

# Intermodal Transport System Quality Indicators in the Context of the Adriatic-Ionian Region

## *Indikatori kvalitete intermodalnog transportnog sustava u kontekstu Jadransko-jonske regije*

Marijan Cukrov

Intermodal Transport Cluster  
Rijeka  
e-mail: cukrov@shortsea.hr

Paola Badurina-Tomić

Intermodal Transport Cluster  
Rijeka  
e-mail: badurina@shortsea.hr

Alen Jugović

University of Rijeka  
Faculty of Maritime Studies  
e-mail: ajugovic@pfri.hr

DOI 10.17818/NM/2016/4.1

UDK 656.02(497.5:4)

Preliminary communication / *Prethodno priopćenje*  
Paper accepted / *Rukopis primljen*: 2. 2. 2016.

### Summary

The Adriatic-Ionian area occupies a very strategic position between three continents: Europe, Asia and Africa. Furthermore, it has a key position along trade routes of major global importance. A number of recent trends such as globalization and growth in international and intercontinental trade, the opening up of eastern Europe and the rerouting of intra-European trade flows provides a new opportunity for the development of the Adriatic Sea ports and for the re-definition of their roles as critical nodal points within the wider area transport network. The aim of this paper is research and analysis of the possibility of redefining the roles of all ports in the observed area with particular attention to all possible transport specializations and cooperation agreements. The above mentioned will be achieved by defining quality labels and indicators.

### KEY WORDS

Adriatic-Ionian area  
Adriatic Sea ports  
intermodal transport  
quality indicators

### Sažetak

*Jadransko-jonsko područje zauzima strateški položaj između triju kontinenata: Europe, Azije i Afrike. Osim toga, ima ključnu poziciju na globalno važnim trgovačkim putovima. Trendovi poput globalizacije i rasta međunarodne i međukontinentalne trgovine, otvaranja Istočne Europe i preusmjerenja unutareuropskih trgovinskih tijekova pružaju novu mogućnost za razvoj jadranskih luka i ponovno definiranje njihove uloge ključnih čvorišta unutar transportne mreže šireg područja. Cilj je rada istraživanje i analiza mogućnosti redefinicije uloga svih luka u promatranom području s posebnim fokusom na sve moguće specijalizacije u transportu i ugovore o suradnji. Spomenuto će se postići definiranjem oznaka i indikatora kvalitete.*

### KLJUČNE RIJEČI

Jadransko-jonski prostor  
jadranske morske luke  
intermodalni transport  
indikatori kvalitete

## 1. INTRODUCTION / Uvod

The Adriatic Gateway is of the strategic importance for Europe, and its prospects of development appear very high. In the global scenario, transport flows in Europe are bound to increase consistently over the next decade despite the negative aspect of the current economic crisis. The trend in increasing freight flows, in the medium long term perspective, is a result of growing international trade. The growing weight of Asia and, broadly speaking, the emerging markets, in world economy and trade is changing the dynamics of the freight transportation market. Even do Western European markets are still the richest on an absolute level, Eastern European Markets are the most dynamic, showing a higher growth rate. In the post crisis scenario this trend is expected to be stronger. On the maritime layer this change will affect heavily the world and European freight routes, opening a window of opportunity for Northern Adriatic ports. The growth of Euro Asian trade will increase the traffic through the Suez Channel and the Mediterranean basin, modifying well - established trade relations.

In general many ports of the observed area have been

characterized in the past by insufficient port infra and superstructure, low productivity, strenuous labor relations and numerous operational bottlenecks seriously restricting their growth potential. Those have, in fact, the potential to increase the productivity of intermodal maritime transport services in the area, rendering it more competitive in an intra-European, international and intercontinental scope. Defining the intermodal transport system quality indicators of services in maritime transport is the key to shipping company's performance and raising competitive advantages of the overall seaborne passenger traffic on maritime markets [7, 53].

