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ACCOMMODATING CONTAINER VESSELS IN THE NORTHERN ADRIATIC PORTS THROUGH OPTIMAL FEEDER SERVICING

ABSTRACT

Maritime traffic, in particular container transport, is experiencing rapid and technologically advanced development of transport means. This development has led to the construction of vessels of constantly increasing capacity that transport containers around the world. Vessels with a capacity of up to 18,000 TEU are to be expected and port development will have to adapt to these trends.

This trend will inevitably change conditions in the northern Adriatic, which is lacking the maritime and market conditions to accommodate large dimension vessels. Hence, the question is raised whether the northern Adriatic ports will be able to establish connections that will allow them to maintain their market share in relation to western European ports. The solution can be provided by an optimal feeder vessel service.

KEY WORDS

container vessel, northern Adriatic ports, container traffic, feeder service

1. INTRODUCTION

The growing significance of containerisation in sea traffic is reflected in the adaptation measures that have to be implemented by sea carriers and ports alike. Worldwide container traffic is increasing at an annual rate of 8 to 10%. However, in the northern Adriatic the growth rate is lower, approximately 6%.

2. THE TREND OF INCREASING CONTAINER TRAFFIC IN THE NORTHERN ADRIATIC PORTS

The increase of container traffic in the northern Adriatic ports can be estimated by means of linear trend extrapolation. The results suggest that in 2005 container traffic in the northern Adriatic ports will amount to 803,000 TEU, a 9% increase over that of the year 2001. The trend is expected to continue, with total container traffic reaching 951,000 TEU in 2010, 1,074,000 TEU in 2015, and nearly 1.2 million TEU (1,198,000 TEU) in 2020.

Today, in the gravitational hinterland of the northern Adriatic ports (due to the different nature of its gravitational hinterland the port of Ravenna is excluded from this particular illustration) approximately 1 million TEUs for overseas exchange[1] are available. In 2001, the ports of Rijeka, Koper and Trieste han-

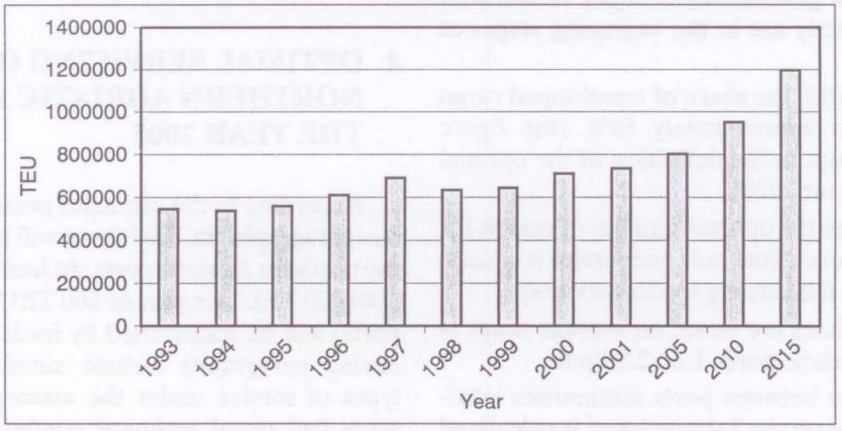

Figure 1 - Linear trend of increasing container traffic in the northern Adriatic ports

dled only 560,000 TEUs; i. e., only slightly more than a half of the total number of containers available for overseas exchange in their gravitational hinterland. The other containers were transported along other routes – mostly northern European routes.

3. DEFINITION OF THE MODEL OF SERVICING THE NORTHERN ADRIATIC PORTS

The maritime container market dictates the construction of vessels of constantly increasing capacity. Because of their technical-technological properties and economic limitations, these vessels will call at only a few ports along their route.

For the northern Adriatic ports, the increasing size of container vessels is a crucial problem. The Adriatic Sea lacks the fundamental maritime and market conditions that would allow ports to accept Malacca-max[2] vessels. Therefore, the implementation of an optimal feeder service is vital for the development and subsistence of ports in this part of the Mediterranean.

The index of the container traffic growth in the northern Adriatic ports is too low to make the introduction of several direct liner services feasible. As a result, one of these two alternatives will have to be chosen:

- the implementation of feeder services to certain ports several times a week, or
- the establishment of a regional hub, collecting all containers in the area to transport to a mega hub port in the Mediterranean with larger vessels.

