ANALYSIS OF THE LOGISTICS TRANSPORT CORRIDORS I BLACK SEA REGION BASED ON THE SHORT SEA SHIPPING CONCEPT

Ivo Veselinov Yotsov, Ph.D., Chief Assistant Professor
Dimitar Yordanov Dimitrakiev, Professor, Ph.D
Angel Zaburtov, CEO State Company Port Infrastructure
Todor Dimov Koritarov, Ph.D.,Assistant Professor

Nikola Vaptsarov Naval Academy, Varna, Bulgaria
e-mail: ivo.yotsov@nvna.eu

Abstract: Regardless of fluctuations in world trade caused by economic cycles and the development of political processes remains a general trend of sustained growth of trade flows. This leads to an increase in both the demand for logistics services and the requirements for them. In this sense, decisive is the planning and construction of transport systems as a basis for the development of competitive logistics.

An important aspect is the promotion of multimodal transport, which in search of optimal transport solutions will reduce the use of relatively expensive and environmentally unfriendly road transportation. This will be at the expense of the efficient combination of different modes in which the concept of short sea shipping occupies a central place. Although this concept is widely applied in many places in the Black Sea, it still has significant potential. It was prompted by stagnation in economic relations as a result of political and economic crises in the region since the late twentieth and early twenty-first century. To evaluate the potential of the concept in the development of transport is done research on Intermodal logistics network in the logistics corridor Central Asia - Central Europe. To optimize intermodal transport links a comparative analysis of the various transport alternatives on the route Tehran – Budapest is done. On this basis it is made optimization assessment on three main criteria - cost, delivery time and environmental protection and basic recommendations on strategic planning development of the Bulgarian transport infrastructure is given.

Key words: Short sea shipping, multimodal transportation, intermodal transportation, transport route optimization.

JEL: F02, F14, F18, F21, F42, F47, H54, L92, L98, O38, P28

Introduction

The growing globalization of industry and commerce, which is increasingly characterized by a global territorial distribution of supply chains, is increasingly demanding for transport as a part of the logistics systems. In this sense, the different means of transport and the macro-framework, and in particular the transport and communication infrastructure, are constantly evolving to meet the increasing demands. Only with significant qualitative and quantitative changes in these structures is it possible to build and control internationally-oriented efficient supply chains.

The principal focus of this study is on the key features of the Black Sea region and its links with Central Europe and Central Asia, which due to their historical links can be considered as a relatively homogeneous commercial space. This is in particular due to the development of the ancient Silk Road in the period of the XXX century BC - XV century AC, the belonging of parts of the region to various state formations and economic unions from the second half of the 20th century. In spite of the sharp geopolitical opposition during the period since 2008 between the US-dominated liberal-democratic world and the emerging economies, the expansion of historically established ties, accompanied by the change of traditional understanding of state borders in the context of The European Union (EU) and the Eurasian Economic Community (EAEC).

Multimodal transport plays a major role in the international logistics, and any improvement in this direction provides significant opportunities for achieving sustainable competitiveness. Therefore, the focal aspects of the design of the transport corridors related to the logistics processes in the Black Sea region and the possible transport options between Central Asia and Central Europe, as well the issues related to the intermodal capacities and the reduction of transport-related emissions, have been studied.

A key factor for the development of the transport sector in Bulgaria, and logistics in particular, is the favourable geographic position of the country, providing an exceptional opportunity to become a connecting transport link between the countries of Western and Central Europe, the Middle East, Western and Central Asia, as well as in the North-South direction.

The aim of this study is to define the concept of Short Sea Shipping (SSS) in the Black Sea and to characterize the conditions for its implementation as an alternative to rail and road transportation and an effective mean of diversifying transport in the circumstances of the dynamically

changing environment in the region. (1) To achieve this goal, similar concepts have been explored in other parts of the world, environmental conditions and by comparative analysis is determined its implementation. The study also presents conclusions on the development of environmentally, economically, socially and politically balanced sustainable transport concepts.

