Abstract: - In the context of increased international trade and the development of modern transport technologies and methods of organization, the port development must be planned in the context of the overall transport trends. Optimum performance of its functions, realization of the planned capacity of the container terminal system together with constant adapting to changes are possible only if all participants and elements of transport are interconnected and coordinated with the goal of optimization of the transport chain. The purpose of this article is to examine problems and current questions concerning container terminal operations in the context of modern transport technologies and methods of organization and the overall transport trends. The aim is also to demonstrate how Port of Rijeka, Croatia through optimization of a logistics chain of transport can achieve its full recognition.

Key-Words: - the port of Rijeka, containerization, logistics chain optimalisation, transport, globalisation.

1. Introduction

Modern ports are not only places for delivering, loading and unloading of cargo and transportation of passengers and goods by sea and further on by land transportation facilities. In the global economic system, ports are an important link in a logistics chain. The competition among ports is becoming more intense, therefore increased cargo-handling rates, higher level of productivity, improved capacity, developed hinterland and foreland are not sufficient to enhance the level of competitiveness. It is becoming necessary to present their business performance through a high-quality network of land routes, a highly developed port infrastructure, and a modern information and communication technology system. All of these necessities arise from the necessity for a quicker and more modern way of transportation.

This paper examines the current theoretical and practical problems of the functioning of the port systems in the 1990s during the implementation of globalization and liberalization processes of maritime transport. It also enquires, through the revitalization process of the container traffic, the possibility of the port in...
becoming recognizable by optimum performance of its functions; moreover, it positions the port in the region according to its relevance, and suggests representative solutions for the target development of the port of Rijeka in container traffic.

In a situation of an increased international trade of goods, developing modern transport technologies and modern methods of organizing logistics chains, the development of ports must be planned within overall transport trends. A wide recognition of the port as well as optimum performance of its functions becomes possible only if all the participants in port activities are fully coordinated. The realization of the planned capacity of the container terminal, its constant adapting to changes, the rationalization and terminal’s business efficiency may become possible only if all participants and elements of transport are interconnected and coordinated. This in turn implies that the affirmation of such process which can depend on the environment where it takes place, and/or happen independently as a transport-technological process, for the purpose of an effective usage of technical-technological, organizational and economic resources.

often changing, as well as the structure of cargo, calling consequently for new transport technologies.

Besides quality and low costs of services, modern market require from today’s ports a coordinated approach to all participants, i.e. an improvement of the logistics chains and an increased productivity in the ports.

The process of globalization in the shipping industry and the geographical globalization has influenced very considerably ports’ business operations. The globalization of ports’ business operations mainly refers to implementation of modern information systems in ports’

The basic scientific hypothesis is the following: negative trends of container traffic in the port of Rijeka are a result of the difficulties, changes and adversities that various activities of this port had faced. By implementing global logistics processes, investing in modernization, equipping and fitting its container terminals, the port of Rijeka would obtain multiple benefits for all participants of container traffic, whereas business subjects and the wider regional community would be the first to enjoy these benefits.

Some arguments in favour of the above stated hypothesis:

The expansion of maritime traffic in the twentieth century has witnessed a rise by twenty times, whereas in the past 50 years by ten times. This happened due to an increase in international trade of goods, as well as the development of transport technologies in all areas of transport – mainly in maritime transport.

In adapting ports to maritime trade trends the quantity of cargo, the routes of cargo trade, and the structure of transport should be taken into consideration. Statistical data in worldwide trends show that quantities of cargo being shipped are rising, that routes of goods flows are operations, thus enabling a high degree of openness and the liberalization of ports’ services, including the openness of the port to its users.

The port of Rijeka started the process of revitalization of container traffic in a most critical time of its recent history. The process begun in the very moment when container movement reached its lowest levels since the existence of the Rijeka container terminal (Brajdica).

The purpose of this paper is to examine problems and current questions concerning container terminal operations in the context of modern transport technologies and
methods of organization, and the overall transport trends.

The aim is to demonstrate how a port, by means of a model of organizational and technical-technological system optimization, can achieve its full recognition by adapting to modern trends of the maritime trade and the process of globalization within the system of shipping industry.

2. Problem Formulation

During the 1980s the port of Rijeka was left out of an important cycle of investment in modern capacities and technologies. At the same time, the neighbouring rival ports of Koper and Trieste invested in modernization and construction of new capacities.

