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COMPETITIVENESS OF THE NORTH ADRIATIC PORTS IN VARIOUS CARGO FLOWS ON SELECTED TRANSPORT ROUTES

ABSTRACT

The functioning of the entire cargo flow process within a transport system lies on the assumption that the operation of all the factors involved in the transport chain has been analysed with the aim of bringing them in harmony and obtaining a competitive price and high quality transportation service. Within the narrow catchment area, the ports of Trieste, Koper, and Rijeka have operated as competitors. All of them gravitate to the same natural hinterland, yet each of them operating on the market with quite a different approach. In assessing the competitiveness of a certain transportation route involving hub ports, land communications with the hinterland, and size of the catchment area, the factors like port charges, inland transport charges, and time required, are considered essential determinants for the selection of an optimum transportation route. In order to assess the overall competitiveness of a certain port regarding various factors involved (port charges, railway transport charges, and time required), and comparing it with another port competitiveness level, this paper proposes that a collective competitiveness index be introduced. The model is aimed at sorting out the most competitive ports according to certain sorts of goods on the selected transportation routes.

KEY WORDS

North Adriatic ports, competitiveness, transportation route, competitiveness index

1. INTRODUCTION

Where the operation and development of a port are concerned, the national transport related to the foreign trade plays a very important role as the one to be counted upon with certainty and with comparatively precise quantity and structure planning possibilities. In general, however, the national substratum does not suffice either for an optimum exploitation of port capacities or for any significant development rate; therefore, a good standing on the international market is highly required as well as struggling for as many commodities as possible from the hinterland countries. These requirements have been also confirmed by the widely known statement that goods in transit represent the non-commodity export producing foreign currency income and attracting significant cargo quantities which make the essential prerequisite for a better port development and port capacity engagement.

As the key link in the transportation chain, sea ports with their tariffs and transport service quality have either a stimulating or destimulating impact upon the acquisition of new cargoes. However, the functioning of the entire cargo flow process within a transport system lies on the assumption that the operation of all the factors involved in the transport chain has been analysed with a view of bringing them in harmony and obtaining a competitive price and high quality transportation service.

In advanced circumstances, according to the basic logistical principles ruling on the international transportation market, in the selection of proper transportation routes for cargo destinations, the situation of the north Adriatic ports deeply indented in the European continent as well as their favourable geographic situation have been given secondary importance, as compared to the transport cost and speed. Two physically different distances may easily become equal in terms of economy. It is important to point out that cargo movement and definitions as well as the creation of particular transportation routes have been nowadays determined to a great extent by multinational companies and large owners to suit their own interests.

For instance, cargo carriage by sea on board two vessels of equal size and features would cost more on the route from Asia to Malta than from Asia to Hamburg, although the former distance is much shorter. Generally speaking, the through transport from Asia to Hungary results more or less the same either through the north Adriatic or the north-west European ports. Thus, the competitiveness of the north Adriatic ports is diminished and their choice depends in the first place

Table 1 - Traffic of dry cargoes in the ports of Trieste, Koper and Rijeka **(in 000 tonnes)**

Port	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Trieste	9.192	7.110	8.864	11.215	9.663	10.275	10.444	12.124	12.377	11.599	8.716
Koper	4.248	4.056	5.429	5.098	5.731	7.001	6.619	7.387	7.456	7.540	9.151
Rijeka	4.347	3.555	3.705	2.309	2.523	3.289	2.546	2.564	2.906	2.727	3.557
Total	17.787	14.721	17.998	18.622	17.917	20.565	19.609	22.075	22.739	21.866	21.424

Source: [4, 7]

on the Asian large transport operators as well as on the policies of EU and other countries.

2. INTERRELATIONS OF THE NORTH ADRIATIC PORTS OF RIJEKA, KOPER AND TRIESTE

Within the narrow catchment area, the ports of Trieste, Koper, and Rijeka operate as competitors. All of them gravitate to the same natural hinterland, yet each of them operates on the market with quite a different approach.

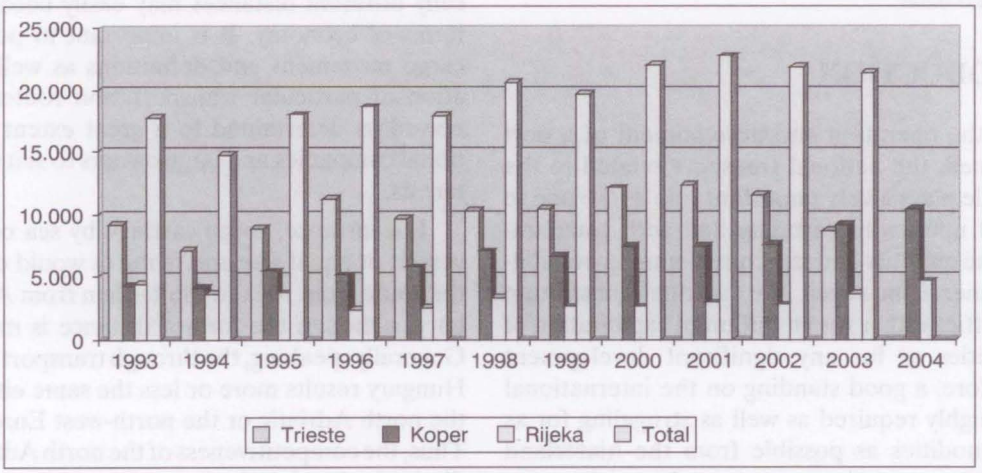
The ports of Koper and Rijeka have been primarily focused on the transit of goods, representing in both ports a share of 70% of the total turnover, whereas the share of transit cargoes in the port of Trieste only amounts to approx. 20% [3]. The most significant transit routes for the ports of Rijeka and Koper reach from Austria, Hungary, Czech Republic, and Slovakia. The port of Rijeka has found a significant transit partner in Bosnia and Herzegovina. Both these ports have had nice prospects in the growth of transit for Serbia, Macedonia and Albania. The development plans of the port of Trieste have envisaged growths in transit, particularly where Austrian, Hungarian, Czech, and German cargoes (Bavaria) are concerned. All three ports have shown interest in Ukraine and south Poland as their potential transit partners.