This study does not provide a detailed analysis of transport services, although it would be interesting to assess their potential from a logistical, economic and environmental point of view. The results can serve operators to obtain a better assessment of the environment and price aspects.

1. Prospects for the development of the concept of regular short sea shipping in the Black Sea

1.1.1. Primary features of the SSS concept

Traditionally, the concept of the SSS is the result of the concepts of logistics chains and intermodality. Its main advantages are the low price, the potentially lower emissions, the available infrastructure and the significant capacity of the ships. Although maritime transport is seen as an ecological alternative to the road transport and the considerable advantages offered by the SSS concept, there are significant challenges. These are, above all, related to the high costs of fuels and harbour taxes; high risks associated with its application; new regulations and environmental charges. For example, application of the requirements to control emissions of sulphur oxides (Sulphur Emission Control Areas (SECAs) in the North and Baltic Sea provides for strict limits on the sulphur content of marine fuels, which automatically means a higher price for bunkering. As a consequence can be expected an increase in the cost of shipping. Stringent environmental regulations are essential to achieve a significant reduction in atmospheric emissions from ships, but they also need to take into account the desire to encourage modal shift from road to the sea.

The SSS concept makes special requirements for rapid and effective transhipment between sea and road or rail transport, which may be technically difficult to achieve in smaller ports. Another problem is the different infrastructure capacity in different ports, which leads to a risk of delays or increased transport time. Problems with load speed and capacity differences also have an impact on the integration of the entire transport system.

The SSS concept includes the transport of cargo between ports and intermodal port hubs with a fixed timetable. (2) Accuracy and frequency are essential factors as they allow the transport at sea of time sensitive goods which are currently transported by other means of transport. The growing importance of maritime transport in future transport systems means increasing requirements

for efficiency, sustainability, and economic stability. Implementation of this concept may in the future lead to problems related to the capacity of rail and/or road infrastructure and to open up additional markets. (2)

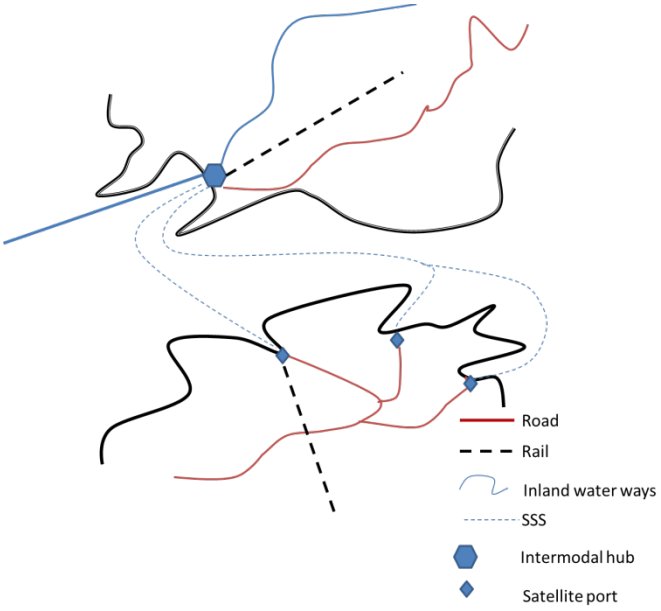

Fig. 1.1 SSS Conceptual scheme

1.1.2. Transport hubs in the Black Sea region

From the point of view of integration in the transport system, the built infrastructure and the existing traffic (Figure 1.2), we can conclude that the ports of Istanbul, Bourgas, Varna, Constanta, Odessa, Novorossiysk (Caucasus), Poti, Batumi, and Samsun can be considered as regional Transport hubs in the SSS concept. (Figure 1.2)