Unlike the port of Rijeka, in which no major investments were made from the end of 1970s to 1990, the ports of Trieste and Koper constructed and equipped new container and Ro-Ro terminals, invested in software and computer equipment, and adapted to new demands of the shipping market.

Inadequate and obsolete railroad and road lines of communication were, at the time, the reason for redirecting the flow of traffic to closer or more distant European ports. In fact, transport infrastructure of adequate quality and greater capacity for attracting period, the traffic in transit to neighbouring central European countries from the port of Rijeka was almost the half of the usual (Hungary) or insignificant (Austria, Czech Republic, and Slovakia). The causes for this lie in greater competitiveness of northern European ports, the inauguration of Rhine-Main-Danube Canal, and the partial redirecting of transit goods to northern Adriatic ports of Trieste and Koper.

Croatian sea ports adapted very slowly to new transport technologies and demands of the shipping market, whereas staff resources of the port could not meet global challenges of modern ports’ business trade flows become the regulatory features for trade flows.

Moreover, the war taking place in Croatia additionally influenced the redirection of trade flows to other ports (increased risk and additional insurance required) affecting the change in the structure of cargo, reducing the market i.e. the area gravitating towards Croatian sea ports.

The underdeveloped foreland (insufficient number of regular shipping lines) and a modest national trade were, along with a significant drop of traffic in transit, the reasons for further backwardness of the port of Rijeka. Due to the relatively small quantities of goods and the structure of Croatian foreign-trade exchange, national traffic could not represent the backbone for a quick recovery of Croatian sea ports. Partial recoveries were to be found mainly in greater competitiveness of ports and in greater traffic in transit. In the previous ten-year operations if considering technical-technological, organizational, transload, marketing, information, economical, ecological, developmental and strategic needs.

Inadequate technical-technological equipment, obsolete port capacity, insufficient specialization of port’s infrastructure and superstructure capacity, inadequate tariff and transit policy, bad organization and insufficient quality of performance, low productivity, excess of administrative staff yet at the same time lack of modern management, successful marketing activities and insufficient involvement in world flaws and changes
within these business activities (ignoring European and world trends in shipping) – all of these were a consequence of many institutional and traffic limitations as well as inexistence of an adequate port policy (there is no purposeful naval policy), and were the main causes for backwardness of the port of Rijeka.

The foreland of the port of Rijeka comprised a network of line services. In the late 1980s the port faced the problem of shipping lines which ceased to exist, and which were the backbone of the logistics chain of transport.

The previously described causes can be seen in chart 1, which shows the dramatic drop of container traffic in the port of Rijeka in that period.

The process of backwardness of the port of Rijeka in all of its segments was long, and resulted from many negative circumstances. In fact, to take place, revitalization needed a series of actions, from creating a strategy of development, to assuring all necessary financial means and time for realization. However, its inclusion into European and world flow trends would also confirm an increased importance of the Republic of Croatia, not only as a developed coastal country, but also as a respectable European country.

Chart 1: Container traffic in the port of Rijeka from 1985 to 1998

Source: Statistical data for the Port of Rijeka, Ltd.

3. Problem solution

3.1 Analysis of the Situation and the Development of Container Traffic in the Port of Rijeka

By the end of 1990s container traffic in the port of Rijeka reached its lowest levels since its beginnings 1977.

The reasons for these events were described in the previous chapter. One of the fundamental causes was the lack of a network of shipping line services due to the bankruptcy of national shipping line, which Croatian ports’ services for many years, and by which bankruptcy one of the most important links in the logistics chain of transport vanished. The thick network of shipping lines constituting the foreland is an indispensible and key factor for the revitalization of the container traffic.

The instauration of a new feeder service was the only possible precondition for setting up a new network of shipping line services. However, since this was just one of the links in the logistics chain, other links had to become competitive in the region once again.
A special attention was given to setting optimal port tariffs for “ship disbursement account.” Actually, by thorough analysis of such documents, it was possible to see the lack of competitiveness of some of its entries. Indeed, they had a negative effect on the individual and overall competitiveness of logistics chains of transport passing through Rijeka’s route. Some of these entries are: pilotage, towing, port charges, shipchandlery, berth tying and untying, quality control, quantity of goods, waste disposal, etc.