The optimal size of container vessels is conditioned by the following factors:

- forecasts anticipate that in the next ten years 30% of all cargo will be transported by feeder vessels. This represents the maximum recommendable share because of the aspirations of shipowners and ports to maintain the share of direct entries at at least 70%. In addition, new generations of super vessels with huge TEU capacity are in the beginning stages of construction,
- after the year 2015, the share of transhipped cargo will increase to approximately 50% (the figure taken into account in the definition of the optimal service for the year 2020),
- in order to define the optimal number of vessels for the entire area, each time only one service is considered (excluding the existing feeder services),
- entry and exit times are based on average times in all northern Adriatic ports; i. e., 2.5h/port,
- the journey time between ports summarises information available on the Internet[3] and is calculated on the basis of distances between ports.

The calculation of the optimal size of container vessels to service the northern Adriatic ports is based on the following equation:

$$N_L = \frac{Q_k\, y_n}{O_L K} \tag{1}$$

The equation includes the following variables:

Q_k = yearly number of containers to be transported [TEU],

Y_n = coefficient of the asymmetrical container influx,

K = vessel capacity [TEU]

O_L = number of turnarounds made by a vessel in one year.

$$O_L = \frac{T}{T_o} \tag{2}$$

T_o = turnaround time needed by a vessel that consists of:

- journey time – p_i
- waiting time for loading or unloading containers in a port – $č_i$
- manoeuvring time (entry and exit of the vessel) – m_i

$$T_o = \sum_{i=1}^{n-1} p_i + \sum_{i=1}^{n} č_i + \sum_{i=1}^{n} m_i \tag{3}$$

T = analysed time

$$O_L = \frac{T}{\sum_{i=1}^{n-1} p_i + \sum_{i=1}^{n} č_i + \sum_{i=1}^{n} m_i} \tag{4}$$

These equations provide the basis for the derivation of the model for the definition of the optimal size of container vessels to service the northern Adriatic ports:

$$N_L = \frac{Q_k\, y_n}{\dfrac{T}{\sum_{i=1}^{n-1} p_i + \sum_{i=1}^{n} č_i + \sum_{i=1}^{n} m_i}\, K} \tag{5}$$

4. OPTIMAL SERVICING OF THE NORTHERN ADRIATIC PORTS IN THE YEAR 2005

According to the estimates presented in the previous paragraphs, in 2005 there will be 803,000 TEU in the northern Adriatic ports. At least 30% of this cargo (240,900 TEU per year or 660 TEU per day in all five ports) will be transported by feeder vessels. The following paragraphs include simulations of various types of service under the assumption that all five ports had equal technical conditions – 2 Panamax shore cranes with a capacity of 25 TEU/crane/h.

4.1. Conventional (commercial) feeder system

The first simulation includes the conventional feeder system that provides feeder services to certain ports only. This system is already present in the northern Adriatic.

The next simulation is based on two liner services providing feeder services to only certain ports in the northern Adriatic (a single feeder connection between all five ports would be too long) and a Mediterranean port (Gioia Tauro or Malta[4]).

This simulation includes servicing of three northern Adriatic ports (Ravenna, Trieste, Rijeka) and their connection with the port of Malta. The simulation is based on vessel speeds of 15 and 20 knots. The optimal number of container vessels and their size were calculated by means of the formulas presented in the previous paragraphs. The parameters taken into account were:

Q_k = 144,500 TEU,
Y_n = 10 %,
K = simulations from 300 to 500 TEU,
T = 365 days,
T_o = 5.83 days, simulation at the speed of 15 knots,
T_o = 4.6 days, simulation at the speed of 20 knots,
O_L = 62.60, simulation at the speed of 15 knots,
O_L = 79.30, simulation at the speed of 20 knots.

The optimal solution includes four vessels with a capacity of 500 TEU and the speed of 20 knots employed at the Malta-Ravenna-Trieste-Rijeka route, providing regular daily service to these ports.