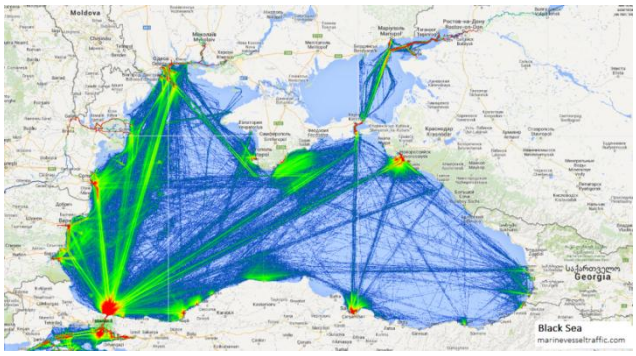

Fig. 1.2 Density map of maritime traffic in the Black Sea, 2013 (3) (4)

1.1.3. The SSS concept in the context of Black Sea Maritime Logistics

From a historical point of view, the Balkans and the Black Sea play an important role as the link between Central and Western Europe and the Middle East. As a bridge between Europe, Africa, and Asia, they have become an important geostrategic region for carrying out some transport projects.

Through the territory of Bulgaria, two major transport corridors along the East-West axis pass, serving the trade between Europe and Asia. These are the "North Corridor" linking China, Mongolia, North and South Korea and Japan along the Trans-Siberian Highway to the European countries, and South Corridor from China, Pakistan, India, and Indochina through Iran to the Middle East, Turkey, North Africa and Europe. These corridors intersect the territory of Bulgaria with its branches through the Caspian region and the Caucasus, joining the route of the ancient Silk Road (TRACECA corridor) connecting China in Central Asia with the Balkans and Europe in the past. (5)

In this sense, the SSS concept in the Black Sea (also in the Caspian Sea) serves to integrate the already described transport systems. (Figure 1.3)

Fig. 1.3 The SSS concept in the Black Sea in the integration of transport systems

Unlike other areas where the development of the concept depends on the overseas lines, in the Black Sea, it is a function of the development of the transport corridors between Western Europe and Asia as a link between European and Asian transport systems. In this sense, it offers opportunities for new business models at both operational and commercial levels.

2. Development of the short sea shipping concept (SSS) in the context of the development and optimization of logistic transport corridors

The development of the concept of short sea shipping is in direct dependence not only on the development of transport corridors but also on the development of logistics infrastructure.

To operate a system with a certain return, the scale of investments is critical. This applies particularly to local and regional logistics facilities. Often such terminals have low traffic volume and therefore do not operate with the required efficiency. This has the effect of reducing their potential for intermodal opportunities and ultimately limiting access to road and rail transport. To some extent, these problems are solved by introducing highly efficient multimodal innovative systems (6) for horizontal cargo handling (7) (8). Extremely promising are the so-called rail highways (9).

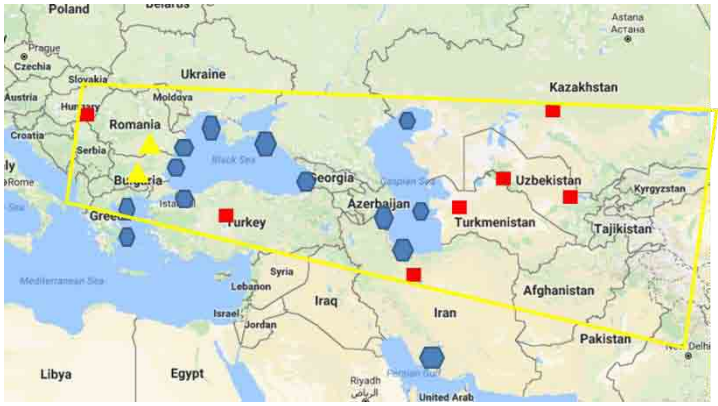

Fig. 2.1 Logistics facilities in the context of the SSS concept in the Black Sea

Thus we can define the corresponding logistics corridor (Figure 2.1). It is also crucial to target investments in the most efficient chains, taking into account their complex economic and environmental sustainability.

2.1.1. Optimizing intermodal transport links

To determine optimal intermodal transport links, we will look at their options between two specific endpoints. Tehran is used as a core unit in Central Asia and Budapest - in Central Europe, where high-performance multimodal transport links have been developed across Europe.