It was of extreme importance to set a competitive tariff for lighting (light due) which excessively burdened Rijeka’s traffic route making it non-competitive if compared to other neighbouring northern Adriatic ports. Not only these tariffs but also the railroad tariffs were corrected. Moreover, along with these activities, it was necessary to coordinate the participants in ship accommodation and align their working hours (e.g. customs, police, and harbour authority), as well as increase the monitoring of their performance.

The implementation of feeder service was supported in logistics by 22 Croatian companies who partook in the logistics chain and offered the overall cost of transport as competitive and adequate in quality as possible.

Supported by the interconnectedness and coordination of all participants in traffic flaws organized by the Port of Rijeka Authority, feeder service inaugurated the revitalization of container transport in the Rijeka traffic route. The process of tariff optimization and promotion of competitive supply chains indicated at the same time the beginning of operation activities of the logistics chains. An overview of the revitalization of container traffic and its most significant elements is given further on in the article (Archive of the Port of Rijeka Authority).

On March 1st, 1999 following new commercial rates, a new shipping line for container transport was introduced; the ship Lipa, belonging to Lošinjska Plovidba Ltd, connected Rijeka-Ploče-Malta-Gioia Tauro-Rijeka, and later on Taranto. In the first period, this line was subsidized by the government.

Thanks to this line service, container traffic registered an annual increase of 60%, whereas with the arrival of new operators, container traffic of the terminal reached 30,000 TEU in 2003 from the initial from 10,000 TEU in 1999.

In the beginning of 2003 two new gantry cranes were bought by the Port of Rijeka Authority for the container terminal in Brajdica. The shore capacity of the terminal was enlarged by three times, and thus one more link in the logistics chain was set to a level of competitiveness.

With a greater number of containers transported during the following few years, some operators such as ZIM-LINE, CMA-CGM, Evergreen and UFS introduced their own feeder lines on commercial basis.

With the growing container traffic in the port of Rijeka, a network of feeder services was introduced. As feeder lines gradually suffered from congestion due to a large number of containers, operators decided to call at the port of Rijeka on a direct line service (or mother-ships) from ports in the Far East.

This was the case of the operator ZIM-LINE who started to call at the port of Rijeka with a mother-ship in September 2003, whereas in November 2003 it called at Rijeka jointly on the same ship with the operator CMA-CGM. Moreover, in February 2006 the operator X Press Container Line introduced a feeder service. In February 2006, after a further growth of container traffic, the operator
CMA-CGM introduced its own ships in the shipping line.

Offering a direct logistics support to line service, the Croatian railroad company introduced the so called “block train” transporting containers from Rijeka to Budapest.

In February 2007 the biggest world operator Maersk Line joined the feeder service, as well as the operator Mediterranean Shipping Company in September 2007.

In September 2009 the port of Rijeka was connected by a direct line with Asian ports. As a matter of fact, from mid September the operators CMA-CGM and Maersk started a new shipping line with their mother-ships on the route Asia-Northern Adriatic.

Lošinjska Plovidba stopped to call at Rijeka in March 2008.

In June 2008 the operator UFS joined the feeder service, and from November 2008 the operator CMA-CGM called at the port of Rijeka with one ship in the feeder service.

During 2009 even other operators started to call at Rijeka with their ships. Such was the case in May 2009 with the operator Hanjin who joined the feeder service. In June 2009 the operators Maersk and CMA-CGM started a joint weekly service on the route Trieste-Rijeka. In August 2009 the operator Cosco Container Lines joined the feeder. Chart 2 shows the flow of container traffic in the port of Rijeka for the period 2001-2011.

In June 2010 a new feeder service was introduced by the operator Norasia Container Lines, and the shipping line Hyundai Merchant Marine-Yang Ming Transport-Hanjin-USAC (www.portauthority.hr).

In February 2011 the operators Hyundai Merchant Marine-Yang Ming Transport-Hanjin-USAC instead of a mother-ship introduced a feeder service.
In July 2011 UFS arrived again with its feeder service.

Chart 2: Container traffic in the port of Rijeka 2001-2011 (TEU)

Since the inauguration of the first new line at the container terminal in Brajdica in 1999, the interest of the biggest world operators for commercial calling at the port of Rijeka grew. The gradual introduction of new operators and the reduced activities of the subsidized operator, as showed in various cases, were the most crucial moments in the process of revitalization of shipping lines.