## 2. SUMMARY OF THE ADRIATIC-IONIAN INTERMODAL TRANSPORT CORRIDOR / *Kratak opis Jadransko-jonskog intermodalnog prometnog koridora*

The EU transport policy aims not just to promote maritime transport individually, but also to efficiently integrate seaborne connections with land modes and enhance intermodality.

Therefore, the Motorways of the Seas can also be considered as a strategic tool for the development of sea-based intermodal corridors of Europe, which will use short sea shipping and ports as the infrastructure required. Maritime routes especially within the geography of the Mediterranean area pose as viable alternatives to inland routes and to road routes in particular given that the objective is the transfer traffic away from the roads to alternative modes. Particular emphasis should be placed on under-developed corridors with a low intermodal supply, but high intermodal potential. The idea is therefore to promote the use of "maritime intermodal" links within wider transnational transport chains by means of horizontal (Ro-Ro) or vertical (Lo-Lo) operations and in many cases hybrid vessels that can accommodate either technology or even Ro-Pax vessels combining passenger and freight transport [2, 26].

In this context, it is important when considering development of new intermodal corridors in the Adriatic - Ionian area to identify the current modal and intermodal corridors. The identification of primary intermodal corridors, in the above mention area including land bridge corridors was based on key transport demand figures i.e. existing freight trade corridors and traffic flows characteristics, currently operated transport service routes and the results of the transport and logistics actors survey performed in the context of the article. Additionally, the outcomes of previous similar studies performed were considered as well as analysis of maritime services in the article area. As such, in the context of this paper, the identification of the intermodal maritime-based freight transport corridors is based upon the work carried out for the supply of Ro-Ro and Lo-Lo services in the Adriatic-Ionian area and the analysis of the international trade flows patterns/volumes within the core and wider study area.

As a part of the European Union development strategy, the European Commission has brought and adopted a series of long-term development plans and projects, extremely important for the development of Adriatic - Ionian area. A large number of international projects and strategic documents relates to the research of the flow of goods, as well as transport and industrial routes. Essentially, these documents emphasize the key role of a sustainable transport system development in the context of the European transport policy and logistics, as an important component of the transport system, in ensuring a sustainable and competitive mobility in Europe [4, 3].

The current situation of the European freight transport is challenging. The transport market is highly fragmented, with an increasing level of congestion, increasing taxes and fuel prices, and a steady increase of service requirements. The transport industry in itself represents an important part of the economy: in the EU it directly employs around 10 million people and accounts for about 5% of GDP [9, 5]. This reality leads to the need to increase capacity and quality in order to better adjust to a globalizing economy, where flexibility is essential. Traditionally, this increase in quality and capacity was achieved by building new infrastructure; unfortunately the amount of resources that can be invested in developing new infrastructure is finite. Thus, it is crucial to measure freight transport quality of the entire transport chains to identify the weak parts of network, so that the resources can be optimally allocated.

To increase the service quality and the efficiency of intermodal transport corridors there is a need to develop

quality indicators, a quality label and a benchmarking system for intermodal corridors. A Quality Label for a given Intermodal Corridor guarantees to a customer that certain required quality levels are fulfilled. Benchmarking is, in the context of intermodal corridors, first of all a management tool. Corridor operators/ administrators need to compare their performance of operations with the best intermodal corridor operators elsewhere in Europe. Benchmarking makes it possible to identify performance and quality problems, to set targets and to understand how best practice is implemented. Benchmarking is therefore a method used to encourage the emergence of the best practice approach. A benchmarking system has to provide best practice values for quality and performance indicators, which are derived from a standardized method.

