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# Development of Small Container Ports: Case Study – Port of Bar*

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**Abstract:** Container ports are just one point on the international transport chain. Therefore, their development is determined by the cooperation of all participants in the transport chain that connects users of transport services with the ports, both economic entities and administration. This paper presents the basic preconditions for development of small container ports and the challenges they face. The Port of Bar was used to study the case. The main goal of this paper is to determine the development steps or phases that small container ports should implement in order to better position themselves on the regional market, i.e. to meet the requirements set by shipping companies. The paper analyzes different types of transport connections with the hinterland as well as a state of port infrastructure and superstructure in relation to ports in the region. The research hypothesis says that the correct sequence of different development steps directly affects the development of small container ports. The methods which will be used in the paper are analysis, synthesis, induction, deduction, generalization and concretization, as well as the method of comparison. The results of the research will provide a new understanding of the issue of development policies of small container ports in relation to available capacities and transport connections. The results can be used by the management structures of small container ports, but also in the work of national bodies in the field of maritime and transport. The research is based on the example of the Port of Bar as well as the ports in the region of Balkans until it doesn't take into consideration other small container ports from around the world. Therefore, the obtained results of the research could not be completely generalized. Thus is, this issue requires further research that would consider its various aspects.

**Keywords:** Small container ports, Port of Bar, infrastructure, shipping companies.

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## 1. Introduction and background

This paper aims to review the experience of advanced container ports and logistics routes in the region of Balkans, cargo availability and comparative advantages of the Port of Bar in order to improvement intermodal transport on the logistics route passing through Montenegro and the Port of Bar. Maritime transport experienced a revolution in the mid-1960s with the invention of the container unit for the transport of goods. Since then, intermodal transport of all types of cargo has been continuously growing [5]. The situation is similar in the region of the Western Balkans, which is the hinterland of the Port of Bar. More and more goods are being transported in containers. Due to the merging of shipping companies into large alliances, ports are facing challenges. There are special challenges for small ports where this phenomenon calls into question their survival [8]. In the Balkans region, at present, there is far greater benefit than the constraints that economies of scale entail, so small container ports must have to respond to that fact. The answer lies in the far greater use of rail transport than has been the case so far. This is especially true for the Port of Bar. The involvement of the state is necessary because the port is only one important point on the transport chain and its development depends on the connection with the hinterland. All participants from Montenegro must be involved in this process and give their contribution which will result in higher container transhipment in the Port of Bar.

## 2. Literature review

International maritime trade using container transport has been grown far more than past three decades than other types of maritime transport. In 2019, global containerized trade expanded at a slower rate of 1.1%, down from 3.8% in 2018 bringing the total to 152 million TEUs. In 2019, nearly 65% of global port-container cargo handling was concentrated in Asia – the share of China alone exceeded 50%. Europe ranked second in terms of container port-handling volumes, behind Asia, whose share was more than four times greater. Other regions in descending order are North America (7.7%), Latin America and the Caribbean (6.5%), Africa (4%) and Oceania (1.6%) [23]. In Table 1 we can notice that the route Europe - Asia along the Transpacific route is the most important in the world. Most of Western European ports are used as a link between the European continent and Asia, which may be changed in the coming years keeping in mind proximity of Mediterranean and Adriatic ports in the terms of less transit time by 7-10 days compared to Western European ports. The main obstacle is infrastructure connection from these ports compared to the infrastructure connections of

Western European ports with the central of Europe. Today, ports are showing more interest in strengthening connections with the hinterland to get closer to the shippers and tap the cargo volumes that could be committed.