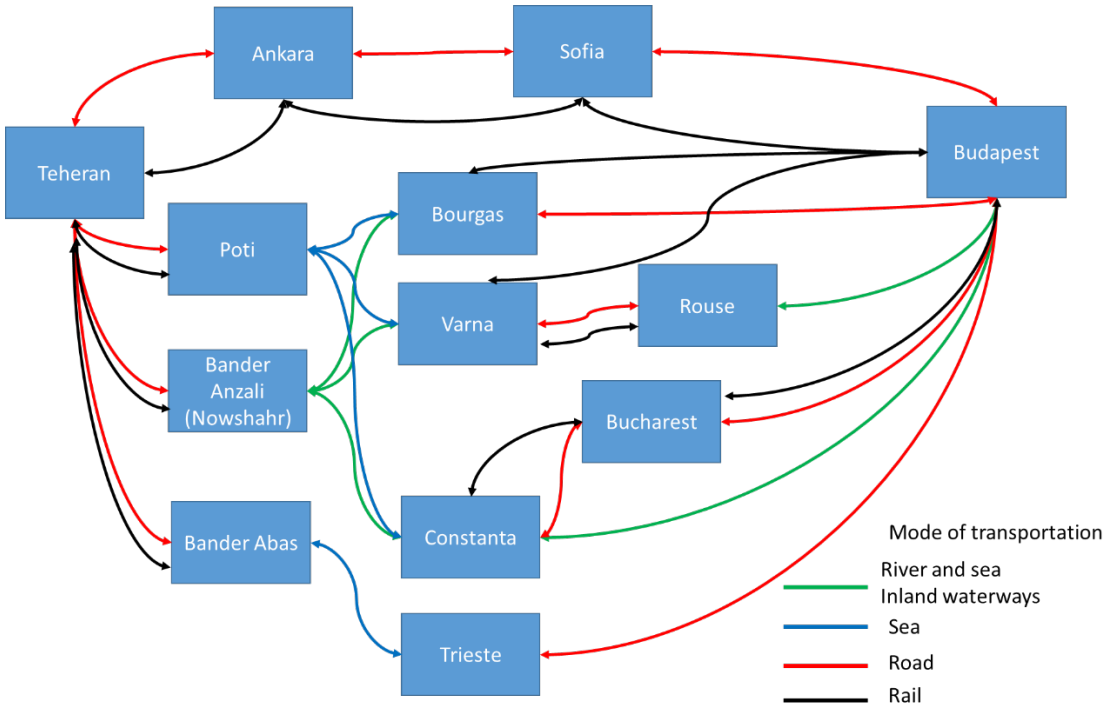

Fig. 2.2 Logistics transport network Tehran - Budapest

Tab. 2.1 Transport chains Tehran - Budapest

	Intermodal transport chain
2.1.	Teheran- (lorry) -Poti- (Ferry) -Varna- (Railway) -Ruse- (Ferry) -Budapest
2.1.a	Tehran- (Railway) -Poti- (Ferryboat) -Varna- (Railway) -Ruse- (Ferryboat) -Budapest
2.2.	Tehran- (truck) -Poti- (Ferry) -Varna- (truck) -Budapest
2.2.a	Tehran- (Railway) -Poti- (Ferryboat) -Varna- (Railway) -Budapest
2.3.	Tehran- (truck) -Poti- (Ferryboat) -Burgas- (truck) -Budapest
2.3.a	Tehran- (Railway) -Poti- (Ferryboat) -Burgas- (truck) -Budapest
2.4.	Tehran- (truck) -Poti- (Ferryboat)) -Constanta- (truck) -Budapest
2.4.a	Tehran- (Railway) -Poly- (Ferryboat) -Constanta- (Railway) -Budapest
2.5.	Tehran- (truck) -Poti- (Ferryboat) -Constanta- (Ferryboat) -Budapest
2.5.a	Tehran- (Railway) -Poti- (Ferryboat) -Constanta- (Ferryboat) -Budapest
2.6.	Tehran- (truck) –Bander Anzali- (Ferryboat Sea-River) -Constanta- (Ferryboat) -Budapest
2.7.	Tehran- (truck) –Bander Anzali- (Ferryboat sea-river) -Varna- (truck) -Budapest
2.7.a	Tehran- (Railway) –Bander Anzali- (Ferryboat sea-river) -Varna- (Railway) -Budapest
2.8.	Tehran- (truck) –Bander Anzali- (Ferryboat sea-river) -Burgas- (truck) -Budapest
2.8.a	Tehran- (Railroad) –Bander Anzali- (Ferryboat Sea-river) -Burgas- (truck) -Budapest
2.9.	Teheran- (truck) –Bander Abbas- (Ferryboat) -Trieste

