

CURRENT ISSUES IN OPERATIONAL PLANNING OF GENERAL CARGO TRANSPORTATION ON CONTAINER FEEDER LINES IN THE BLACK SEA REGION

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Abstract: The present paper analyzes the current issues of operational planning of general cargo transportation on container feeder lines in the Black sea region. The process is influenced by the presently unfavorable economic conditions, shipping policy incentives of the European Union, structure and capacity of the container terminals in the region and recent regulations for control of air pollution from ships. Within the framework of increasing fuel prices and decrease of cargo volumes, liner operators have to apply new approaches for operational planning through optimization of vessels' service speed, shipping capacity utilization and schedule integrity.

Keywords: CONTAINER FEEDER LINES, OPERATIONAL PLANNING, SHIPPING CAPACITY, SERVICE SPEED, SHIPPING SCHEDULES

1. Introduction

Development of containerized general cargo transportation in the Black Sea region is influenced by the geographical location of the region, cargo volumes generated on mainstream container lines and current status of development of regional container terminals. The organizational specifics of the technological process and configuration of the transportation networks of container feeder lines in the region are also the outcome of the policy incentives of the European Union as concerns short-sea shipping and international regulations for air pollution prevention in maritime transportation. Within the framework of increasing fuel prices and decrease of cargo volumes, liner operators have to apply new approaches in operational planning for optimization of operational costs levels, shipping capacity utilization and schedule integrity.

2. Analysis of current issues in transportation planning of container feeder lines in the Black Sea region

The dynamics of containerized general cargo transportation in the Black Sea region are presented in Figure 1. In 1995 cargo volumes accounted for 200000 TEUs and increased to 1.79 million TEUs in 2005.

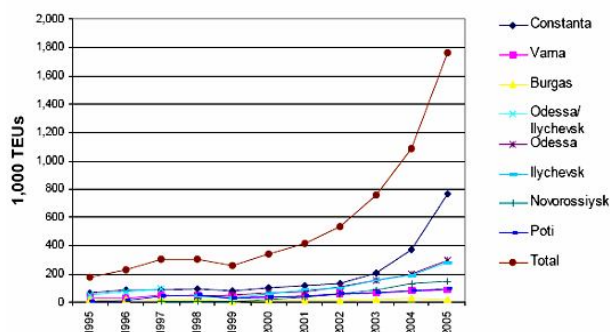


Figure 1. Containerized general cargo volumes at Black Sea ports in 1995-2005[9]

Maritime transportation plays an important role in the development of international trade of the European Union as 90 % of the international trade volumes and 40 % of the internal trade volumes are transported by maritime transport [2].

The expected increase of containerized general cargo volumes at Black Sea container terminals will reach in 2018 about 350 million tons. In 2007 the volume of cargoes transported on short-sea shipping routes accounted for 1.86 billion tons which represents an increase of 1.3 % as compared to 2006 [4]. The same tendency is valid for containerized general cargo transportation on container feeder lines: an increase by 20% on a yearly basis is ascertained during the last decade and as of the beginning of year 2011 containerized cargo transported on feeder lines accounts for 50% of the container traffic in the European Union [5].

The European Union policy for development of short sea shipping aims at providing efficient, regular and reliable cargo transportation by sea ensuring for its competitiveness as concerns time reliability and costs. Other important objectives are to ensure efficient interconnections between container terminals and hinterland in the Black Sea region, to improve administrative services quality and to ensure for high quality of the transportation process. Among the major objectives are not only the development of the short sea shipping networks but the concentration of cargo volumes on maritime logistics routes, decrease of freight traffic on inland routes through redirection of cargo volumes from road to sea transportation, decrease of air pollution levels incurred by road transportation.

Container feeder lines in the Black Sea region provide for important transport interconnections between the region and the mainstream intercontinental lines from Far East and North America to Europe, as well as the Mediterranean region and the Middle East. The dynamics of containerized cargo transportation in the region is mainly a direct consequence of the dynamics of cargo volumes on the mainstream lines between Asia and Europe, especially as concerns the increased cargo volumes on the direction from Far East to Europe. Given an increase of seaborne cargo volumes on the Asia/Far East - Europe mainstream lines, an increase of cargo volumes in the hinterland is observed, including higher transshipment volumes at Black Sea container terminals. The latter is a direct factor for the increasing importance of the transportation of containerized general cargoes on feeder lines in the Black Sea region serving as links between the hub ports in the Mediterranean and Middle East with feeder ports in the region. Thus an increase of volumes transported on feeder lines in the Black Sea region enhances the opportunity to attract more cargoes on short sea shipping routes and ensures for higher capacity utilization in order to achieve higher efficiency of transportation. The latter tendency lies behind the perspectives for the expansion of feeder networks in the region along with relatively steady increase of the number of containerships servicing the lines and higher volumes of

containerized cargoes generated at hub ports. Having in mind the limitations imposed by the technological characteristics of container terminals in the region, liner operators are confined in operating smaller containerhips and thus cannot benefit fully from the economies of scale in contrast to the mainstream lines.