The users and potential users (shippers, logistics service providers, intermodal service providers etc.) of intermodal transport and also the operators (terminal operator, pre- and end haulage transport companies, railway and shipping companies) have a big interest in a high quality service at low costs. At present at terminals they face severe problems as long waiting and handling times, reliability of loading unit preparation times, limited opening times, access problems, damaged loading units, paper work, communication problems between the involved actors, etc. Such problems have been identified in past European research projects, e.g. IQ, IMPREND, EUTPII, IMPULSE, REFORM, TERMINET, PROMOTIQ, Freight Integrator study, etc. These problems have a negative impact on service quality and costs at terminals and the overall intermodal transport chain. From the customer's perspective, intermodal transport on many European routes is not competitive with truck-only transport because it [1, 4]:

- costs more,
- takes longer,
- is less reliable, and
- its service offer (routes, frequency) does not meet customer needs.

From the provider's perspective, today's small market for intermodal transport has high growth potential, but the current business environment (a geographically dispersed market with many operators) makes it very difficult to build-up an attractive and efficient network. Customer and operator problems can be grouped into two main categories:

- Quality (i.e. reliability, speed etc.); and
- Coverage area (i.e. network density/number of routes offered).

The effects of these problems are higher production costs and a less competitive service for intermodal transport compared with truck-only transport. Today intermodal terminals in Europe are not subject to any specific quality assessment and control that would allow customers to have a fair view of their performance. Quality criteria and standards are largely missing. To increase the service quality and the efficiency of terminals there is a need to develop quality indicators, a quality label and European benchmark system for terminals. The ISO Standards 9000 and 14000 are neither directly applicable to intermodal transport nor for intermodal terminals and can also not be used as benchmarking systems.

The European Union's ultimate goal in its widest context is to improve Europe's global competitiveness by maximizing the effectiveness of its supply chains. Special attention should

be given to the ports which constitute the main gateways of European territory in terms of freight transport and therefore should be monitored upon [1, 5]:

- Quality: providing the correct mix of standard port services and innovation,
- Efficiency: providing a minimum use of resources,
- Competitive Pricing: ensuring that other partners in the supply chain do not have to pay more for port services than their cost,
- Safety and Security standards to minimize risks for human and property losses,
- Environmental footprint of the operations while moving cargo and while loading/unloading in terminals

It should be recognized that these four targets are standing way beyond the main stream definitions of KPI methodologies, but nevertheless it seems that the concept of CQN as this was envisaged by ADB project should be addressed as possible as it gets. The purpose of this paper is to introduce the concept of breaking down the corridor operation in four discrete types:

- Sea to Rail intermodal connection through a port facility (inbound freight traffic),
- Sea to Hinterland intermodal connection through a port facility (outbound freight traffic),
- Land terminal to Land terminal intermodal connections,
- Information exchange through ICT means/documentation requirements.

For all the above mentioned types of operation adequate sets of Key Indicators should be put in place to formulate a system that can measure all operations against a specific standard.

### **3. INTERMODAL TRANSPORT QUALITY LABELS / *Oznake kvalitete intermodalnog transporta***

There are several reasons to introduce a quality label for intermodal transport corridor operations given. One main problem of intermodal transport is quality such as reliability/punctuality and efficiency. Several combined transport operators are aiming at increasing the reliability in the total intermodal transport chain. Terminal operations are the interface and "central nerves," of that intermodal transport chain and therefore a central node that influences quality in terms of reliability and overall transport speed. To increase the quality in the overall intermodal transport chains means also to increase the quality of terminal operations. A quality label can help to set quality standards that are measurable and by this useful for customers to decide between terminals but also other transport modes. Different objectives can stand behind and foster a quality label:

- Quality makes a difference/Comparison of quality between services in different terminals,
- Better quality can create more benefits in form of productivity and efficiency,
- Certificated quality can be used as marketing tool for operators,
- Quality management can reduce expenses,
- Quality management improves targeted financing and funding,
- Quality regarding sustainability (environment-friendliness) can be used for funding policy,
- High-quality service enhances competition between

terminals and against other transport modes like road transport,

- Quality management can support improvements in performance.