	Intermodal transport chain
2.9.a	Tehran- (Railroad) –Bander Abbas- (Ferry) -Trieste
2.10.	Tehran- (Rail / Truck) -Ankara- (Rail / Truck) -Sofia- (Rail / Truck) -Budapest

Tab. 2.2 Results of the study of the transport chains Tehran - Budapest

	distance							
	track km	**rail km**	**Ferry (river-sea) km**	**Ferry nm**	**sum**	**Duration (hours)**	**cost ($)**	**CO2 (kg/t·km)**
2.1.	1464	260	1127	611	3982	186	3330	146,21
2.1.a		1724	1127	611	3982	186	2627	109,61
2.2.	2544			611	3676	83	4105	185,73
2.2.a		2544		611	3676	83	2883	122,13
2.3.	2625			627	3786	86	4233	191,53
2.3.a	1161	1464		627	3786	86	1812	154,93
2.4.	2541			582	3619	83	4084	184,57
2.4.a		2541		582	3619	83	2864	121,04
2.5.	2541			582	3619	83	4084	184,57
2.5.a		2541		582	3619	83	2864	121,04
2.6.			4541		4541	423	4541	81,74
2.7.	1080		3234		4314	302	3161	128,40
2.7.a		1080	3234		4314	302	2697	101,40
2.8.	1161		3289		4450	310	3305	134,67
2.8.a		1161	3289		4450	310	2806	105,64
2.9.	1276			4196	9047	364	4220	222,82
2.9.a		1276		4196	9047	364	3607	190,92
2.10.	3770				3770	54	5580	245,05

The estimates applied in Table 2.2 show that the fastest is the automobile transport link. An optimal price has the chain 2.1.a Tehran- (Rail) -Poti- (Ferry) -Varna- (Railroad) -Ruse- (Ferry-boat) -Budapest, and the least harmful in emission terms is the link using the river-sea concept and the connection Caspian Sea across the Volga River, the Don, the Black Sea and the Danube River (10). The Different cargo has a different "appetite" for these criteria, and at the company level there are no mechanisms to impose the implication the most environmentally friendly options. This requires cooperation actions at regional and interregional level to establish regulatory mechanisms in this direction.

The results of Table 2.2. are processed and shown in Table 2.3 to obtain complex minimums and maximums. Thus, optimal intermodal transport chains according to the criteria value, time and amount of harmful emissions are 2.4.a Tehran- (Railway) -Poti- (Ferryboat) -Constanta- (Railroad) -Budapest and 2.5.a Tehran- (Railroad) -Poti- (Ferryboat) -Constanta- (Ferryboat) -Budapest. The 2.2.a Tehran- (Railroad) -Poti- (Ferryboat) -Varna- (Railroad) -Budapest and 2.3.a Tehran- (Rail) -Port- (Ferryboat) -Burgas- (Truck) -Budapest are just a bit behind. It follows that the ports of Varna and Bourgas must set their strategic priorities to improve their competitiveness in these areas.