Within the wider catchment area, there are a number of transportation routes which have experienced fast development in the past decade, to become strongly involved in competition with the north Adriatic transportation route. The first to be mentioned is the route across the north-west Europe with the ports of Rotterdam, Hamburg and Bremen, followed by the eastern one across the Black Sea. These cargo flow routes have recorded a significant turnover growth in the past few years, particularly where the share of Hungarian cargo is involved.

It is therefore necessary and indispensable for the ports of Trieste, Koper, and Rijeka to cooperate and join their efforts regarding joint competition with the north-west European and the Black Sea ports.

However, it should be highlighted here that, unlike Rijeka, the ports of Koper and Trieste have been provided with information technology systems and communication networks linking them with their service users, in addition to their advanced technological process automation and computerization, and investments in updated information technology infrastructure in general. It is worth mentioning here the joint European project, presently under preparation, on electronic integration of transportation and trading systems of Slovenia, Hungary, Austria, and Italy, with the Republic of Croatia also invited.

The present cooperation between the ports of Trieste, Koper, and Rijeka has been felt in their joint promotion as well as in the promotion of the north Adriatic transportation route on international trade markets, yet, there is a need for aggressive joint marketing activities on any actual as well as potential markets.



Graph 1 - Traffic of dry cargoes in the ports of Trieste, Koper and Rijeka

Table 1 presents the traffic of dry cargoes in the ports of Trieste, Koper and Rijeka.

The port of Trieste and the port of Koper in particular, have made intensive investments in new facilities in the past two decades or more. According to the facts, these undertakings have proven profitable and they are expected to generate positive results in the long run constantly. The port of Rijeka is facing a significant turning point at the moment: either to start an intensive investment cycle aimed at upgrading the existing facilities and building the new ones in a ten-year period, in order to be able, by using its technological solutions and fast service rendering, to fight the competition and to regain and/or attract new cargoes; or to develop just a small and self-sufficient port.

3. COMPETITIVENESS ASSESSMENT MODEL FOR PORTS AND THEIR APPROPRIATE TRANSPORTATION ROUTES

In assessing the competitiveness of a certain transportation route involving hub ports, land communications with the hinterland, as well as the size of the catchment area, factors like *port costs and expenses, and land transport costs and time required* are considered essential determinants for the selection of an optimum transportation route.

The distance between the port and the point of destination in the hinterland is an essential factor. However, in consideration of the fact that different distances may take different times in dependence on the land infrastructure quality rate, the number of border crossings, land transport means technical features, transport organization, and the like, the distance is often a poor indicator. For this reason, this paper has chosen the time required from/to the port to/from the point of destination in the hinterland as the factor relevant for the selection of a transportation route.

3.1. Competitiveness factor analysis for the ports of Rijeka, Koper, and Trieste

The major objective of the competitiveness assessment model for ports and their appropriate transportation routes to the selected points of destination in the hinterland is to find out which one among the three north Adriatic ports: Rijeka, Koper, or Trieste, is the most competitive transit port for the selected points of destination in the hinterland, taking into consideration:

- *port charges* for a certain type of vessel,
- *railway transport charges* to the selected point of destination in the hinterland,
- *transport time taken* from the port to the destination.

The subject of the study comprises:

- three north Adriatic ports: *Rijeka, Koper, and Trieste* which operate as competitors, owing to the more or less same catchment areas,
- various *types of vessels* calling at the ports: general cargo, coal, and grain carriers,
- selected *points of cargo destination*: Vienna in Austria, Budapest in Hungary, and Brno in the Czech Republic.

In setting the model, it is necessary to carry out a number of various preliminary activities, among which appropriate data collection is very important for an analysis of the model as good as possible. Here are the *data* required:

- *port charges* by the category for the three ports observed,
- railway transport charges, and cargo *transport charges* to the destination in the hinterland,
- *transport time* required from particular ports to particular points of destination.

The model has the objective to show which one of the ports is more competitive for certain types of cargo: general cargo, coal, and grain carriers. Liquid cargoes have not been considered here.

Port charges comprise the following categories of charges: light dues, port dues, pilotage, mooring/ /unmooring, customs clearance, agency fee, garbage removal, licence fee, bunk guarantee, towage, and miscellaneous.

In publicly open ports the port tariffs are applied consisting of port fees and port dues. Port fees are adopted and publicly announced by the Port Authorities and they comprise [6, 158/03, Art. 62]: port dues, demurrage and berthage.

Port dues are charged to vessels carrying out commercial operations, i. e. loading or discharging passengers, goods, and vehicles. Inoperative ship berthage is imposed upon vessels using the port for any purpose other than loading or discharging passengers, goods, and vehicles. Berthage fee is imposed on fishing vessels, yachts, and fishing, sport and other types of small crafts and floating units.

Port dues are charged to port users with respect to services used in publicly open ports. It is within the Port Authority's competence to determine the maximum amount applicable. Concessionaires carrying out their activities in publicly open ports are required to publicly announce their own port dues applicable for each particular activity or service rendered.

In order to maintain the competitiveness within the port, and on the basis of objective circumstances evaluated as indicative of the port non-competitiveness, the Port Authority is entitled to reduce the tariffs either completely or selectively, with respect to the

possibility left to the concessionaires of adapting their business operation to such reduced tariffs.