The most important advantage of general cargo transportation on container feeder lines in the region is the decrease of the freight traffic on inland connections, decrease of air-pollution from road transport and lower costs. This type of transportation organization can help in overcoming the underdeveloped inland based transport links in some countries in the region. Feeder shipping provides for higher efficiency as relates to costs in comparison with road transportation and ensures for higher degree of cargo preservation. The expansion of container feeder lines gives way to direct access to a number of regional markets thus limiting the number of transshipments and increasing the number of direct ports on the line.

Table 1 presents the organization and configuration of container feeder lines in the Black Sea region of major liner operators. The service frequency is weekly and most of the liner operators maintain feeder services from hub ports in the Mediterranean region. The number of ports of call varies from 6 to 12 and round voyage duration is planned for between 7 and 25 days.

Table 1: Main characteristics of the organization of container feeder lines in the Black sea region (as of November, 2010)

Liner operator	Feeder service rotation	Number and capacity of containerhips	Number of ports	Round voyage duration (days)
Maersk Line	Gioia Tauro – Thessaloniki – Varna – Constanza – Ilychevsk – Thessaloniki – Gioia Tauro	2 vessels 1000 TEU	6	21
MSC	Istanbul – Varna – Bourgas – Istanbul	1 vessel 1388 TEU	3	7
ZIM	Ashdod – Haifa – Limassol – Odessa – Ilychevsk – Varna – Ambarli – Istanbul – Izmit – Gemlik – Izmir – Piraeus – Ashdod	3 vessels 1100 TEU – 1800 TEU	12	25
Arkas Line	Cagliari – Marport – Constanza – Odessa – Novorossiysk – Poti – Varna – Constanza – Marport – Cagliari	3 vessels 1500 TEU – 1600 TEU	9	25
CMA CGM	Malta – Volos – Constanza – Novorossiysk – Poti – Trabzon – Odessa – Constanza – Varna – Malta	3 vessels 900 TEU	9	21

Along with the increase of containerized cargo volumes at the terminals of Constanza, Odessa and Ilychevsk, the intensity of the container feeder lines transportation increases which leads to direct effects on the terminals of Varna, Bourgas, Novorossiysk, Poti and Trabzon. We have to mention that ports in Turkey have followed a different pattern of development in order to overcome the limitations of the Bosphorus strait as concerns the number of passages through the strait on a round voyage as well ships' size and draft. Traffic congestions at Bosphorus incur problems primarily as to schedule integrity. The latter affects not only the large-scale terminals of Constanza, Ilychevsk and Odessa, being visited by larger vessels, but redirects the transshipment points towards the Mediterranean ports. Having those geographical and technological limitations at hand, liner operators configure the feeder lines within the Black Sea region giving way to the development of a truly short-sea shipping network.

According to empirical data the transportation of containerized general cargoes on feeder lines is more efficient as concerns total costs per TEU in comparison to multimodal transportation. The latter, however, is more efficient as concern time reliability [6]. In the long-run, given the increase of road traffic volumes and increase

of fuel prices, container feeder services can attract on certain routes larger cargo volumes and provide shorter transit times.

Container feeder lines in the region are vital part of the global hub-and-spokes transportation networks in liner shipping. The transportation process comprises containerhips calling certain number of ports in the region according to a predefined schedule and sequence of ports. The number and capacity of container feeder vessels depends on the planned frequency of service, technological characteristics of the ports of call, containerized cargo volumes as well as the operational costs of the vessels. Feeder lines in the Black Sea region are serviced by container vessels with shipping capacity of up to 2500 TEU basis existing limitations of draft, channels width and depth and cargo handling equipment at ports.

Service frequency depends on the availability and functioning of the interconnections of container terminals in the region with the hinterland. Lower frequency of service, i.e. larger intervals between vessels' calls at ports, leads to unreliable multimodal transportation and increase of costs for containers storage. For this reason, feeder transportation should achieve higher reliability of service as concerns frequency, service speed of vessels and optimization of containers storage times [1].