The process of revitalization of shipping lines in the port of Rijeka proved that by means of interconnectedness and coordination of all participants of the logistics chain conditions could be created to attract the supply chain from the manufacturers (in the Asian region) to the buyers (in the central European region) and vice versa. The reduction of tariffs in all segments to a level of competitiveness, yet assuring an efficient service, was the only way of attracting shipping lines. Considering hard market conditions in which operators do business on the world market, competitiveness of a traffic route provides new optimized supply chains, the logistics chain of transport being their essential part.

In these logistics chains ports are just one link, however, the importance of modern ports lies in their new roles of providing supply chains and holding a leading position within logistics chains. It was, therefore, not by coincidence that the port of Rijeka took a major role in the process of revitalization of shipping lines in 1999.

It is quite interesting to note that in the beginning of the process of revitalization of shipping lines, most of the operators mentioned above decided to open their Croatian branch offices in Rijeka. Moreover, many forwarding agents and transport companies were founded in Rijeka.

Table 1 shows a list of 20 world leading container operators in 2012 as to their cargo space and their share in the overall world cargo space. Almost all of the mentioned operators had their offices in Rijeka.
3.2 Implementation of global logistics processes

After a successfully implemented process of revitalization of shipping lines, it can be said that the port of Rijeka has overcome the critical period of the early 1990s and regained its position on the market.

The strong growth of container traffic shown in Chart 2 happened thanks to the implementation of all activities related to optimization of the logistics chain in the Rijeka traffic route. The port has changed the nature of its foreland. From a local port connected with feeder services with other Mediterranean ports, it has become a global port where mother-ships connecting it with south-eastern Asia call at.

The reason for this transition of the port of Rijeka is to be found in the nature of the logistics chain from central Europe and Asia. Countries from south-eastern Asia report one of the worldwide highest growths of their national GDP, and are large overseas exporters. A logistics chain has been formed in south-eastern Asia with a product destination in central European countries.

The port of Rijeka with its potential has found itself on this route. With the recognition of Rijeka’s and other northern Adriatic’s ports, through an alternative logistics chain, goods have found the so called “southern” route to Europe. A significant advantage of the “southern” route is a shorter distance, i.e. the journey from south-eastern Asia is 5 to 7 days shorter than the “northern” route to North Sea ports.

In 2008 this new nature of the above described logistics chain was included by the Port of Rijeka Authority in the new master plan for the development of the port of Rijeka as a strategic guideline for the development in a ten-year period. A basic assumption of this master plan was that the port of Rijeka would conform the capacity of its terminals to market’s demand.

Table 2: Plan of container traffic in the port of Rijeka up to year 2030

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</thead>
<tbody>
<tr>
<td>Low</td>
<td>94,390</td>
<td>140,490</td>
<td>148,898</td>
<td>281,959</td>
<td>460,024</td>
<td>698,315</td>
<td>1,017,203</td>
</tr>
<tr>
<td>Middle</td>
<td>94,390</td>
<td>140,490</td>
<td>163,884</td>
<td>355,554</td>
<td>637,181</td>
<td>1,050,984</td>
<td>1,658,996</td>
</tr>
<tr>
<td>High</td>
<td>94,390</td>
<td>140,490</td>
<td>179,150</td>
<td>437,798</td>
<td>854,354</td>
<td>1,525,221</td>
<td>2,605,659</td>
</tr>
</tbody>
</table>

Source: Master plan of the Port of Rijeka Authority, 2008

The master plan was based on a detailed analysis of economic growth, operating model, access to corridors and alternative corridors to central European countries. It also included an investment plan depending on market’s demand. An important feature of the master plan was the plan for container traffic.
Strategic guidelines for container transport in the port of Rijeka could be basically drawn to the creation of capacities of the container terminal in conformity with market’s demand, as shown in Table 2. With respect to modern trends of ports globalization, attribution of responsibility was made in the port section as to creating these capacities. On the one hand there were investments in infrastructure and superstructure of the terminal, while on the other hand there were investments made in transloading equipment and new information technology by companies (concessionaries, strategic partners).