Addresses of a quality label can be: users of terminal services such as intermodal transport operators, logistics service providers, political authorities (national and EU authorities). The users of terminal services, mainly logistics service providers and intermodal operators, are demanding efficiency and quality for terminal services. For the user it is important to know that offered services guarantee reliability and efficiency. Actually their decision for the usage of a terminal depends also on existing infrastructure and location. A major difficulty for the definition of a quality label is probably the diversity and difference between intermodal terminals. A first major distinction can be made between:

- rail/road terminals for combined transport,
- maritime terminals (SSS Terminals and Deep Sea Terminals) for intermodal transport with transshipment of maritime ISO containers, as well as terminals for unaccompanied ro-ro services,
- inland waterway (IWW) terminals connected with road and rail.

Size and location of terminals has to be also taken into account:

- regional terminals for regional accessibility to intermodal network,
- interregional terminals,
- international terminal hubs/gateways.

The diversity of situations and functions of terminals lead to complex typologies of terminals based on the following factors:

- an interface between actors; different types of actors such as infrastructure managers, rail operators, intermodal operators, logistic service providers, road haulers, with often intervention of local authorities or land-use planners,
- an interface between infrastructures of modes: road, rail, inland waterways but also air and maritime infrastructures,
- an interface between operations: operations of different modes, transshipment operations including handling, as well as other maintenance or repair operations with often control and administrative operations.

For the quality label difference in the terminal landscape means that:

- different thresholds for an indicator with respect to different terminal segments could be used or
- different indicators for different terminal segments could be used or
- selected indicators that show reliable performance and quality for all terminals could be taken, mainly on basis on relative values (e.g. energy consumption per loading unit).

The customers can use the quality label for a comparison of offered quality and performance. It helps them to assess services between different terminals. In connection with this it has to be stated that most of the users (logistics service providers and intermodal operators) are aware of the existing terminal landscape and offered services. But in the direct competition between pure road transport and intermodal transport a guaranteed terminal quality via a QL can of course encourage customers to rethink their transport strategy. It is often an argument that intermodal transport does not fulfill

quality aspects. Price, quality, advertisement of comparable products do not differ in many ways. The difference possibilities are focused on the field of customer service providing and costs reduction associated with the management and implementation of goods and information flows. The way to achieve the mentioned objectives is logistics. Logistics plays a key role in the economy in two basic ways [5, 95]:

- logistics is one main items of enterprises' expenditures, thereby affecting other economic activities and is determined and influenced by these activities.
- logistics supports the movement and fluent flow of many economic transactions, is a necessary activity by sale of any product.

Another issue that is of importance is the terminal density. Only where a certain density of terminals is given a competition takes place. A user is not interested in terminals that are far away from his client (shipper). In this case pre- and end-haulage costs are too high and road transport would be the better alternative. But nevertheless the selection of terminals and opportunities in intermodal transport can be made on basis of required quality standards. The QL therefore has a marketing effect that shows the required quality a customer wants to have. Given examples of a marketing effect for quality standards are railway operators. They often publish statistics with respect to punctuality of their trains. If this indicator improves yearly new customers can be expected. On the other hand if this result worsened passenger chooses other operators or modes. This example

shows that indicators can of course be used to win customers and encourage the operator to improve his service level. When designing a quality label there are a number of conditions, described below in table 1, that need to be taken into account.

#### 4. SCOPE AND GENERAL CONTEXT FOR QUALITY INDICATORS / *Djelokrug i opći kontekst za indikatore kvalitete*

By conception, multimodal rail-based chains (composite maritime-rail chains) are meant to be associated with a minimum acceptable QUALITY BASIS of the provided transport services throughout the various chain links. A number of predetermined quality criteria therefore are needed to guarantee the competitiveness of the multimodal rail-based chains against the road haulage alternative with respect to:

- speed, frequency, regularity, continuity and safety/security,
- cost of "door-to-door" service,
- simplicity of documents and administration processes.