Major planning objectives of liner operators in the region concern maintenance and keeping of announced schedules, minimization of vessel's stay at ports and provision of optimal frequency of feeder services. As concerns ports' infrastructure the main problem is the availability of efficient technologies for cargo handling operations at container terminals in the region and the technological possibilities to handle larger containerhips. Main characteristics of container terminals in the Black Sea region are presented in Table 2.

Table 2: Black Sea container terminals characteristic at major ports in the region [12]

Port	Containers turnover in 2007 (TEU)	Containers storage capacity	Maximum depth	Hinterland connections	Average storage time of containers (days)
Ilychevsk	532766	6000 TEU	13 m	Road transport	12-17
Odessa	523881	13500 TEU	13 m	Road transport	10-13
Constanza	1037068	N/A	13.5 m	Rail, road, inland waterway transport	11-13
Varna	99713	3600 TEU	9 m	Rail, road transport	7-20
Bourgas	26000	1330 TEU	11 m	Rail, road transport	7-15
Poti	184792	16248 m ²	8.4 m	Road transport	N/A

Many of the ports in the Black Sea region lag behind in their investment policies for infrastructure development and improvement of cargo operations at technological level. These specifics have been taken into account as no direct ports of call are introduced on the feeder lines in the region and the ports are included in local feeder lines instead. At present, Black Sea ports of Bulgaria are mainly import ports and not transshipment points. Among major problems are the hinterland connections, outdated and inefficient road and rail national network which places Bulgarian Black sea ports in the position of being peripheral feeder ports only.

Another main issue to be confronted by liner operators are the international and European Union regulations as concerns prevention of air-pollution by emissions from ships. The International Convention for the Prevention of Pollution from Ships (MARPOL '73/'78), namely Annex VI, sets forth specific regulations as related to emissions from ships. In addition to Annex VI of MARPOL, EU Directive 2005/33 has widened the application

of the convention as concerns maximum levels of sulfur dioxide emissions from ships fuels to be maximum 0.1% as from 1 January 2010 during navigation within EU territorial waters and during ships stay at EU ports. The objective of this measure is to reduce the impact of ship emissions on local air quality and acidification through the reduction of the sulphur contents of marine fuels used in the European Union [3].

A comparative analysis of environmentally detrimental emissions by type of transport is presented in Table 3. The presented data show that maritime transportation by container vessels leads to lower levels of carbon dioxide and nitrogen oxides as compared to road and rail transport. At the same time the levels of sulfur dioxide emission are higher than those by containerships while energy consumption, measured in MJ per ton/km, is four times lower.

Таблиця 3. Comparative analysis of air polluting emissions by mode of transportation [8]

	Energy consumption (MJ/t/km)	CO ₂ g/t/km	NO _x g/t/km	SO ₂ g/t/km	CO g/t/km	HC g/t/km
500 TEU containership	0.212	16.5	0.52	0.33	0.049	0.015
1 500 TEU containership	0.165	12.9	0.41	0.26	0.038	0.012
3 000 TEU containership	0.145	11.3	0.36	0.23	0.034	0.011
Road freight transportation	N/A	0.2	0.5	0.04	0.2	0.1
Rail freight transportation	0.69	50.4	0.52	0.0016	0.011	0.059

According to IMO expert study, the use of heavy fuel oils will largely have to be abandoned once the sulphur content limit in fuel decreases to less than 1% [7].

Applying the EU regulations for use of low sulfur fuels raises several issues for organizational and technological changes in liner shipping operations. Empirical evidence shows that the effect of these regulations on liner shipping costs is towards considerable increase of bunker costs. For containerships of 1000 TEU capacity and 9 m summer sea water draft bunker costs represent 54% of total operational costs. Apart from the above mentioned, there are serious incentives to reduce vessels' service speed in order overcome the higher bunker costs [7].

Above is mainly due to the higher prices of low-sulfur fuel oils and the need for technological reorganization of the bunkering procedures, bunker storage on board and certain equipment rearrangements for switching to low-sulfur fuels on board. Higher bunker costs will inevitably lead to higher liner tariffs and to an increase of or introduction of Low Sulfur Surcharges on tariffs which presently vary from USD 5 to USD 10 per TEU for containers transportation in the Black Sea region.

Faced with unstable cargo volumes in the region, liner operators apply new approaches for decrease of operational costs of ships. Priority should be given to broadening the short-sea feeder shipping networks through expansion of container feeder lines in the region. Shorter sea passages between ports lead to comparative decrease of bunker costs per TEU transported. Besides, a decrease of service speed from 25 knots/hr to 20 knots/hr leads to a considerable decrease of bunker consumption. The possible operational planning measures, within the air pollution prevention requirements and high bunker costs, include operational changes of schedules and close monitoring of vessels' capacity utilization while being more flexible in the management of the number and capacity of operated feeder vessels. One approach is to increase the buffer time on each feeder line and increase the number of operated vessels. The duration of the round voyage on each rotation depends on the frequency of service and the number of vessels servicing the line.