The next simulation includes the ports of Venice, Koper and Malta, and takes into account the following parameters:

Q_k = 96,360 TEU,
Y_n = 10 %,
K = simulations from 300 to 500 TEU,
T = 365 days,
T_o = 5.48 days, simulation at the speed of 15 knots,
T_o = 4.27 days, simulation at the speed of 20 knots,
O_L = 66.6, simulation at the speed of 15 knots,
O_L = 85.5, simulation at the speed of 20 knots.

In this simulation, the optimal solution includes three vessels with capacity of 550 TEU and the speed of 15 knots, servicing each port four times a week.

Another simulation includes servicing of all northern Adriatic ports (Ravenna, Venice, Trieste, Koper and Rijeka) and their connection with the port of Malta. The parameters taken into account were:

Q_k = 240,906 TEU,
Y_n = 10 %,
K = simulations from 500 to 1600 TEU,
T = 365 days,
T_o = 6.55 days, simulation at the speed of 15 knots,
T_o = 5.2 days, simulation at the speed of 20 knots,
O_L = 55.73, simulation at the speed of 15 knots,
O_L = 70.2, simulation at the speed of 20 knots.

Regular service supplied to all the northern Adriatic ports would require four vessels with a capacity of 1200 TEU and a speed of 15 knots, or four vessels with a capacity of 1000 TEU and a speed of 20 knots. The high daily costs make vessels of this size inappropriate. Therefore, this service would have to include more vessels with a lower capacity and that is why it is not to be recommended.

4.2. Regional hub service

The second possibility is the selection and creation of a regional hub in the Adriatic. Studies forecast that the main ports; i. e., mega hubs along the Round-the-World (RTW) line will require a relatively high number of regional and subregional hubs connecting smaller ports.

Despite its poor economic results in the last years, the port of Trieste can be determined as the only port in the northern Adriatic that meets all the requirements for the creation of a regional hub. It is equipped with suitable transhipment gear, in particular the two post-Panamax cranes, and has sufficient sea depth (18m at the post-Panamax cranes).

The simulation is based on the service linking all the five northern Adriatic ports on a daily basis. Containers are collected in Trieste and transported by high-capacity vessels to Malta. Only the traffic in four ports is taken into consideration because in Trieste containers do not have to be reloaded onto a feeder vessel.

This simulation takes into account the following parameters:

Q_k = 192,725 TEU,
Y_n = 10%,
K = simulations from 300 to 500 TEU,
T = 365 days,
T_o = 2.32 days, simulation at the speed of 15 knots,
T_o = 2.03 days, simulation at the speed of 20 knots,
O_L = 157.3, simulation at the speed of 15 knots,
O_L = 179.8, simulation at the speed of 20 knots.

In this simulation the optimal solution includes the employment of two vessels with a capacity of 600 TEU and the speed of 20 knots providing a daily service to all the northern Adriatic ports.

The next simulation includes servicing the port of Trieste and a hub port in the Mediterranean (Malta in the case studied) with vessels with a capacity of 1000 to 2000 TEU and the speed of 20 to 24 knots. The port equipment includes three cranes with the capacity of 25 TEU/crane/h.

Q_k = 240,900 TEU,
Y_n = 10%,
K = simulations from 1000 to 2000 TEU,
T = 365 days,
T_o = 4.55 days, simulation at the speed of 20 knots,
T_o = 4.29 days, simulation at the speed of 22 knots,
T_o = 4.04 days, simulation at the speed of 24 knots,
O_L = 80.22 days, simulation at the speed of 20 knots,
O_L = 85.10 days, simulation at the speed of 22 knots,
O_L = 90.35 days, simulation at the speed of 24 knots.

The optimal service between Trieste and Malta includes two vessels with a capacity of 1700 TEU and the speed of 20 knots, servicing the ports every other day.

4.3. Analysis of optimal servicing in 2005

In the coming years the world container traffic will increase significantly. To enhance their competitiveness in relation to the western European ports and to maintain their market share on the European container market after the year 2005, the northern Adriatic ports will have to adapt to the world trends and introduce joint measures into their activities. One of the solutions entails the optimal servicing of this part of the Mediterranean with container vessels.