The Quality Basis should represent a minimum acceptable quality level to be attained (quality targets or indicators), against which design standards and performance levels have to be adapted regarding the areas of:

- infrastructure, installations and equipment,
- operations (shipping, port, rail),
- externally provided services,
- information flows and documentation

Quality indicators in order to be practical and easy for

Table 1 Intermodal transport systems quality labels  
*Tablica 1. Oznake kvalitete intermodalnih transportnih sustava*

QUALITY LABEL	DESCRIPTION
Open access and Transparency	Open access is a policy objective that is demanded from the EU initiatives. Open access is mainly referred to rail access but of course implies also the question if open rail access can be ensured without open access to terminal services. Therefore it is important that terminal services are open to a wide and not restricted user group. The transparency objective will have consequences in terms of type of information to be provided for terminal activities. For the creation of a quality label information is needed and should be made transparent to the certifying or assessing authority which will provide the quality label.
Service quality	As already mentioned for the end-users (shippers or logistics services) of terminal services mainly the supply of a terminal and the quality aspects are of importance. It is necessary to provide measurable standards that are applicable to the variety of terminals. But it has also to be mentioned that the size should play no role. The end-user will select the terminal independently from the size. For him the offered service level in correspondence with the price are of main interest. He will not make the decision with respect to the difference of terminal.
Safety and security	With security the protection against thefts and terrorism is meant whereas with safety the avoidance of accidents especially in case of handling of dangerous goods is meant. Accidents are besides the financial damage of the freight also a risk for employees in the transport business. Security and safety plays nowadays an important role. For dangerous goods specific measures must be taken, in handling and storage conditions
Environmental Quality	Environmental quality plays in the first line a role for political authorities. For them a QL with respect to the Commissions' objectives is of interest: sustainability of the terminal process, less energy consumption etc. For the end-user more the costs and service quality in the total intermodal transport chain are of special interest.
Human resources and personal	The quality of operation is often depending on the employees and their performance and quality. The globalization and internationalization demand on well-educated personal in an international environment. This requirement does not only count for high educated people but also for working employees. The fast technical developments require flexible and adaptive employees that react towards the technical and economic changes. But also know-how in languages and environmental concerns is asked. A QL therefore should also take the factor "Human resources and personal" into account.
Certification of intermodal transport corridors	The certification and labeling authority for the intermodal transport corridor quality label should be neutral and should have a high acceptance. It can be distinguished between the fee for application and a general annual fee. It can be taken into account to have a differentiated fee system in dependence on the terminal size, function or yearly turnover. A differentiated fee system could be most suitable that would take into account the difference of terminals, i.e. taking into account the yearly turnover of a terminal operator.

Source: Authors

application, they have at the same time to be:

- specific enough in order to create a clear identity for multimodal rail-based services,
- suitably generic in order to be uniformly applied to all multimodal rail-based services, corridors and associated constituent elements (ports, vessels, train, operators, etc.),
- orientated towards chain-link operations efficiency rather than technical characteristics/capacities of infrastructure, installations, handling equipment and transport means.

As already mentioned, multimodal rail-based services are complex services with their overall efficiency depending on efficiencies of individual links and interconnections. The following figure schematically presents multimodal rail-based service integral components and how these are interconnected. In this sense, Quality indicators of an integrated multimodal service are stemming from a synthesis of the Quality indicators of its integral components. For this reason, multimodal Quality indicators were developed by categorizing them in terms of performance quality for [1, 16]:

- Port hinterland rail connection,
- Land-side terminal and quay,
- Sea-side terminal and quay,
- Shipping operations,
- Information exchange and Documentation.

#### 4.1. Port hinterland rail connection / *Željeznički priključak zaleđa luke*

Port connection with adjacent rail networks refers to the link between port rail gate to the closest main rail artery, and it is of crucial importance to multimodal rail-based services efficiency.