**Table 1** - *Containerized trade on major East-West trade routes 2017-2020 in percentage*

| | **Trans-Pacific** | | | **Asia-Europe** | | | **Transatlantic** | | |
|---|---|---|---|---|---|---|---|---|---|
| **year** | ***East-bound*** | ***West-bound*** | ***To-tal*** | ***East-bound*** | ***West-bound*** | ***To-tal*** | ***East-bound*** | ***West-bound*** | ***To tal*** |
| 2017 | 19,2 | 7,3 | 26,7 | 7,1 | 16,4 | 23,4 | 3,0 | 4,6 | 7,5 |
| 2018 | 20,8 | 7,4 | 28,2 | 7,0 | 17,3 | 24,3 | 3,1 | 4,9 | 8,0 |
| 2019 | 20,0 | 6,8 | 26,8 | 7,2 | 17,5 | 24,7 | 2,9 | 4,9 | 7,9 |
| 2020 | 18,1 | 7,0 | 25,1 | 6,9 | 16,1 | 23,0 | 2,8 | 4,7 | 7,4 |

Source: [23]

In the second quarter of 2020, there were 939 seaports that were connected to the global liner shipping network through regular container shipping services. If all ports had direct connections with each other, there would be 440,391 port-to-port liner shipping services. In reality, only 12,748 port pairs had such direct services, that is to say, 2.9 per cent of the theoretical total. For trade between 97.1 per cent of port pairs, containers need to be trans-shipped in one or more other ports. The necessary number of trans-shipments is one or two for most port pairs. The least connected port pairs require up to six trans-shipments [8]. The goal is for the port to be connected to other ports with as few transhipment ports as possible. In order for that to happen, that is, for shipping companies to be justified in maintaining weekly services on longer routes, it is necessary to have enough cargo. In addition to the economic development of the hinterland in which a port is located, good infrastructural connection is one of the most important preconditions. One of chances for small container ports that are not well connected with its hinterland is to be transhipment ports. This may be considered to be applied on the case of Montenegro and the Port of Bar. Ports must be prepared for the future. This means improving local connections to the wider road, rail and inland waterways networks; fully optimising services to make the best use of ports as they are now; and creating a business climate to attract the investments that are so badly needed if capacity is to expand, as it must do. The proposal to review EU ports policy focuses on the ports of the trans-European Transport Network, which accounts for 96% of goods and 95% of passengers transiting through the EU ports system. Lastly, as in many other economic sectors, staffing needs in ports are changing rapidly and there is a growing need to attract port workers. Without a properly

trained workforce and skilled people, ports cannot function [22]. Port selection/choice is a complex process, which has been studied from various perspectives. Most studies dealing with the choice behaviour of shippers and third-party logistics service providers focus on modal choice and carrier selection, instead of port selection. The main selection criteria of logistics companies and shippers can be identified as a competitive price of port services, reliable services, low time costs for goods, cargo security and damage prevention, facilitation through the use of information platforms and good intermodal connectivity to the hinterland [14].

## 3. The research problem

The research regarding the Development of Logistics Routes of Intermodal Transport in the Eastern Adriatic [17] had for aim to show how certain significant economic and logistical factors (marked as independent variables) affect the stated dependent variable. The initial research model connects three independent variables with one dependent variable. The paper investigated the impact assessment of three independent variables: a) seaport connectivity measured by the LSCI (Liner Shipping Connectivity Index), b) seaport development and c) seaport connectivity with dry ports (intermodal terminals, i.e. economic centres) in the hinterland on the dependent variable. The container throughput as the dependent variable is given in Figure 1.

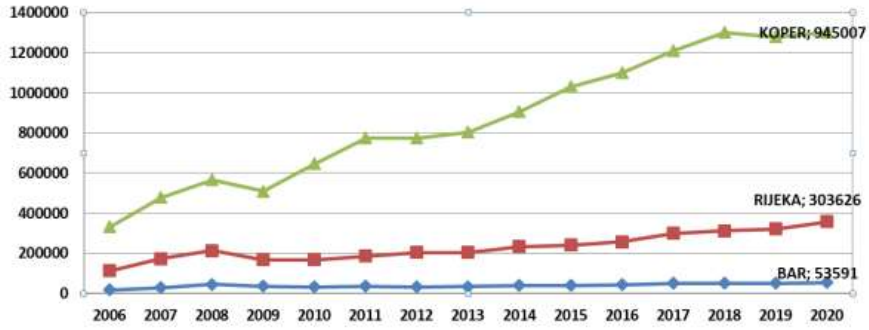


**Fig. 1** - *Container throughput 2006-2020/TEU*
Source: [17]

The first independent variable in the research was Liner Shipping Connectivity Index depicted in Table 2.