3.3 Strategic Partner at the Rijeka Container Terminal

Pursuant to statutory regulations in the Republic of Croatia, the port area represents maritime welfare. Maritime welfare is a non-proprietary system. The port open for public traffic is managed by the port authority or, respectively, the port authority manages maritime welfare in the port area which is comprised of port infrastructure and superstructure facilities. The ports section differentiate between the port management function (of the port authority) and the port utilization function (port companies, i.e. concession holders). According to statutory regulations, activities on maritime welfare in the Republic of Croatia may be performed on the basis of concessions only. This means that the licensor (the port authority) and the concession holder (the company) have entered into a concession agreement which regulates the rights and obligations in the performance of economic activities in the port area.

The container terminal Brajdica has a specific management model where the Port of Rijeka Authority (the licensor) and the company Jadranska vrata d.d. (Adriatic Gate Inc. – concession holder) have concluded a concession agreement with a term of 32 years. The concession agreement sets forth the rights and obligations in performing activities in the port area of the container terminal Brajdica. A crucial prerequisite for conclusion of the concession agreement has been the concession holder's obligation to invest in superstructure facilities and container transshipment equipment.

The company Adriatic Gate Inc. had published a tender for selection of a strategic partner. Upon completion of the tendering procedure, International Container Terminal Services Incorporated (ICTSI) was selected as the terminal's strategic partner. This company is a major international container terminal operator. Established in 1987 with registered office in Manila, the Philippines, the company operates at seven container terminals in the Philippines and sixteen container terminals worldwide. In Europe, the company holds another container handling concession at the Baltic Container Terminal in Gdynia, Poland (http://www.ictsi.com).

Upon finalization of the acquisition of shares from the Port of Rijeka Inc. (the Port of Rijeka Inc. had 100% ownership in the company Adriatic Gate Inc.) the new owner of the company managing the container terminal Brajdica started to prepare a Business Plan.

The Business Plan's most important part was the Master Plan of the Container terminal Brajdica (AGCT, Adriatic Gate Container Terminal). The Master Plan defined the following parameters: the Terminal's spatial plan, the container storage mode, procurement of new gantry cranes, storage facility equipment, storage space, storage space organization by phases, definition of the quay's handling
capacity, gantry crane handling capacity, warehouse machinery, horizontal transport equipment, quay occupation, entry and exit point, repair and maintenance area, installations, assessment of investment cost, labor etc.

Within the scope of the AGCT Master Plan, a capacity projection of the container terminal Brajdica was defined. The maximum capacity has several limiting parameters, namely the storage space and connection to the railway. The basic prerequisite is Container Terminal construction - Phase 2. Upon consideration of the aforementioned limitations, the container terminal's maximum annual capacity of approx. 500,000 TEU was defined.

3.4 Construction of Container Terminal Brajdica - Phase 2

The highest throughput of the container terminal Brajdica was achieved in the year 2008, when more than 167,000 TEU were handled. The container terminal's Phase 1 capacity is assessed to 250,000 TEU per annum. Limitations primarily relate to container stacking space and availability of a single operating quay for transshipment.

The sharp increase of container traffic in 2003, optimization of the logistics chain and the arrival of new maritime shipping routes indicated the need for capacity increase at the container terminal Brajdica. The maximum capacity was expected to be reached within a relatively short period of time.

Construction of a new quay with a sea depth of 14.5 m will provide safe berthing of larger container mother vessels.

Construction of the container terminal Brajdica - Phase 2 comprises four components:

A – quay extension by 330 meters and related stacking area; construction of a new quay and 50,000m² of storage space. Completion of construction of such Phase 2 will double the container stacking capacity. Procurement of additional handling equipment will provide transshipment of two large container vessels at the same time, at a single quay.

B – Construction of a new entry / exit point;

C – Railway loading/unloading station;

D – Facilities for repair and maintenance services.

Upon construction of Phase 2, the container terminal Brajdica will have a maximum annual capacity of 500,000 TEU; by application of state-of-the-art technological solutions, the terminal's projected capacity can be further increased. Investment in construction of the container terminal Brajdica - Phase 2 is a part of the operations of Rijeka Port Authority (the licensor) which provided the funds for its implementation. Construction Phase 2 pertains to investments in port infrastructure (new quay and areas, railway station) and superstructure (new entry / exit point, repair and maintenance workshops).

Investment in the terminal's container handling equipment, port cranes and storage facility equipment lies within the responsibility of Jadranska vrata d.d. (AGCT, concessionaire, concession holder).