Its quality refers to the following parameters [1, 18]:

- speed (average speed to cross the connection leg),
  - safety,
  - capacity,
  - easy access to rail operator(s) within the port.
- Focusing now on rail connection side of a port, belonging to a Motorways of the Sea chain or otherwise, it needs to [1,18]:
- be the shortest possible in length,
  - have the shortest path through urban areas,
  - be adequately maintained and signposted, to acceptable national and EU standards,
  - have adequate capacity (taking into consideration normal traffic conditions), so that congestion is avoided.

Having these parameters in mind, key Quality indicators of port hinterland rail connections for multimodal service compatibility are proposed in the following table.

#### 4.2. Land-side terminal and quay / *Kopneni terminal i obala*

Stevedoring operations should be efficient and flexible with respect to availability and capacity of staff and equipment, to absorb delays and demand peaks. Full compliance to existing safety regulations should be applied, particularly with respect to Dangerous Goods and Cargo Stowage and Securing. Quay(s) cross docking should be adequately designed to the existing standards and regulations. A certified crossing docking service provider should be allowed to ensure fast and safe loading/unloading operations. Following the above, key Quality indicators for the land-side of multimodal rail-based terminal(s)/quay(s) are proposed as follows in table 3.

Table 2 Key Quality Indicators for multimodal rail-based port – hinterland rail connections  
*Tablica 2. Ključni indikatori multimodalne luke blizu željeznice – željezničke linije u zaleđu*

OBJECTIVE	INDICATORS	VALUES
Safe and fast access of freight trains from port exit rail gate to the closest main rail artery connection.	Time needed for a standard freight train to reach the closest main rail artery connection from the port exit rail gate (and inversely), under fully safe driving conditions (taking into consideration rail network quality and normal traffic conditions).	Thirty (30) minutes.
Fast and direct access to rail haulage operators within port premises.	Number of certified rail haulage operators based within port premises.	At least one (1).
Direct port connection with national rail network.	Existence of rail-terminal within the port.	At least one (1).

Source: Authors according to the research within ADB Multiplatform project; SWP 3.4., Establishment of Corridor Quality Networks, p. 19.

Table 3 Key Quality Indicators for the land-side of multimodal rail-based terminal(s)/quay(s)  
*Tablica 3. Ključni indikatori kvalitete za kopneni dio multimodalnih terminala/obala blizu željeznice*

OBJECTIVE	INDICATORS	VALUES
Suitable rail - port facilities	Dedicated multimodal rail - based terminal/quay.	YES
Easy and fast access through port - rail entry gate.	Clearing time through port - rail gate .	Max. allowed time – 15 min.
Easy and fast access of the multimodal rail-based terminal/quay within the port area (after entering the gate).	Special and clear rail signposting. Absence of obstacles that could interrupt the flow of freight trains to/from the multimodal rail-based terminal/quay Differentiation between loading/unloading yard buffer area and the national railway network.	YES
Fast access to the mooring quay through the multimodal rail-based terminal.	Multimodal rail - based terminal adjacent to, or close to the mooring quay.	YES
Terminal/quay security.	Conformity with ISPS Code.	YES
Safe container embarkation/ disembarkation.	Certified ramp service provider.	YES
Conformity with International Terminal Security Regulations.	TAPA (TRANSPORT ASSET PROTECTION ASSOCIATION).	YES
Safety with respect to Dangerous Goods regulations.	Conformity with EU Dangerous Goods regulations.	YES
Fast safety and security inspections.	Priority assigned to multimodal rail-based freight trains.	YES

Source: Authors according to the research within ADB Multiplatform project; SWP 3.4., Establishment of Corridor Quality Networks, p. 21

### 4.3. Sea-side terminal and quay / Pomorski terminal i obala

Looking now multimodal rail-based service requirements from the sea-port-side there is a need for fast, safe and guaranteed sea access of the terminal(s)/quay(s) throughout the year. This calls for high technology level of monitoring means from the port. It also implies that multimodal rail-based ports are carefully selected so that they do not shut down operations easily due to extreme weather conditions. Multimodal rail-based services vessels should be allowed priority once they enter port boundaries regarding quay mooring. In parallel, auxiliary services (tugging, pilotage, waste collection) should be readily available again on a priority basis. Subsequently, key Quality indicators for the sea-side of multimodal rail-based terminal(s) / quay(s) are proposed as follows in table 4.