The calculation results reveal that the optimal servicing of the northern Adriatic ports in the year 2005 includes the use of two feeder services. The first service, providing a regular service 5.5 times a week, would connect Malta-Ravenna-Trieste-Rijeka and employ four vessels with a capacity of 500 TEU and the speed of 20 knots. The second service would connect Malta-Venice-Koper-Malta and would employ three vessels with a capacity of 550 TEU and the speed of 15 knots. In this manner, a regular service would be provided 4 times a week on the average.

Such organization of the feeder service would certainly result in an increase in the container traffic handled by the northern Adriatic ports. Shipowners regularly follow movements on the sea and land. Therefore, increased service provided in an area leads to an increased interest of shipowners in the same area. That is why two additional feeder vessels should be prepared in order to supplement the present feeder vessel fleet.

In this case, the creation of a regional hub in Trieste is not feasible (an insufficient quantity of containers) because it would result in two container transhipments – in Trieste and Malta – that would considerably increase the cost of the entire transport route.

Today, ports aim at regular and rapid container traffic services. Hence, the implementation of this simulation would provide a daily service to all the Adriatic ports, which ought to result in increased container traffic in these ports.

5. CONCLUSION

In the near and distant future the world container traffic will continue to increase, with consequences for all ports, including those of the northern Adriatic. The container traffic through the northern Adriatic ports is too low to make them attractive as hub ports to major shipowners; which is why feeder connections with the main Mediterranean ports bear vital importance for the development and subsistence of these Italian, Croatian and Slovene ports. In addition, the northern Adriatic ports are at a disadvantage because of the length of the traffic route – 1500 nautical miles longer than ideal. And finally, their maritime conditions do not allow for the acceptance of vessels exceeding certain dimensions.

Nevertheless, the northern Adriatic ports have the advantage of being the 'south route' to Europe for cargo from the Near and Far East. The route to the northern Adriatic ports is several days 'shorter' than to northern European ports. Despite this advantage, the northern Adriatic ports cannot compete with the northern European ports unless they cooperate by implementing an optimal feeder service.

The major problem facing the northern Adriatic ports is the increasing dimensions of container vessels. Hence, even though the existing cargo handling gear allows for higher traffic, investments into its modernization will be necessary to enhance higher transhipment effects and new feeder connections with the main transhipment ports in the Mediterranean. A well-organized feeder service can guarantee an increase in the container traffic in the entire area. The success of the feeder service is not predetermined by very high quantities of containers. It depends vitally on its organization and strategic connections between the ports and the shipowners. Optimal servicing of the northern Adriatic ports can result in higher container traffic. In addition, in order to achieve the desired results, land connections (in particular block trains running several times a day from each port) will have to be improved.

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POVZETEK

MODEL SERVISIRANJA SEVERNOJADRANSKIH PRISTANIŠČ S KONTEJNERSKIMI LADJAMI

Zadnja leta se pomorski promet, zlasti pa pomorski prevoz kontejnerjev, izredno hitro in tehnološko napredno razvija. To se kaže predvsem v gradnji ladij vse večjih kapacitet, ki prevažajo kontejnerje med največjimi svetovniimi pristanišči (RTW servis). Strokovnjaki napovedujejo ladje s kapaciteto okoli 18.000 TEU. Temu trendu se bo neobhodno moral prilagoditi tudi razvoj pristanišč.

Ta razvoj bo spremenil tudi razmere v severnem Jadranu, ki nima maritimnih ne tržnih pogojev za sprejem ladij omenjenih dimenzij. Zato je za severnojadranska pristanišča nadvse pomembno, kako se bodo znala in zmogla medsebojno povezati in tako obdržati tržni delež glede na zahodnoevropska pristanišča. To jim lahko omogoči dobro organiziran servis s feeder ladjami.

KLJUČNE BESEDE

kontejnerske ladje, severnojadranska pristanisča, kontejnerski promet, feeder servis

NOTES

1. Marketing activities at Pier VII, internal material of Luka Koper, 2001
2. Larger vessels that can still navigate the Straits of Malacca in Southeast Asia.
3. http://www.distances.com/Distance.asp
4. In the long-term perspective, the port of Malta is more suitable for transhipment activities. The world trends of container vessel growth anticipate the draught of Malacca-max vessels to reach approximately 21m. In the Mediterranean, only the ports of Algeciras in Spain and Malta are currently capable of accepting vessels of this size.

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