**Table 2** - *Liner Shipping Connectivity Index 2006-2020*

| LSCI | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BAR | 1,51 | 1,51 | 2,51 | 3,82 | 3,50 | 3,37 | 4,40 | 3,65 | 3,88 | 3,65 | 4,55 | 3,92 | 3,11 | 4,27 | 5,25 |
| RI-JEKA | 10,36 | 11,43 | 13,80 | 10,82 | 16,89 | 17,35 | 17,87 | 18,72 | 19,97 | 23,17 | 26,99 | 29,80 | 29,32 | 32,34 | 33,35 |
| KO-PER | 13,23 | 13,85 | 16,67 | 17,83 | 19,28 | 19,91 | 20,12 | 21,05 | 22,61 | 26,78 | 29,96 | 32,44 | 31,37 | 34,26 | 35,32 |

Source: [17]

In this paper, the economic modelling was applied to the three selected the Eastern Adriatic seaports (Koper, Rijeka and Bar), in which was conducted a field survey (the samples of 60 respondents in each of these seaports). The aim of the survey was to obtain valid responses, based on the perception of 180 respondents about the level of development of logistical routes of intermodal transport in the three mentioned seaports, as well as about the possible positive impacts of the selected factors. In this sense, the responses had been obtained to the following research questions: – What is the level of development of logistical routes of intermodal transport in the three mentioned seaports? (the dependent variable in the model); – What is the positive impact of LSCI on the development of logistical routes of intermodal transport in the three mentioned seaports? (the first independent variable in the model); – What is the positive impact of the development of the seaport on the development of logistical routes of intermodal transport in the three mentioned seaport? (the second independent variable in the model), and – What is the positive impact of connection of the seaport with the network of intermodal terminals in the hinterland (the third independent variable in the model). In addition to theoretical considerations, and in order to verify the initial and auxiliary hypotheses, the numerical tables have been used with graphical and statistical analysis and regression multiple linear analyses applied to the data obtained in the course of surveying 180 respondents. For the realization of multiple linear regression analysis, it was used Modules Solver and SPSS [17]. The constructs used in the study were measured on a Likert scale from 1 to 5, where 1 means the least impact and 5 the greatest impact. Multiple regression analysis was applied to the results of the respondents & # 39; perceptions obtained through the survey, for cases of specified ports. The research showed that the seaport of Bar is noticeably behind the seaports of Rijeka and Koper. The reasons are numerous, and they are dominated by the low level of infrastructural, superstructural and logistical development of the Port of Bar, high costs of its port and logistics services, deteriorating political relations between Montenegro and Serbia, the poor infrastructural transport connections of the Port of Bar with

Serbia, development investment deficit, orientation of Serbia to other seaports, a percentage of idling of engaged containers in the return direction, etc [17]. The main competition today for the Port of Bar is Rijeka port while their main overlapping market is Serbian market that is the most important market for the region of Western Balkans. The Port of Piraeus becomes another strong competition to the Port of Bar for Serbian market keeping in mind COSCO's regular container train connecting Piraeus and Belgrade established in 2017. The new threat for development of intermodal transport via Bar port is MBOX intermodal terminal in Niš that will be connected with Thessaloniki port by regular container train. The service is expected to start by the end of 2021 attacking the last main market in South-eastern Serbia that used to go via the Port of Bar. The quality hinterland connection of the Port of Bar is currently far behind the other main ports in southeast Europe, resulting in all other ports expanding their capacity, while the Port of Bar cannot utilize 30% of the capacity installed in the last century. In the hinterland of the Port of Bar, only 4% of cargo is on the territory of Montenegro, 8% on the territory of Kosovo, 17% from Bosnia and Herzegovina and 71% of cargo on the interior of Serbia. Well-built infrastructure from the northern Adriatic ports to Serbia have enabled 70% of Serbian goods to go to those ports. Poor condition and when we look at the liner shipping connectivity index where the Port of Bar in 10 years (2009-2019) fell by about 150 places while the Port of Rijeka advanced by 214 places on the same scale [4].