### 4.4. Shipping operations / Transport

Adequacy of shipping services may be examined with respect to operations features and vessel characteristics. Shipping services as part of multimodal rail-based services are unavoidably associated with high regularity, reliability and continuity. Therefore service frequency and punctuality must be high. Continuity throughout the year must be guaranteed by the operators. Safety and security on board are also non-negotiable. Shipping vessels on the other hand must be adequately fast and reliable, particularly in terms of navigational/ communications means and mooring flexibility [2, 26]. As a result, key Quality

indicators for shipping operations as component of the multimodal rail-based operations are proposed as follows in table 5.

### 4.5. Information exchange and documentation / Dokumentacija i razmjena informacija

Information exchange and Documentation efficiency within a port is crucial for multimodal rail-based level standards performance. Main concerns are:

- the exchange of real time information between multimodal rail-based service stakeholders (shipping operators and agents, port authorities, rail haulers, ship crew, stevedores, customs, etc.)
- time consuming inspections (for documents, transport means, cargo and passengers).  
Critical issues in order to minimize delays are:
- the use of modern ICT technology in order to be able to process multiple documents in parallel, in advance and from a distance
- streamlining of inspections (parallel inspections and not in series)
- assign priority to multimodal rail-based subjects, identifying regular customers and certifying them in advance so that they can be easily cleared (create relevant data bases).

Key Quality indicators for multimodal rail-based procedures related to Information Exchange and Documentation are proposed as follows in table 6.

Table 4 Key Quality Indicators for the sea-side of multimodal rail-based terminal(s)/quay(s)  
Tablica 4. Ključni indikatori kvalitete za morski dio multimodalnih terminala/obala blizu željeznice

OBJECTIVE	INDICATORS	VALUES
Suitable rail-port facilities.	Dedicated multimodal rail-based terminal/quay.	YES
Fast, safe and guaranteed sea access of the terminal/quay by vessels.	Operation of VTMS system in port. Adequate sea-access channel for draught of maximum sized vessel.	YES
Minimize waiting times for services provision to vessels within port (mooring, tugging, pilotage, waste collection).	Priority assigned to multimodal rail-based service vessels. Pilotage Exemption Certificates granted to regular port multimodal rail-based service operators. Coordination between service operators and multimodal rail-based terminal.	YES
Safety with respect to Dangerous Goods regulations.	Conformity with EU Dangerous Goods regulations	YES

Source: Authors according to the research within ADB Multiplatform project; SWP 3.4., Establishment of Corridor Quality Networks, p. 24

Table 5. Key Quality Indicators for shipping operations as component of the multimodal rail based operations  
Tablica 5. Ključni indikatori kvalitete za transport kao sastavni dio multimodalnih operacija blizu željeznice

OBJECTIVE	INDICATORS	VALUES
Regular, reliable and continuous shipping services.	Service frequency Vessel departure/arrival times predetermined and advertised. No interruption allowed throughout the year.	YES
Reliable shipping vessels.	Vessel compliance with all IMO safety/security/reliability regulations. Vessel compliance with VTMS technology requirements (navigation and communication aids). Bow-thruster availability.	YES
Safety of personnel and cargo in shipping.	Availability of cargo securing Manual on board. Compliance with Directives on means of securing cargo.	YES

Source: Authors according to the research within ADB Multiplatform project; SWP 3.4., Establishment of Corridor Quality Networks, p. 26

Table 6 Key Quality Indicators for multimodal rail-based procedures related to Information Exchange  
 Tablica 6. Ključni indikatori kvalitete za multimodalne procedure blizu željeznice vezane uz razmjenu informacija