The newly constructed part of the terminal will provide the use of new generation port cranes (18-container outreach over the vessel's width) and storage facility
equipment, vessel berthing will advance by two generations (vessels of up to 10,000 TEU capacity), along with a 14.5 meter sea depth by the quay. Considering the shipping companies' strategic commitment to include vessels of 8,000 to 9,000 TEU capacity into the Mediterranean (and Adriatic) liner shipping service, the sea depth along the quay and the cranes' outreach will ensure safe transshipping.

Photo 2: Components of construction of the container terminal Brajdica - Phase 2

As the concession holder's Master Plan provides for transportation of up to 60% of containers by rail, the capacity of the wagon loading and unloading station needed to be increased. To this purpose, a conceptual design was prepared for reconstruction of the Rijeka-Brajdica shunting yard which, in the future, in addition to the shunting point, will have four 420 m long rail tracks for container loading/unloading, equipped with three port cranes for direct wagon-truck container transshipping (Transportation Technological Study, Railway Project Company - ŽPD, December 2011).

3.5 New Container Terminal Zagreb Pier and Container Terminal on the Island of Krk

In terms of sea port development, it is never a matter of a unified port development model, as each individual port has its specific features reflected in the development of the related hinterland, development of the related traffic infrastructure of roads, railways and interior water ways. Moreover, ports have diverse networks of line shipping services defined by the so-called sailing list. The development stage of port infrastructure, superstructure and equipment has a major impact on the port system's internal efficiency. Internal structure and organization of the ports or, respectively, the management model, are just a result of the national economy's development stage.

Each port constitutes an important part or, rather, forms an important link of a logistics chain whose strength and development indicates the traffic route's competitive position.

There are several variants of the Rijeka port development model. There can be no port development without consideration of the specific properties of the area, but also taking into account modern trends in container traffic. The port of Rijeka has an extremely favorable geostrategic position. However, the port's spatial concept is
extremely complex, providing only a few opportunities for expansion.

The traffic forecast of the Port of Rijeka Master Plan provides for 100% occupation of the container terminal Brajdica (including Phase 2 of the same) until the year 2020 at the latest, the logical assumption being that new capacities need to be ensured when 70% utilization of the existing terminal is reached. Therefore, construction of a new terminal at the Zagreb pier must be planned, so that it can be put in operation in 2017, when the container terminal Brajdica reaches approximately 70% utilization.

Plans provide for location of the container terminal at the Zagreb pier on the Western part of the Rijeka port area, on a surface of approximately 25 hectares, with a 680 m long quay to be constructed in two phases, 400 m followed by 280 m. Depending on the applied container handling technology, the terminal's capacity is estimated to reach a maximum of 500,000 TEU per annum. 50% - 60% of containers are planned to be transported by rail. The remaining container quantity will be transported by truck, via the future link road D-403.

For construction of Phase 1 of the pier, a tender was conducted recently for selection of the most favorable bidder for design and construction of the 400 m long and 20 m deep pier, which will enable transshipment of the latest generation containers.

Photo 3: Computer simulation of the container terminal at the Zagreb pier

Source: The Port of Rijeka Authority Archive

In almost all of its development activities, the port of Rijeka is clearly committed to container traffic. All documents defining future activities of port infrastructure development are focused on development of container terminals.

Construction of the container terminal Brajdica Phase 2 is expected to provide capacities for annual transshipment of 500,000 TEU.

The container terminal at the Zagreb pier is a new development project. Construction of this container terminal would give the
The project in the port area is designed to be implemented in three phases (www.portauthority.hr):

Phase 1: Construction of the 400 m long quay with a surface area 250,000 m²
Phase 2: Construction of an additional, 280 m long quay through public-private partnership;
Phase 3: Creating prerequisites for terminal expansion to the area of the Mlaka old refinery.

Construction of the terminal's infrastructure has been ensured by funds of the Rijeka Port Authority (licensor). The price of the project's Phase 1 amounts to 71 million Euro. Phase 2 of the project is to be implemented in cooperation with the concession holder (concessionaire) at the container terminal.

Upon completion of Phase 2 of the container terminal Brajdica and of Phase 1 and 2 of the container terminal at the Zagreb pier, the annual capacity of the port of Rijeka would reach 1 million TEU.