### 3.1. Intermodal transport in Croatia

The Port of Rijeka port is the main Croatian port while AGCT (Adriatic Gate Container Terminal) is container terminal operator. AGCT is connected to 5 services within the Mediterranean and 2 services from the Far East, which makes it extremely well connected for regional conditions and attractive for users of intermodal transport. Official statistics for 2020 says that 10 world shipping companies are present in AGCT, the terminal handled 303,500 TEU in 2020, that is 11% more than in 2019. One of the main reasons for the success of the Port of Rijeka in intermodal transport is the good connection by container trains with its hinterland, of which the connection with Serbia and Hungary stands out. 40% of transhipped containers in the Port of Rijeka are transported by Rail [1]. In addition to AGCT as a container operator in Croatia, there are also the ports of Split and Ploče, which deal with container transhipment and together make up about 13% of the total transhipment of Croatian ports [6], which is a confirmation of the importance of Rijeka and AGCT for Croatia and the region. The main market for the Port of Rijeka is the Serbian market with 38%, followed by Croatia 32%, Hungary, the Bosnian market and, to a lesser extent, Austria, the Czech Republic and Slovakia [2]. Over 60% of containers were transported to and

from Serbia by rail in 2019, according to the interviews with the main Serbian freight forwarders. All cargo and vessels processing is done through Terminal Operating System (TOS) NAVIS. It also includes internal processes as well as interaction processes with 3rd parties needed in order to provide smooth and clear container flow through AGCT [3]. A total of around EUR 935 million was invested in the reconstruction of railways, plants, stations, stops and other infrastructure facilities from 2010 to the end of 2019, in accordance with the realization of investments under the programs, while the plan for the period from 2020 by 2024 amounts to 1.8 billion euros, of which almost 78.7% refers to projects co-financed by the European Structural and Investment Funds (ESI) and the Connecting Europe Facility - CEF). The estimated value of the planned projects co-financed by European funds is more than 2.7 billion euros by 2030. As the most significant, both in terms of coverage and financially, these are projects co-financed from European funds on the RH1 corridor from the state border with Slovenia to the state border with Serbia and on the RH2 corridor from the state border with Hungary to Rijeka. On the RH1 corridor, the length of two-track lines will increase by 82 km (section Dugo Selo - Novska) and after the implementation of this project, the entire corridor from the state border with Slovenia to the state border with Serbia will be two-track. On RH2 corridor, the length of two-track lines will increase by at least 190 km. So it is planned to both corridors be with two-truck lines by 2030 [10]. The Community for combined transport was established on 22 March 1995. At its 22nd session, held on 6 July 2015, the Management Board of the Croatian Chamber of Commerce passed a decision amending the name of to the Community for Intermodal Transport and Logistics. Objectives are integration and effective cooperation between the academic sector and economy, networking of economic sector, identification of changes in the intermodal transport and logistics market, proposal for the development of intermodal transport and logistics, scientific and professional research for the purpose and application of the economic sector of the Republic of Croatia. The mission is to promote the use of intermodal transport and logistics services in the Republic of Croatia, application of the highest European and world standards in Croatia with special emphasis on sustainable development, satisfaction of all users of intermodal transport and logistics service. Vision is that all those involved in business and work in intermodal transport and logistics be informed about world trends and that they achieve their maximum in raising the quality of service and the application of technological developments [9].