Tab. 2.3 Bringing the results of the study of the Tehran-Budapest transport chains to choosing the optimal option

	2.1	2.1a	2.2	2.2a	2.3	2.3a	2.4	2.4a	2.5	2.5a	2.6	2.7	2.7a	2.8	2.8a	2.9	2.9a	2.10
Duration (hours)	3,446	3,446	1,537	1,537	1,597	1,597	1,528	1,528	1,528	1,528	7,825	5,586	5,586	5,741	5,741	6,735	6,735	1,000
Cost ($)	1,268	1,000	1,563	1,098	1,612	0,069	1,555	1,090	1,555	1,090	1,729	1,203	1,027	1,258	1,068	1,606	1,373	2,124
CO_2	1,789	1,341	2,272	1,494	2,343	1,185	2,258	1,481	2,258	1,481	1,000	1,571	1,241	1,648	1,292	2,726	2,336	2,998
Ranking	6,503	5,787	5,372	4,129	5,552	4,183	5,341	4,099	5,341	4,099	10,554	8,361	7,854	8,664	8,101	11,067	10,444	6,122

At a national level, a source of competitive advantage may be the continuous improvement of administrative services and the reduction of bureaucratic procedures. To some extent, this can be solved by deepening multimodality in freight, where mergers and acquisitions will not only

result in economies of scale but also in the use of complex optimization models at a company level. Last but not least, there is the investment potential of the large international logistics companies. Thus, the dynamic development approach enables investment in highly efficient innovative methods and tools for handling and transporting cargo.

Conclusions

Planning of intermodal transport chains cannot be achieved as a result of unambiguous optimization criteria, as it is based on a multi-criterion management approach that often compromises or counts some quality criteria.

A central element of the logistics corridor Central Asia - Central Europe is the development of SSS in the Black Sea. It is a highly effective link between Europe's and Asia's transport systems of increasing importance in the context of evolving integration processes. Its role will also increase with increasing environmental requirements to the transport system.

The demand for optimal transport solutions will drive businesses into mergers and acquisitions in the transport sector, which will provide financial opportunities for infrastructure modernization and the implementation of innovative means and methods for handling and transporting freight.

References

1. [Online] http://www.europarl.europa.eu/atyourservice/bg/displayFtu.html?ftuId=FTU_5.6.1.html.

2. **Linda Styhre, Violeta Roso, Richard Bergqvist, Johan Woxenius, Kent Lumsden.** *Development of the Short Sea Shuttle Concept.* IVL Swedish Environmental Research Institute Ltd. IVL Report B2157.

3. MARINE VESSEL TRAFFIC. [Online] [Cited: 11 January 2017.] http://www.marinevesseltraffic.com/2013/06/black-sea-marine-traffic.html.

4. http://www.marinevesseltraffic.com/2013/06/black-sea-marine-traffic.html. [Online]

5. *Regionalization of the global space.* **Martin, Andre Roberto.** 3, s.l. : Geopolitics: A Journal of Geopolitics, Geostrategy and Analyzes, 29 08 2013, Geopolitics: A Journal of Geopolitics, Geostrategy and Analyzes.

6. **Antti Permala, Jarkko Lehtinen, Jenni Eckhard.** *Promoting Innovative Intermodal Freight Transport.* s.l. : PROMIT European Coordination Action, 2009. p. 110.

7. *Organisation apprenants logistique magasinage et manutention.* [Online] [Cited: 11 January 2017.] http://www.lomag-man.org/transport/multi%20modale/domino.pdf.

8. **Ruesch, Martin.** Innovative Intermodal Transport Concepts and Urban Distribution. [Online] 12-16 1 2003. [Cited: 11 January 2017.] http://rapp.ch/wAssets-de/docs/trans/fachartikel-referate/2003/dokumente/trb__15jan03_msr.pdf.

9. Projects. *Lohr Group.* [Online] [Cited: 11 January 2017.] http://lohr.fr/lohr-railway-system/projects/.

10. *List of instructions for the meeting of the State Council Presidium on the development of inland waterways.*