Main reasons for lack of schedules integrity on container feeder lines in the region are due to the following: port congestions and

delayed berthing (65.5%), delay during cargo operations due to port equipment (20.6%), delays due to worse climatic conditions (5.3%), delays due to time lost for waiting of pilots, tugs (4.7%) and a total of 3.9% for accidental delays at ports, delays in supplies of fuels, channel passages, etc.

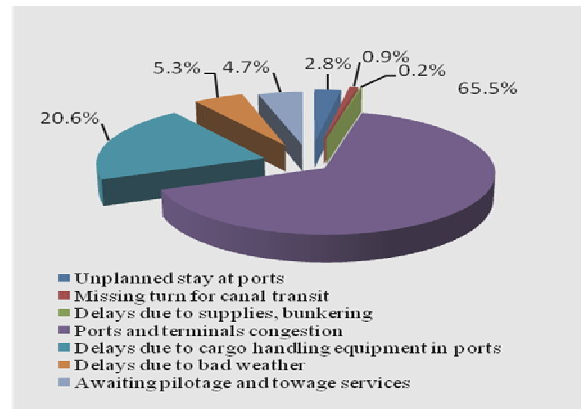


Figure 2 Main reasons for lack of schedules integrity on container feeder lines in the Black sea region

3. Planning levels in transportation management of feeder lines in the Black Sea region

The overall management objective of liner operators are related to minimization of total transportation costs in order achieve overall efficiency of the transportation process [11].

Strategic goals include planning and configuration of feeder lines, defining the characteristics, number and shipping capacity of service vessels, ratio between chartered and owned tonnage, number of visited ports along the feeder line according to their structure and capacity. Longer sea routes require lower number of ships with higher shipping capacity. Such an approach can lead to delays in cargo transportation on inland routes and increased dwell time of containers at the terminals and potentially lead to loss of customers.

Tactical planning includes decisions related to routing of vessels and defining the sequence of ports. In order ensure for comparatively long-run schedules, most liner operators maintain a minimum of one sailing weekly from initial feeder line port which makes it logical that the number of vessels corresponds to the number of weeks needed to perform the round voyage. Planning of berthing operations, schedule amendments, planning of cargo operations equipment at ports and ship management organization are also elements of tactical planning.

Operational planning includes decisions for managing the optimal service speed of vessel during the voyage, amendment of routes according to climatic conditions or the intensity of cargo flows and control of the shipping capacity utilization. Besides, liner operators perform cargo routing as well in deciding which containers to load for a certain vessel's call and which routes to use for their transportation. Due to the present surplus in containerships supply and high running costs as well as customers demands for time reliability, liner operators accept cargoes for carriage on feeder lines at the limit of their marginal costs which inevitably leads to direct operational losses on certain routes.

4. Conclusion

Major planning issues for the transportation process on container feeder lines in the Black sea region are related to the dynamic operational planning for schedule integrity, shipping capacity utilization and service speed optimization against high levels of bunker prices as well as management of containers dwell time and close monitoring of operational costs. The efficiency of transportation process on container feeder lines in the region

depends on the total time needed for the transportation, including the dwell time of container at ports before loading and ships stay time at ports. The analysis of the background to the general cargo transportation on container feeder lines in the Black Sea region has revealed the following specifics:

- container feeder lines network in the region is well structured and serviced by leading liner operators

- policy incentives of the European Union as concerns short sea shipping in the region provide valuable impetus to broadening and reconfiguration of feeder lines in the region and promote cargo volumes increase

- container feeder lines structure is influenced by the cargo volumes on mainstream lines and limited by the technological limitations and capacity constraints at Black Sea terminals

- the underdeveloped port infrastructure of container terminals at Black Sea ports imposes limitations on the operations of bigger vessels and thus impedes large-volume transportation of containerized cargoes on sea routes

- international and EU requirements regarding control of air pollution from ships set new challenges to liner operators in terms

Liner operators in the region need to apply differentiated approach aiming at total transportation costs decrease given the technological and operational characteristics of feeder vessels – shipping capacity, service speed, vessels running costs. Planning of schedules according to the container cargo volumes in the region and determining the number and shipping capacity of owned and chartered tonnage are major issues in operational planning of the transportation of containerized general cargoes in the Black Sea region.

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