## 3.2. Intermodal transport in Greece

The Port of Piraeus is located at the crossroads of Europe, Asia and Africa. It specializes in container handling. The main characteristics of the port are the following: the natural port for Athens and the main Greek port, the

main European port after the Suez Canal with a branched feeder connections to the Black Sea, the Mediterranean and the Adriatic, land connection (road and rail) to the Balkans and Central Europe. The largest container terminal in the Mediterranean, the fourth largest terminal in Europe and 26 in the world [21]. Significance of the entry of COSCO in 2009 in the Port of Piraeus speaks the fact that in 2007 Piraeus was not even among the 15 first ports in Europe. The acquisition enabled a much shorter transit time from the Far East to the central economic centres in Central Europe compared to Western European ports, with the activation of PEARL [18]. For example, the Czech market received a 9-day shorter travel time via Piraeus than via the ports of Rotterdam and Antwerp. With its investments, COSCO plans to enable the Port of Piraeus to tranship over 10,000,000 TEU per year. How significant was the takeover of the Port of Piraeus by COSCO is shown by the fact that the transhipped cargo increased by 5.5 times from 2009 to 2018, while the amount of transhipped TEU units increased by over 1100%. Of the total transhipment in Greek ports, as much as 86% of containers are transhipped in the Port of Piraeus [19]. PEARL is a railway operator that received a permit from the Greek authorities on May of 2016 to operate. It is estimated that in 2019 there were over 1000 container trains that transported over 80,000 TEU freight [18]. The current line map is given in Figure 2. Greece has more than 25 commercial ports, of which the ports of Piraeus and Thessaloniki are the most important. Thessaloniki is the second largest container port in Greece, but the largest port for bulk and general cargo, which is part of the trans-European transport network TEN—T. Its position is such that the market of northern Greece is its main user as well as the Balkan countries. Unlike the Port of Piraeus, which specializes in container transhipment, the Port of Thessaloniki strives to attract as many containers and bulk goods as possible to its piers [21].


**Fig. 2 -** *Rail intermodal connection of Piraeus port with its hinterland*
Source: [18]

Container transhipment is ca 500,000 TEU in Thessaloniki port, while the planned investments will increase the capacity to 1,300,000 TEU. During the launch of the first container train on the route Thessaloniki – Sofia, CEO of the Port of Thessaloniki Franco Nicola Cupolo stated that the Port of Thessaloniki is committed on the strategic development of intermodal railway transport to the Balkans, starting from November 27, 2020. With a direct train connection to the dry Port of Sofia owned by the Port of Thessaloniki [21].

## 3.3. Intermodal transport in Montenegro

Intermodal activities in the Port of Bar are being performed through the company Port of Adria AD with an annually transshipment capacity of TEU 50,000. Four shipping lines operates in Bar [20] with no direct service from Far East. There was only 0.9% of transported containers by rail out of the total amount of 50,444 TEU (twenty-foot equivalent unit) [16]. According to the interviews with the local representatives of shipping lines and freight forwarding companies, there are 70% of cargo that is being stripped in the port while it is 82% of transit cargo that don't leave the port but being stripped on the port territory. It doesn't help boosting of intermodal activities since the significant amount of containers are being loaded onto vessel

empties what causes costs for shipping lines which doesn't exist at this scope at other regional port. According to the official statistics of Port of Adria, there is 38.5% of empty containers that is being loaded empty in Bar while in Rijeka and Thessaloniki, according to their statistics, it is cca. 16-17%. Another problem is the max allowed gross capacity of rail of 1060t. Although it is built in 1976, there was not significantly investments till 2009, since that it was reconstructed 26% of the railway from Bar to Vrbnica (the cross border with Serbia). It is a reason for lower bandwidth compared to competing routes [24]. Comparing to competitive routes from Croatia and Greek that are connected with Belgrade with full profile of high-way there is still no high-way in use in Montenegro. The main problems are the political relation between Montenegro and Serbia which does not allow increasing activities which would lead to better infrastructural connectivity and investment accordingly. While Croatia has the community for intermodal transport and logistics since 1995, there is no body in Montenegro although the coordination committee for transit traffic was established in 2021 [19].