OBJECTIVE	INDICATORS	VALUES
Fast, flexible and remote exchange of real time information between multimodal rail-based service stakeholders (shipping operators and agents, port authorities, rail haulers, ship crew, stevedoring operators, customs, health services, port police etc) regarding documentation of the provided multimodal rail-based services.	Availability of suitable ICT system for remote real time information exchange (electronic document transfer) between all multimodal rail-based service stakeholders.	YES
	Coordination between ports of origin and destination.	YES
	Communication of cargo documentation well in advance of ship arrival in port.	YES
	Priority assignment to multimodal rail-based services for procedures and dispatch.	YES
Fast clearing of multimodal rail-based subjects from document and physical inspections.	Identify regular customers and certify them in advance so that they can be easily cleared (create relevant data bases).	YES
Streamlined document and physical inspections by Customs.	Priority assigned to multimodal rail-based cargo.	YES
Coordinated customs and safety inspections.	Coordination of routine inspections between different authorities.	YES

Source: Authors according to the research within ADB Multiplatform project; SWP 3.4., Establishment of Corridor Quality Networks, p. 27

## 5. CONCLUSION / Zaključak

The current transport system and its quality indicators in the observed area have been developed by individual activities of some ports and by separate strategies of development in each country. Considering the potential, this system is underdeveloped. The solution is in common act and activities. The EC has recognized and identified bottlenecks of development and issued guidelines based on which this theoretical model was developed. The model includes the implementation of actions to identify bottlenecks in the intermodal transport system, the development of logistics information tools (a sort of route planners for freight), formation of a common regional system of promotion and the development and introduction of quality indicators [3, 145].

Intermodal transport system quality indicators must be conducted through the combination of multidisciplinary scientific methods, transport experience from the participants, as well as analyses of the real situation and potential of the transport system in the observed area. The mentioned can be reached through the following activities [5, 8]:

- definition of viable transport corridors in observed area and their connections to EU member states in East and West Mediterranean, as well as their extensions to other regions,
- definition of quality and security requirements for the identified services,

- performance of an analysis of the transport needs in the region,
- forecast of the future demand of the transport corridor and identify bottlenecks and missing links, infrastructure and services needs,
- identification and evaluation of alternative scenarios,
- provision of investment and time planning for identification of funding sources.

## REFERENCES / Literatura

- [1] ADB Multiplatform project, SEE Transnational Cooperation Programme; SWP 3.4., Establishment of Corridor Quality Networks, 2014.
- [2] EastMoS project, IPA SEE; East Mediterranean region flow patterns and key tendencies related to future MoS development, 2009.
- [3] Jugović, A.; Žgaljić, D.; Poletan Jugović, T. (2010). „Model poticaja razvoja intermodalnog prijevoza jadranske regije u funkciji održivog razvoja“. Pomorstvo: journal of maritime studies, vol. 24, no. 2, pp. 129-146.
- [4] Kegalj, I.; Cukrov, M. (2012). „Influence of the Adriatic Transport Corridor on the Sustainable Development of Croatia“. ZIRP, Zagreb, 17. travnja 2012.
- [5] Majerčak, P.; Masárová, G.; Klieštik, T.; Buc, D.; Majerčaková, E. (2013). „System Approach of Logistic Costs Optimization Solution in Supply Chain“. Naše more, vol. 60, no. 5-6, pp. 95-98.
- [6] Plazibat, V.; Krčum, M.; Skračić, T. (2015). „Tools of Quality in Determining the Characteristics of Services in Maritime Passenger Transport“. Naše more, vol. 62, no. 2, pp. 53-58. <http://dx.doi.org/10.17818/NM/2015/2.2>
- [7] White Paper, A Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system, European Commission, Bruxelles, 28 March 2011, COM (2011) 144 final.
- [8] Žgaljić, D.; Cukrov, M.; Tsamboulas, D.; Chiappetta, A. (2011). „The development of Adriatic motorways of the sea for sustainable development of intermodal transportation“. 6th International Scientific Conference on Ports and Waterways POWA 2011, Zagreb.