The fees and dues are presented in Table 2 with respect to various services being rendered at the ports of Rijeka, Koper, and Trieste. For illustration, the computation of the total disbursements is presented in relation to the general cargo carrier. The data do not include cargo-handling tariffs, and consequently the results obtained should be interpreted with a certain reserve.

Formal tariffs are not completely reliable and it is necessary to point out that according to the established custom, lower rates are usually negotiated with customers and particularly where long-term agreements are involved, with respect to the demand fluctuation on the port service market. Owing to its "very delicate" nature, this sort of information is practically unavailable.

Tables 3-6 present port charges (USD per ton, per net tonnage, and per vessel gross tonnage) with respect to the following categories of vessels:

- general cargo vessel discharging 3000 metric tons (MT) of a certain general cargo composition (paper, coils, and timber). Vessel features are: 3119 GT and 1548 NT;
- bulk carrier discharging 130,000 tons (MT) of coal; having the following features: 80,300 GT and 40,300 NT;
- bulk carrier discharging 27,000 tons (MT) of grain; having the following features 17,973 GT and 7,056 NT; and
- drive-on/drive-off ferry discharging vehicles weighing 1500 tons (MT); having the following features: 40,772 GT and 12,232 NT; data relating to this type of vessels in the port of Trieste were not available.

Table 2 - Port charges for general cargo vessel in the ports of Rijeka, Koper and Trieste

Port / Cost type	Rijeka		Koper		Trieste	
	USD	%	USD	%	USD	%
Light dues	1,471 (0.95xNT)	20.1	542 (0.35xNT)	7.8	1,161 (0.75xNT)	19.7
Port dues	3,000 (1.00xMT)	40.9	3 150 (1.05xMT)	45.5	85 (har.due)	1.4
Pilotage	176 (88x2)	2.4	240 (120x2)	3.5	348 (174x2)	5.9
Mooring/unmooring	206 (0.033xGT)	2.8	237 (0.038xGT)	3.4	200 (100x2)	3.4
Custom clearance	200	2.7	300	4.4	543	9.2
Agency fee	1,100	15.0	1,135	16.4	2,080	35.2
Garbage removal	124 (124x1)	1.7	56 (56x1)	0.8	42 (42x1)	0.7
Licence fee	35	0.5	105	1.5	–	–
Bank guarantee	58	0.8	55	0.8	–	–
Towage	804 (1/1x402)	11.0	900 (300x3h)	13.0	900 (1/1x450)	15.3
Rest	150	2.1	200	2.9	543	9.2
Total	7,324	100	6,920	100	5,902	100
Total without light dues	5,853	100	6,378	100	4,741	100

Source: [3]

Table 3 - Port charges for general cargo carrier (in USD with and without light dues) in the ports of Rijeka, Koper and Trieste

Port	Rijeka		Koper		Trieste	
Light dues	with	without	with	without	with	without
USD/MT	2.44	1.95	2.31	2.13	1.97	1.97
USD/GT	2.35	1.88	2.21	2.04	1.81	1.89
USD/NT	4.73	3.78	4.47	4.12	3.81	3.81

Source: [3]

Table 4 - Port charges for a coal vessel (in USD with and without light dues) in the ports of Rijeka, Koper and Trieste

Port	Rijeka		Koper		Trieste	
Light dues	with	without	with	without	with	without
USD/MT	0.88	0.58	0.71	0.60	0.43	0.43
USD/GT	1.42	0.95	1.14	0.97	0.69	0.69
USD/NT	2.83	1.88	2.28	1.93	1.37	1.37

Source: [3]

Table 5 - Port charges for a wheat vessel (in USD with and without light dues) in the ports of Rijeka, Koper and Trieste

Port	Rijeka	Koper	Trieste			
Light dues	with	without	with	without	with	without
USD/MT	0.95	0.71	0.81	0.72	0.73	0.73
USD/GT	1.43	1.06	1.21	1.07	1.10	1.10
USD/NT	3.65	2.70	3.09	2.74	2.80	2.80

Source: [3]

Table 6 - Port charges for a car carrier (in USD with and without light dues) in the ports of Rijeka and Koper

Port	Rijeka	Koper		
Light dues	with	without	with	without
USD/MT	15.55	7.70	9.49	8.06
USD/GT	0.57	0.28	0.35	0.30
USD/NT	1.89	0.94	1.16	0.99

Source: [3]

Table 2 presents a port charges breakdown by the charge category with respect to the general cargo carrier in the ports of Rijeka, Koper, and Trieste. On the basis of data presented in Tables 3-6 it is possible to make a computation, just like in Table 2, of port charges with respect to a bulk grain carrier and a coal carrier (their features including capacity, net, and gross tonnage are quoted above). However, where the competitiveness assessment model is concerned, all this will not be necessary, since the competitiveness rate is to be assessed in respect of port tariffs (from Tables 3-6).

Prior to setting the model, it should be pointed out that it appears strikingly clear from the data presented in the Tables above, that the port of Rijeka is not competitive according to its actual light dues figures. The port charges figures are indicative of the seriously jeopardized competitiveness of the port of Rijeka in contrast to the ports of Koper and Trieste, due to the very high light dues level. For this reason, in setting the port of Rijeka competitiveness assessment model, the data are going to be used with this charge included/excluded in order to possibly obtain different results.

In consideration of the *inland (railway) transport charges*, let us point out that transport operators, not being inclined to disrupt their reputation and to impair their development prospects, have consequently made every effort to obtain the freight rates assuring their maximum possible net-returns, whereas on the other hand, transport service users have demanded lower freight rates to be compatible with the transport terms and conditions offered. It can be therefore justifiably argued that the demand for the land transport services on the Rijeka transportation route as well as the size of the port of Rijeka catchment area and turnover will very much depend on the competitiveness of this transportation route as against any other transportation route, in terms of the "inland through transport rates to be borne by the transport service user".

