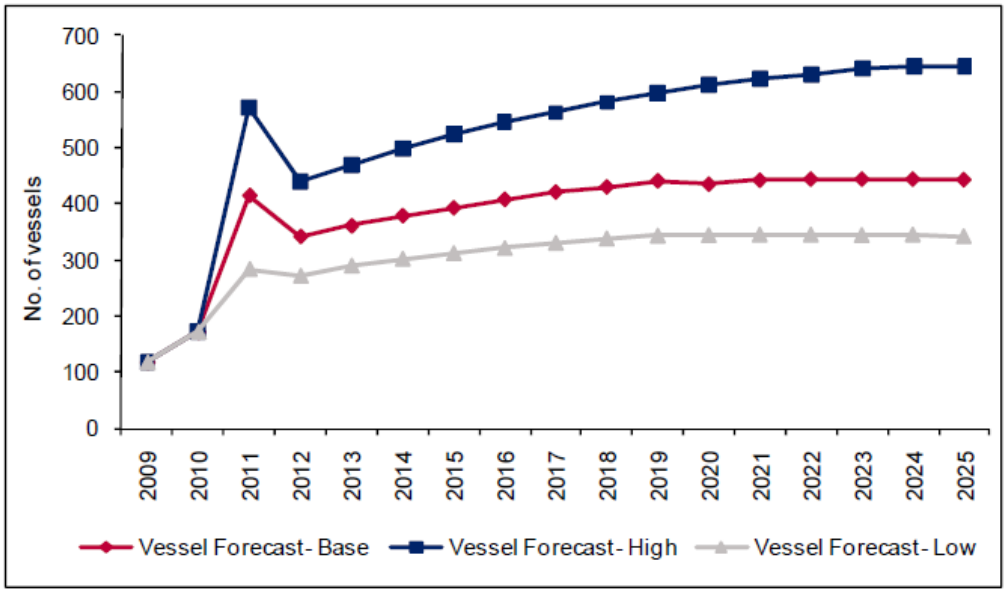

Figure 19: Number of vessels (source Study Development Plan for the Port of Bar Dry Bulk Terminal / HPC Hamburg Port Consulting GmbH)

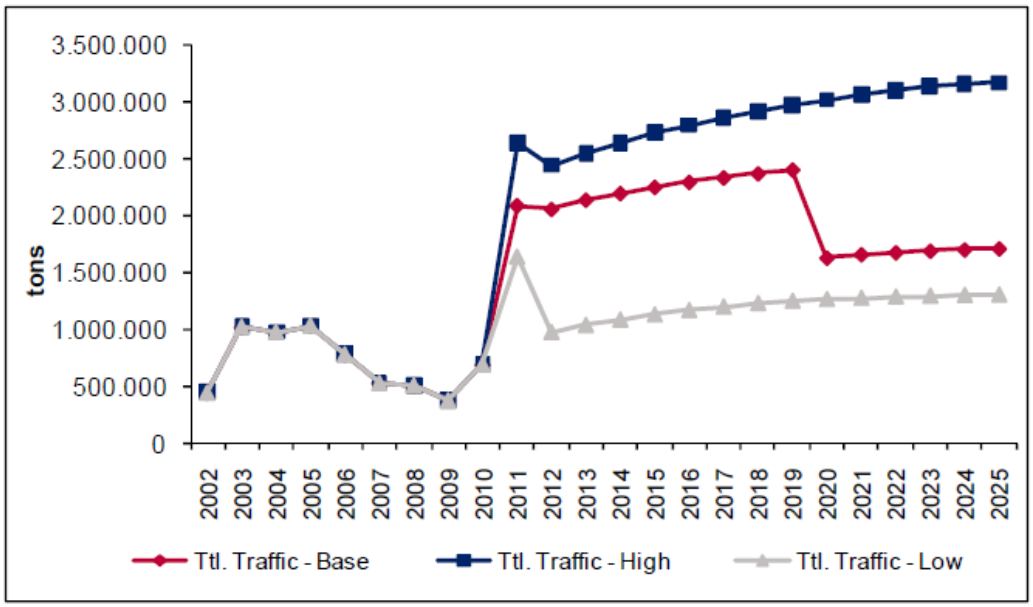

Figure 20: Overall Dry Bulk Traffic Potential Port of Bar (source Study Development Plan for the Port of Bar Dry Bulk Terminal / HPC Hamburg Port Consulting GmbH)

4.3 Expected impacts of alternative scenarios

- **Impacts of scenarios related to the influencing factors**

Scenario A have negative impact on development of the port hinterland chain due to decrease of economic activities and investments in the region. Due to all of assumed factors, all ports efforts for improvement will be limited by external factors and in this case unchanged.

In scenario B, slight improvements of the transport related infrastructure will allow some small-scale improvements of the port operations, with sporadic influence of the state institutions in transport issues resolving.

Scenario C, optimistic scenario, implies high level investments and funds reallocated to transport systems, infrastractural and operational activities with great impact on technological improvements , higher quality of port services provided and higher level of compliance with EU standards.

- **Impacts of scenarios related to the cargo forecast in the port**

In the past, cargo traffic in Port of Bar was characterized by high volatility. The main driver will be the development of the hinterland connections of the Port of Bar, namely by significantly improving road and rail connections. Investments into road and rail infrastructure projects are of high importance in order to help the Port of Bar to become more competitive and thus be able to keep clients or attract even more cargo.