The actual total annual traffic of the strategic partner at Brajdica and the concession holder at the Zagreb pier should come close to this figure. Overall annual container handling at these two container terminals will depend on several factors and circumstances on the market and in the hinterland of the port of Rijeka.

In order to arrive at the full required container terminal capacity of 2.5 million TEU per annum, as indicated in the traffic projection of the Port of Rijeka Master Plan, possibilities for another 1.5 million TEU per annum must be found.

If container traffic reaches the maximum capacity level of 1 million TEU per annum, and the port of Rijeka fails to find new space for development, in such case, based on experience of other ports, the port of Rijeka would enter a period of stagnation which may result in shipping companies and other factors of the logistical chain abandoning this transportation route.

This is exactly why the port of Rijeka initiated activities with regard to long-term container terminal development. The construction of a new terminal can begin after an entire set of issues have been resolved: spatial plans, documents, invitation to tender employing a BOT (build-operate-transfer) model, finding a BOT partner, construction documents, building permit, construction of related road and rail infrastructure, terminal construction and fitting, operational utilization.

A location on the North-Western part of the island of Krk was found to be the optimum solution for accommodation of such new container terminal. This is a long-term development project of the port of Rijeka which requires resolution of the entire set of the above-mentioned issues.

In the future, this location could meet the requirements for the annual capacity of 1.5 million TEU. A fundamental prerequisite would be the construction of new road and rail infrastructure, including construction of a new bridge between the island of Krk and the mainland.

The strategic guidelines of container traffic in the port of Rijeka are reduced to recognition of global logistical processes. The optimization of logistics chains on the Rijeka route will change the port's character with regard to its foreland. The recognition of the port of Rijeka as a new alternative in the whole supply chain and transportation will promote the so-called „South“ route to Europe.
Globalization in ports and in the shipping industry resulted from optimization of logistics chains. Finding a strategic partner at the container terminal Brajdica is one of the prerequisites for the Rijeka transportation route's long-term competitive position. Falling behind in development projects and in expansion of container handling capacities may lead to traffic stagnation.

3.6 Social Aspects of Investment in Container Traffic

A port is a potential generator of development of its hinterland. The port area accommodates participants of traffic flows which use the port's technical and technological resources. The port is just one link in the logistics chain of international transportation on the respective traffic route.

Basically, the port's commercial activities come down to attracting cargo to the port and thus to the transportation route. In terms of the logistics chain of transportation, the port is situated on the way between the manufacturer and the end buyer. This way, the port becomes a part of the supply chain. Each supply chain has its alternative. The port is an important factor in finding such supply chain alternative, thus having a key impact on the entire logistics chain of transportation. A port can have either a reviving or an extinguishing impact on the logistics chain of transportation.

These are exactly the reasons why, by the Port of Rijeka Master Plan, projections of container traffic up to the year of 2030 were brought fully in line with the new terminal capacities. The new container terminals at the Zagreb pier and on the island of Krk lay the foundations for long-term competitiveness of the port of Rijeka.

![Diagram 3: Importance of the port of Rijeka within the framework of the Transportation and communications sector of the Republic of Croatia](image_url)

1 * measured without complex multiplicative effects
The project of modernization of existing container terminals at the port of Rijeka and construction of new ones, as well as future utilization of the same, have both a direct and indirect impact on the development of the hinterland, as the flow of increased quantities of goods will make use of several logistics activities. Reinforcement and creation of new logistics activities create new added value. Such new added value will generate direct revenue for the Croatian state budget and for the local community.

In the period from 2010 to 2020, modernization of the existing terminal and construction of new ones and their utilization will be of extreme importance for the national economy in general and for the economy of the Primorje-Gorski Kotar County in particular. This follows from the results of expert analyses gained by measurement of impacts of the port of Rijeka on national and regional levels, pertaining to direct impacts and, in addition, to complex economic impacts.

With regard to new added value (increase of the gross domestic product), indicators showed that, by implementation of the entire project, in the period from 2010 to 2020, the port is contributing 10% to the growth index of the Republic of Croatia and 30% to the same index on the Primorje-Gorski Kotar County level.

Measured by complex multiplicative effect, the port of Rijeka contributed 1% to the overall gross domestic product of the Republic of Croatia, while in 2020, its contribution will reach a level of 12.7%.