Public railway tariffs often differ from the actually agreed railway tariffs due to various railway freight rebates granted by most railway authorities in different forms and amounts, the majority of them being considered confidential. Taking into account that these rebates cannot be precisely foreseen, being agreed on a case-to-case basis in dependence on cargo types, cargo quantities, transport user (permanent or tempo-

Table 7 - Railway transport rates and time for iron ore, grain, and containers from the ports of Rijeka, Koper, and Trieste to the hinterland destinations in Vienna, Budapest, and Brno

Port	Rijeka				Koper				Trieste			
Destination	iron ore	grain	cont.	h	iron ore	grain	cont.	h	iron ore	grain	cont.	h
Vienna	1,997	1,539	55.98	26	1,010	1,439	52.34	31	809	875	31.83	18
Budapest	980	980	35.63	32	1,308	1,308	47.54	39	1,337	1,449	52.29	48
Brno	1,563	1,563	56.81	76	1,890	1,890	68.73	48	1,920	2,032	73.88	48

Source: [1, pp. 78-82; 2, pp. 28]

rary), and many other factors, the only possible and justifiable way to carry out the analysis of the railway freight transport tariff component is to use the public railway tariffs in determining the railway transport charge. Accordingly, the railway transport charge figures presented in Table 7 refer to the public railway tariffs applicable for iron ore, grain, and containers from the ports of Rijeka, Koper, and Trieste to the hinterland destinations in Vienna, Budapest, and Brno. The rates are expressed in EUR/ton, in addition to EUR/TEU for containers. Railway transport times from particular ports to the destination have been presented as well.

3.2. Setting of the competitiveness model

Here are the requirements for setting the *competitiveness assessment model of the port of Rijeka*:

Step 1

- comparison of port charges between Rijeka and Koper,
- comparison of port charges between Rijeka and Koper for particular vessel types;

Step 2

- comparison of railway transport charges from Rijeka and Koper to the three selected points of destination within the catchment area: Vienna, Budapest, and Brno,
- comparison of railway transport charges from Rijeka and Trieste to the three selected points of destination within the catchment area: Vienna, Budapest, and Brno;

Step 3

- comparison of railway transport times from Rijeka and Koper to the three selected points of destination,
- comparison of railway transport times from Rijeka and Trieste to the three selected points of destination,

Step 4

- with the aim of achieving a better layout of the results following the preceding steps, an individual index table should be drawn up so that this relative number may be used in making the above mentioned comparisons,
- the competitiveness index of the port of Rijeka should be calculated with respect to various cargo types and various hinterland points of destination.

An index is a type of relative number used in comparing two frequencies of the same statistic mass. It indicates the relative change in one frequency as against the frequency it is compared with. The relations between particular phenomena within a group of diversified phenomena can be monitored by individual indexes. Thus, it is the very index to be used in computing the relations between particular factors of one port as against the other.

By applying this model, it is possible to make the computations of: the port charge index, railway transport charge index, and railway transport time index.

The formula for computing the index is the following [5]:

$$I = \frac{f_1}{f_2} \cdot 100$$

where:

f_1 – statistic mass frequency 1;

f_2 – the same statistic mass frequency 2, used as the comparison basis.

For illustration purposes, here are the port charge indexes computing methods including and/or excluding light dues for general cargo at the port of Rijeka as against the port of Koper. The data required for this index computation can be found in Table 3.

The port charge index with light dues included can be obtained as follows:

$$I = \frac{2.35}{2.21} \cdot 100 = 106,$$

and without light dues:

$$I = \frac{1.88}{2.04} \cdot 100 = 92.$$

The results obtained have shown that, where general cargo is concerned and the port charges include light dues, the port of Rijeka is by 6% behind the port of Koper, whereas with port charges excluding light

Table 8 - Indexes for the model of competitiveness

	Rijeka-Koper			Rijeka-Trieste		
Port charges	with light dues		without light dues	with light dues		without light dues
general cargo	106		92	124		99
coal	125		98	206		138
grain	118		99	130		96
vehicles	163		93	–		–
Railway transport charges	Vienna	Budapest	Brno	Vienna	Budapest	Brno
general cargo	107	75	83	176	68	77
coal	198	73	83	247	75	81
grain	107	75	83	176	68	77
Railway transport time	84	82	158	144	67	158

dues in either of the ports, the Rijeka transport route appears to be by 8% more competitive. Other indexes contained in Table 8 can be obtained by analogy.

Additional rows and columns can be inserted in the Table, thus enabling more than the above three factors to be observed as influencing the selection of the transport route. In addition, apart from the three hinterland points of destination, any other point of destination can be selected for cargoes handled in a particular port. Likewise, it is possible to have the competitiveness index computed in respect to additional cargo types, although almost all of them have been comprised with the types already mentioned. However, no liquid cargoes have been considered, such as oil and oil products, where the port charge indexes can be realistically expected to differ considerably from one port to another. The Table of individual indexes is to be used as the basic prerequisite for the competitiveness index computation.

With the aim of assessing the overall competitiveness level for a particular port with respect to various factors (port charges, railway transport charges, transport time), and comparing it to another port competitiveness level or to a competitiveness level expressed in another time unit, the proposal made in this paper refers to the introduction of *competitiveness index*. It represents a number expressing the relation between the values of factors observed in the port subject to competitiveness assessment and the port compared with, within the time unit observed, for the selected route and cargo type.