## 4. Conclusion

It is argued at the beginning of this paper the importance of intermodal transportation that is still growing unstoppably and more and more goods are being transported in this way, both in the world and in the Western Balkans. By uniting shipping companies in alliances, the position of small container ports becomes even more marginalized and for some the survival on the map of feeder services of global shipping companies will be questioned. The two main container routes today are Transpacific and Far East - Europe. The most frequently used European ports are those on the Western European continent due to the poor infrastructure network from the Mediterranean and Adriatic ports to Central Europe. In the coming years, it is to be expected that part of the goods from Western European ports will be transferred to Mediterranean and Adriatic ports. The Port of Bar must be ready for it. The research raises an important question about the manner in which the cargo flow through the Port of Bar may be increased. Using the methods of comparison, analysis, synthesis, induction, deduction, generalization and concretization, the level of development of intermodal transportation in Montenegro is compared to the level of development of intermodal transportation in Croatia and Greece. The research hypothesis confirmed that the correct sequence of different development steps directly affects the improvement of cargo flow through the small container ports. The absolute priority of Montenegro is to include the country in the map of pan-European corridors, i.e. the TEN-T network. The same will enable easier access to EU funds related to the financing of capital infrastructure projects, primarily the completion of the Bar-Belgrade highway and the reconstruction of the Bar-

Belgrade railway, which passes through Montenegro. In order to make sense of investing in the highway and railway, it is necessary that Serbia, for its part, plans to build infrastructure to Montenegro. In that sense, the relations between Serbia and Montenegro are important. Infrastructural connection with Serbia is important because through Serbia, the Port of Bar comes to Hungary and Romania, where the logistics route through the Port of Bar may have comparative advantages. Montenegro must also get an Intermodal Transport Strategy, which will have its own action plan. The above is primarily the responsibility of the state administration, which with the help of the economy in the field of logistics should create the preconditions for the development of intermodal transport. After investing in capital infrastructure facilities, connecting with dry ports in the region should be one of the priorities of the Port of Bar and the logistics route through Montenegro. One of these possibilities is illustrated in Figure 3 as countries that can use the logistical route through Montenegro. The above aims to make the logistics route through the Port of Bar far more interesting to regional users than is the case today, which will result in greater interest of shipping companies for the Port of Bar. Greater competition and the introduction of direct lines from the Far East will contribute to a lower price of sea freights, which will further strengthen the position of the Port of Bar. In parallel with the above activities, it is necessary to work on the modernisation of infrastructural equipment of the port itself in terms of adapting the port infrastructure and superstructure to the requirements that include operations for vessels over 15,000 TEU. It is necessary to work in parallel on attracting cargo as well as planning investments in port infrastructure. It is important for the partner to be found a renowned world company in the field of logistics, preferably one of the world's largest shipping companies that would made the Port of Bar as its gateway port for this part of Balkans.

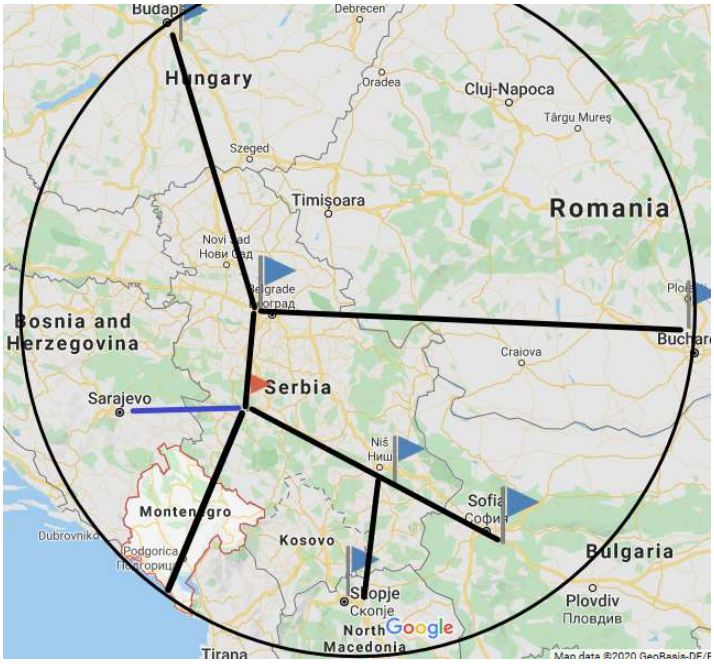


**Fig. 3 -** *Example of Potential Connection of the Port of Bar with Dry Ports of Long and Medium Range in the Region*

Source: [16]

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