The influence of economic effect and project implementation on development and growth of the transportation and communications sector in the Republic of Croatia will show substantial growth, as it will increase from a 2.8% share in gross added value in 2010 to a 17.2% share in 2020. (Inženjerski biro Zagreb, 2010).

Scientific research points to the fact that investment in modernization, equipping and fitting of the port area brings multiplicative benefits for all the economic entities operating in the Port of Rijeka area; both the economic entities and the wider community of the surrounding area. Such development has been proven to be significant and offering a new quality, as it is based primarily on modernization and creation of a new value.

Research has provided evidence that whatever the port of Rijeka earns as one of the links within the container transport logistics chain, the other links in the chain will earn 12 times more.

When analyzing the port of Rijeka as a part of the supply chain between the manufacturer and the end buyer, it is safe to say that the port has a direct impact on the selection of the transport route or, respectively, the supply chain which includes the logistics chain of transportation as a constituent part of the same.

The project of modernization and construction of new container terminals will reinforce the link of the logistics chain of transportation and will assign a more active role to the port's hinterland, particularly to the network of inland road and rail routes.

The port of Rijeka plays a particularly important role in the integration of the Croatian inland transportation system and its inclusion in international transportation flows, as well as in establishing links between the Pannonian and Adriatic regions of Croatia and between the Danube and the Adriatic regions. The port of
Rijeka not only generates the major part of Croatia's export and import operations; it is at the same time the most important Croatian port for transit of goods via the Croatian transportation system.

The results of this research provide the proof of the fundamental scientific hypothesis that the port of Rijeka is the key subsystem of the land and sea transportation system, an accelerator of cargo flow development, having a substantial impact on numerous economic activities. In its operations, the port of Rijeka is applying basic economic principles in order to provide services and to expand economic activities; it is the basic factor which determines proper and efficient operation of all the other participants in transportation.

4. Conclusion

Experience with development of international ports has shown that systematical development and growth was achieved by those ports which have been following trends of international cargo flows, which have been keeping track of the globalization process in the shipping and port industry and which have adopted the process of dynamic development of the logistics chain of international transportation.

European ports are natural environments of logistics services; they function as intermodal (combined) connection points. Their efficiency is greatly based on the efficiency of services rendered, both at the ports' terminals and in the ports' hinterland.

Pursuant to statutory regulations in the Republic of Croatia, at the port of Rijeka, roles are clearly divided in ensuring the links of the logistics chain outside as well as inside the port area. Port management has been assigned to the port authority which will ensure development of the port infrastructure and will regulate all participants of transportation in the port area and monitor cost-effectiveness of the transport route's logistics chain of transportation. Utilization of the port is assigned to companies (concessionaires, concession holders, operators) which ensure and cost-effectively use the technical and technological resources of the port's superstructure and equipment.

Such companies are integrated as a key link in the transportation route's logistics chain of transportation.

A prerequisite for substantial growth of container traffic lies in the creation of cost-effective logistics chains, which may be turned into a benefit for the port of Rijeka only by a faster, more favorable and higher quality service rendered by all factors of the logistics chain of transportation.

Competition among ports is becoming more intense, therefore increased cargo-handling rates, a higher level of productivity, improved throughput, a better developed hinterland and foreland of the ports are not sufficient to enhance the ports' competitive position. There is a need to present the ports' efficiency and performance through a high-quality network of land routes, developed port infrastructure, superstructure and equipment, keeping track of globalization processes related to shipping companies and ports, optimization of logistics chains of transportation and application of new IT technologies.

Croatia has made a decision to focus on development of modern market economy which is open to the European and global environment. Without an advanced transportation system which is compatible with the developed European environment, cargo flows on the transportation routes will completely bypass Croatia, to the detriment of Croatian sea ports and to the
detriment of the coastal region's economy and overall national economy.

This article looks into problems and current questions regarding container terminal operations of the 1990s in the context of modern transport technologies and methods of organization and of overall trends in transportation. This article pays particular attention to the operation and expansion of the container terminal Brajdica, as well as on plans regarding construction of new container terminals at the Zagreb pier and on the island of Krk.

The port of Rijeka managed to overcome all the difficulties of the former decline in container traffic. The container traffic revitalization process has been successfully initiated, and care was taken to connect and coordinate all the links of the logistics chain on the Rijeka transportation route.

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