The competitiveness index is a collective index obtained as the arithmetic mean of individual indexes. Collective indexes are numbers used in the measurement of relative changes within a heterogeneous group of phenomena. Typically, the sequence frequencies are expressed in different measurement units or at different value levels.

The collective index should be used for a numerical description of a relative change for the whole, whereby the relations between the parts of the whole should be properly manifested. The arithmetic, geometric, and harmonic mean values should be applied for the purpose. The choice depends on each particular case, yet the arithmetic mean has been most frequently used. The mentioned mean values can be either pondered or simple. A simple mean is good representative of the group value only provided all the phenomena within a group are equally valued, as in case of this model. Where some of individual indexes are to be particularly emphasized, i. e. attached more value as against the others (e. g. to emphasize the significance of the port charge index within the competitiveness index, as against any other indexes) then the correct relation between the parts and the whole is to be pursued by means of the pondered mean. Pondered values are used to emphasize the significance of a phenomenon within a group.

The formula for computing the collective index is as follows [5]:

$$I_k = \frac{I_1 + I_2 + \cdots + I_n}{n}$$

where:

I_k – competitiveness index,

I_i – individual index; $i = 1,\ldots, n$

For illustration, here is the computation procedure for the competitiveness collective index of the port of Rijeka as against the port of Koper for general cargo destined for Budapest. The data required for this index computation can be found in Table 8.

Table 9 - Competitiveness collective index of the port of Rijeka considering the cargo type and its destination: a) with light dues and b) without light dues

a) with light dues

Cargo type	Rijeka – Koper			Rijeka – Trieste		
	Vienna	Budapest	Brno	Vienna	Budapest	Brno
general cargo	99	88	116	148	86	120
coal	136	93	122	199	116	148
grain	103	92	120	150	88	122
vehicles	118	107	135	–	–	–

b) without light dues

Cargo type	Rijeka – Koper			Rijeka – Trieste		
	Vienna	Budapest	Brno	Vienna	Budapest	Brno
general cargo	94	83	111	140	78	111
coal	127	84	113	176	93	126
grain	97	85	113	139	77	110
vehicles	95	83	111	–	–	–

It follows that the competitiveness index with light dues is:

$$I = \frac{106+75+82}{3} = 88$$

and without light dues:

$$I = \frac{92+75+82}{3} = 83$$

As consequence of the above, it can be concluded regarding the port of Rijeka, taking into account the port charges, railway transport charge, and railway transport time to the destination, that the port of Rijeka is by 12% more favourable than the port of Koper, whereas with port charges excluding light dues in both ports, the Rijeka transport route appears to be by 17% more favourable. Other indexes contained in Tables 9a) and 9b) can be obtained by analogy.

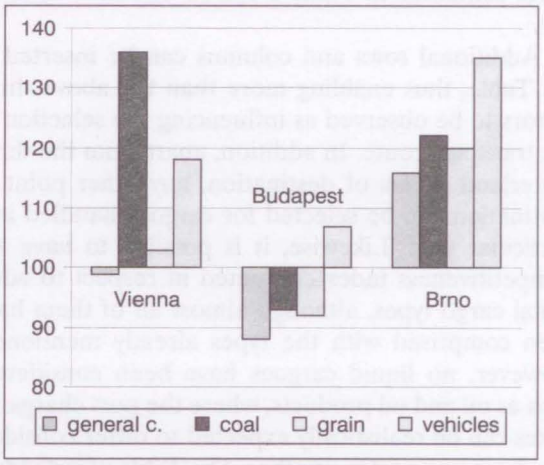
The above described model may be extended with regard to:

- other charges and some other factors affecting the selection of a particular transport route,
- additional points of destination within the catchment area of the ports observed,

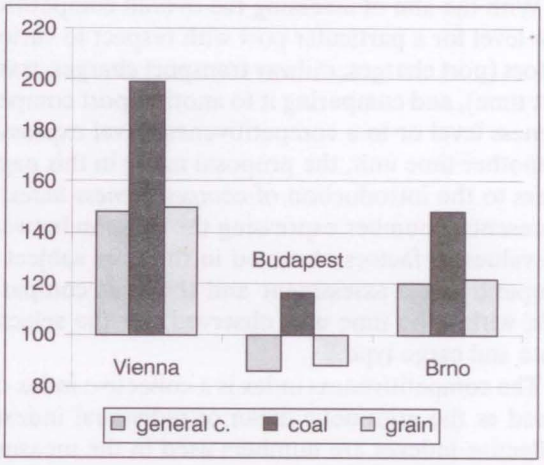
and eventually applied to any other ports accordingly.

It is easy to understand from Graphs 2 and 3 the advantages of the port of Rijeka as compared to the port of Koper where general cargo, coal, and vehicles are concerned with Budapest as destination, as well as compared to the port of Trieste where general cargo and grains destined to Budapest are concerned.

Table 10 shows a general breakdown of competitiveness indexes for any port, various cargo types, and multiple points of inland cargo destination (D)/departure (Dp).



Graph 2 - The competitiveness collective index for the port of Rijeka compared to the port of Koper



Graph 3 - The competitiveness collective index of the port of Rijeka compared to the port of Trieste

Table 10 - General table for competitiveness index

Port I – Port i	Port I – Port II				...	Port I – Port i			
destination/departure	D/D_{pI}	D/D_{pII}	...	D/D_{pn}	...	D/D_{pI}	D/D_{pII}	...	D/D_{pn}
Cargo type					...				
cargo I					...				
cargo II					...				
cargo III					...				
.					...				
.									
.									
cargo k					...				

3.3. Review of the competitiveness levels of the ports of Rijeka and Ploče

Whilst the port of Ploče does not fall within the category of the north Adriatic ports, it is for the purpose of comparison that the competitiveness index of the port of Ploče is going to be computed here by the same method as in case of the port of Rijeka, the port of Ploče being the second largest transit port in the Republic of Croatia, immediately following Rijeka.

The task required data collection with regard to port charges of the port of Ploče applicable for general cargo carriers, coal carriers, grain carriers, and container carriers. The setting of the model also required the collection and analysis of railway transport charges for the cargo types involved, to their hinterland destinations in Vienna, Budapest, and Brno, as well as the transport times required. The data required are displayed in Table 11.

It can be concluded from the results presented in Table 12 as follows:

- most individual indexes exceed 100, which does not favour the port of Ploče,
- the port is least of all in competition with the port of Trieste,
- the port is more competitive than the port of Koper and the port of Trieste where the railway transport charge to Budapest is concerned, by 10% and 20% respectively,
- it is out of competition with the other two ports where port charges are concerned, particularly

Table 11 - Railway transport charges and times for the cargo types involved from the port of Ploče to their destinations and charges of the port of Ploče

Factor	Transport charges (euro)			Time	Port charges (USD/MT)		
Destination	iron ore	grain	cont.	hours	general cargo	coal	grain
Vienna	3,303	2,545	92.6	43	2.70	1.55	2.08
Budapest	1,194	1,194	43	39			
Brno	2,386	2,386	86.71	116			

Table 12 - Indexes for the model of competitiveness for the port of Ploče

Port charges	Ploče-Rijeka			Ploče-Koper			Ploče-Trieste		
general c.	111			117			137		
coal	176			218			361		
grain	146			172			189		
Railway transport charges	Vienna	Budapest	Brno	Vienna	Budapest	Brno	Vienna	Budapest	Brno
general c.	165	121	153	177	90	126	291	82	117
coal	165	122	153	327	91	126	408	89	124
grain	165	122	153	177	91	126	291	82	117
Railway transport time	165	122	153	139	100	242	239	81	242

Table 13 - Competitiveness collective index of the port of Ploče considering the cargo type and its destination

Cargo type	Ploče – Rijeka			Ploče – Koper			Ploče – Trieste		
	Vienna	Budapest	Brno	Vienna	Budapest	Brno	Vienna	Budapest	Brno
general c.	147	118	139	144	102	162	222	100	165
coal	169	140	161	228	136	195	336	177	242
grain	159	130	151	163	121	180	240	117	183

with respect to coal, where the figures applied in the ports of Koper and Trieste are exceeded by 118% and even 260% respectively.

The competitiveness collective indexes for the port of Ploče do not exceed 100, which means that, generally speaking, the port of Ploče is not in competition with the ports of Rijeka, Koper, and Trieste, just as expected, yet they have been computed here for the sake of competitiveness level review. First of all, the port of Ploče is not provided with satisfactory inland transport communications with the hinterland, apart from being more distant from the observed hinterland centres and less adequately equipped with port facilities, infrastructure and suprastructure than the ports of Rijeka, Koper, and Trieste. The major turnover rate of the port of Ploče results from cargoes in transit for Bosnia and Herzegovina. Its significance is expected to grow considerably with the construction of the Vc transport corridor.

4. ANALYSIS OF THE COMPETITIVENESS MODEL RESULTS

It can be concluded from the competitiveness model presented here regarding the port of Rijeka as compared to the neighbouring ports of Koper and Trieste, attracted by almost the same catchment area, that the competitiveness level of the port of Rijeka would be much higher if the category of charges concerning light dues were not taken into account.

In order to make the port charges of the port of Rijeka competitive, there were some 30% [3] reductions introduced in the period 1996 - 2001 with respect to the categories collectable from various port participants, such as port dues (Port Authority), towage (private enterprise), pilot charge (private enterprise), garbage collection (municipal sanitation dept.), etc. There were no reductions in light dues, which are collected by the state-owned enterprise for the maintenance of navigation aids 'Plovput d. o. o. ', Split.

Consequently, despite the 30% reduction in port charges, the Rijeka transport route is still less competitive than the ports of Koper and Trieste, due to the light dues which exceed the figures applied in the ports of Koper and Trieste by 171% and 27% respectively. The calculation refers to light dues per vessel net tonnage (NT) amounting to 0.95 USD/NT for the port of Rijeka, 0.35 USD/NT for the port of Koper, and 0.75 USD/NT for the port of Trieste. Thus, a vessel carrying 130,000 t of bulk cargoes (coal or iron ore) on the Rijeka transport route will be charged light dues exceeding by 24,180 USD the ones applicable for the port of Koper. The difference appears to be even more striking where car ferries are concerned. Thus, a 40,772 GT / 12,232 NT vessel will be charged light dues in amount of 11,620 USD at the port of Rijeka (0.95 USD/NT) and 2,140 USD (0.175 USD/NT; official tariff amounts to 0.35 USD/NT) in Koper. In this case, light dues on the Croatian transport route exceed by 443% the figure applied at the port of Koper. As a result following the preceding data, there has been no vehicle handling at the port of Rijeka any more, whereas the port of Koper recorded an annual turnover of 300,000 units.

Light dues are imposed upon any vessel navigating through the lanes along the coast of the Republic of Croatia. They are collected by the Plovput shipping agent. Plovput is a limited liability company, with the majority of shares owned by the state. Light dues are equally applied to all vessels calling at Croatian ports (Rijeka, Ploče, Split, and Dubrovnik), the rate being much lower in case of yachts and passenger ships.

Early in 2001, the Port of Rijeka Authority made an attempt towards Plovput aimed at finding a solution to the problem, the light dues applied by the Republic of Croatia being extremely heavy as compared to other countries. The letter was supported with documents submitted by the Croatian Association of Shipping Brokers and Agents, the Port of Rijeka, and Transadrija (leading forwarders). There has been no response up to this day and no measures undertaken in respect to the problem. The total income collected by Plovput from vessels calling at the port of Rijeka amounts approximately to USD 3 billion yearly.

With the reduction of light dues, the port of Rijeka might be in competition with the neighbouring ports, thus stimulating the vessel and cargo turnover growth at the port, as well as an increasing income for Plovput d. o. o., and total turnover growth which would reflect upon higher profits for all the subjects involved in the transport of goods, insurance, and other activities on the Rijeka transport route. All this would significantly contribute to faster revival of the port of Rijeka and

prosperity of the complete trading industries in Croatia.

The port of Rijeka covering more than 70% of Croatian ports' total turnover, participates just with 6-15% in the total income of all the participants in the Rijeka transport route, the share of all the other participants in the transport (railway, ship owners, road transport operators, forwarders, shipping agents, ship-handlers, surveyors, insurance companies, banks, etc.) amounting to 85-94%.

It is therefore indispensable for light dues to be brought to a competitive level as soon as possible, thus to enable the Rijeka transport route to compete with other north Adriatic ports under the same conditions. This will open faster possibilities for the comeback of cargoes and shipping lines lost, as well as for the attraction of new ones. Provided a favourable solution to the problem concerning light dues, the port of Rijeka will be able to take advantage of the positive change.

An analysis of the results displayed in Tables 9a) and 9b) brings us to the conclusion that the position of the port of Rijeka is not as bad as it may appear in comparison with the competition. The port of Rijeka is in competition with the port of Koper where general cargo is concerned, provided that either the point of destination or the departure of cargo is Vienna, and also where general cargo, coal, and grain are concerned, provided that Budapest is the point of destination/departure. Compared to the port of Trieste, the port of Rijeka is the better choice with respect to general cargo and grain destined to Budapest. However, taking into account light dues, the port of Rijeka stands in competition with Koper where grain and vehicles are concerned, provided that the point of destination/departure is Vienna, as well as for vehicles destined to Budapest, whereas where coal transport to Budapest is concerned, the port of Rijeka is more competitive than the port of Trieste and the Trieste transport route.

Having in mind that practically the inland transport charge and quality, particularly where railway transport is involved, have considerable impact upon the canvassing of new cargoes, attention should be paid to the canvassing of cargoes in transit from Hungary, the Czech Republic, and Slovakia, where railway transport charges are more competitive than those from the neighbouring ports of Koper and Trieste. The port of Rijeka is competitive in respect to almost all cargo types destined to Hungary, in particular for grain, iron ore, and container transport destined to the Czech Republic and Slovakia.

On the basis of the above said, and according to the analysis of the data collected, as well as an insight into the competitiveness model results, it can be concluded that the port of Rijeka and the Rijeka transport route catchment area cover the territories of the Czech Republic, Slovakia, and Hungary, whereas in case of Austria the competitive ports of Trieste and Koper offer more significant advantages. For this very reason, it is necessary to establish a common administrative body (with the Ministry of Shipping, Transportation, and Communications) to be entrusted with the complete information technology integration and harmonization of all the transport service participants' requirements and objectives. Particular attention should be paid to elimination of "bottlenecks" and impermissibly high disbursements. The basic objective should comprise the determination of the transport service total expenses and quality level required to be competitive on the shipping market and to guarantee the acquisition of new cargoes on the Rijeka transport route.

There is already some statistic evidence showing that the port of Rijeka has made certain steps in this direction, i. e. the port of Rijeka statistics 2003, recording a 31% turnover growth rate as compared to 2002. The 2003 turnover reached 3,557,206 tons of cargo [4]. The port of Rijeka turnover in 2004 was 4,654,698 tons, which was the level the port of Rijeka had been achieving in the late 80s.

Beside the timber cargo, a 34% general and bulk cargo turnover growth rate was recorded as well. The container turnover has been distinguished out of the general cargo group for the high growth rate reaching 81%, thus representing the fastest growing cargo turnover throughout 2002. There has been a favourable turnover and a 34% growth rate recorded in respect of the so-called other general cargoes, a 40% turnover growth rate in respect to ferrous metals in particular (pipes, plates, profiles, coils, wires, bars, rods, concrete reinforcing rods), a growth rate exceeding 80% regarding pulp, followed by a 15% growth rate in respect to rice, and considerable quantities of bagged sugar. In addition, there was also the fruit cargo turnover monitored separately within the general cargo group during 2003, with a 24% growth rate recorded.

The 2003 bulk cargo turnover also recorded a 34% growth rate as compared to the 2003 figures. The Bakar terminal recorded a 42% turnover growth rate. There were particularly outstanding growth rates recorded in respect of the coal cargo turnover for Italian market and the iron ore turnover for the Hungarian market. The Bakar terminal also recorded some significant turnover rates in respect to the cement and clay. The turnover growth rate in respect of the so-called other bulk cargoes nearly redoubled (92%), particularly in respect of the Istrian road gravel in export for Italy via the port of Bršica, and soya in transit for Hungarian market, closely followed by salt and sugar in bulk.

According to commercial plans, favourable announcements, and larger number of new contracts, particularly regarding the second semester 2004, further turnover growth has been guaranteed in 2005, which would bring the port of Rijeka back to the favourable position it had enjoyed in the early 90s.

5. CONCLUSION

The principal objective of the competitiveness assessment model for particular ports and their appropriate transport routes to the selected points of destination in the hinterland is to find out which one among the three north Adriatic ports observed, i. e. Rijeka, Koper, or Trieste, is the most competitive transit port for the selected points of destination in the hinterland.

The model is aimed at evaluating the overall competitiveness level of the port of Rijeka with respect to various factors involved (port charges, railway transport charges, transport time) and comparing it with competitiveness levels of the ports of Trieste and Koper. For this purpose, this paper has proposed the competitiveness index to be introduced for use as the number expressing the relations between the values of particular factors of the port observed as compared to the port compared with, within the time unit observed, for the selected route and cargo type.

In setting a model, it is very important to carry out appropriate data collection which would enable the performance of as good an analysis of the model as possible. The model imperfection refers to the large number of various data to be collected and unified for all the ports observed, but there is also great advantage in obtaining the exact result, having in mind the determinist nature of the model.

The advantage represents the exact result comprising a number of segments: what other ports the port of Rijeka is in competition with, considering cargo types and movement directions. As it results from the study carried out, the port of Rijeka is in competition with the port of Koper where general cargo is concerned with the point of destination/departure in Vienna, as well as where general cargo, coal, and grain are concerned with their point of destination/departure in Budapest. Compared to the port of Trieste, the port of Rijeka provides a better choice in respect to general cargo and grain in transit for Budapest.

It is possible to extend the above-described model with regard to other charges and some other factors affecting the selection of a particular transport route. It makes it possible for additional routes and port communications with different points of destination within their catchment areas to be considered as well. Finally, the model may apply to the competitiveness analysis regarding any group of ports.

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SAŽETAK

KONKURENTNOST SJEVERNOJADRANSKIH LUKA ZA RAZLIČITE VRSTE ROBA NA ODABRANIM PROMETNIM PRAVCIMA

Funkcioniranje cjelovitog procesa protoka tereta u prometnom sustavu pretpostavlja analizu funkcioniranja svih čimbenika u prometnom lancu s ciljem usklađivanja i dobivanja konkurentne cijene i kvalitete prometne usluge. U užem gravitacijskom području luke Trst, Kopar i Rijeka djeluju kao međusobni konkurenti. Sve tri luke posjeduju ista prirodna gravitacijska područja, ali postoje stanovite razlike u opsluživanju tržišta. U određivanju konkurentnosti određenog prometnog pravca, koji obuhvaća luke kao čvorišta, kopnenu povezanost luke sa zaleđem, i veličinu gravitacijskog područja značajni čimbenici su troškovi koji nastaju u luci, cijena i vrijeme kopnenog prijevoza, kao bitne odrednice u odabiru optimalnog prijevoznog puta. Da bi se utvrdila veličina ukupne konkurentnosti određene luke s obzirom na raznorodne čimbenike (lučke troškove, cijenu željezničkog prijevoza, vrijeme prijevoza) te usporedila sa stupnjem konkurentnosti neke druge luke, u ovom se radu predlaže uvođenje skupnog indeksa konkurentnosti. Cilj modela je pokazati koja je luka konkurentnija za određene vrste tereta na određenim prometnim pravcima.

KLJUČNE RIJEČ

sjevernojadranske luke, konkurentnost, prometni pravac, indeks konkurentnosti

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SCIENCE COMMUNICATION IN ELECTRONIC JOURNALS IN THE FIELD OF TRAFFIC AND TRANSPORT

ABSTRACT

Electronic journals have become an inevitable source of scientific information. Their advantage, in relation to the printed journals results from the characteristics of the media: they are available to all the interested users at the same time, before than the printed version, and they are not necessarily related to the location of the library. Since one of the basic roles of librarians in the process of disseminating scientific and professional information is to provide the users with the information which they need and when they need it, the librarians tend to inform the users primarily about the available electronic sources. The objective of this work is to systematize the journals in the field of transportation sciences through an overview of journals that are available to the Croatian academic community in the databases of full text articles at the National and University Library, and the libraries of scientific institutions and faculties, which are gathered around the subsystems of the Scientific Information System. In the aggregated databases of EBSCO Publishing, 34 journals from the field of transportation sciences were selected, and in the publisher databases the following was selected: 8 titles by the publisher Kluwer Academic Publishing, 24 titles by the publisher Elsevier Science, 6 titles by Springer Verlag and 3 titles by the publisher John Wiley & Sons. For the selected full text journals the Impact factor (IF) was used from the Journal Citation Reports (JCR). The data on indexing and abstracting rates in the secondary databases for individual journals were taken from the ULRICH'S database.

KEYWORDS

journals in the field of transportation sciences, databases with full text articles, ISI selection, impact factor, secondary databases

1. INTRODUCTION

Science communication in its contemporary form is experiencing an innovative era of the way of thinking, acting and production of knowledge in the recent 40 – 50 years. It has become one of the key elements of accelerated and sustainable growth of population development, and the inter-social exchange of knowledge and skills have become the *spiritus movens* of every further development in human history.

Modern tendencies in the development of electronic technology are modifying the traditional two-way flow of scientific communication. The communication process has evolved from the slow individual communication channels towards very fast and interactive ones. This results in the network of scientific communications which stimulates the formation of digital communication network independent of time and space distance [1].

The significance of transportation sciences in the modern world is growing constantly and it may be claimed that this is one of the essential characteristics that influence all the aspects of human activities. At the end of 20th century and the beginning of the third millennium the trend of fast development and globalization is continuing. In today's economy traffic has found itself in the narrowest circle of production and social interest, thus including the scientific circle as well. The scientific knowledge and its timely availability in the field of transportation sciences are of high importance, and thus they acquire an important social status [2].

Advanced strategies and transformations of transportation sciences make the classical travelling method increasingly unnecessary and introduce us to the world in which information travel more and more instead of people. The development of transportation sciences has to be followed by the libraries and they have to provide faster and better availability of the latest research results.

The journals are considered the most important form of the primary scientific periodicals and they play a crucial role in the scientific activity especially in the natural and applied sciences. They are places of pre-