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Modern Trends and Research in Intermodal Transportation

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Preface

The modern world has shrunk in the eyes of people. Scientists from the USA and the UK have named this phenomenon «the small-world effect».¹ This is facilitated by global industrialization when individual elements of machines or devices can be produced in different countries. The total informatization of society also leads to this phenomenon, when the Internet unites users in different countries. Recent events related to the pandemic have led many to begin to assess communication opportunities differently. The editor of this book was one of the organizers of the International Scientific Conference “Transport Problems,” during which scientists from different countries involved in the organization of transport could communicate using the Internet and be separated by 15 time zones. A similar effect is also exerted by the creation of a single financial organism in our global world, when local financial problems are immediately reflected on the stock exchanges of the whole world, which can lead to global crises of the world economy.

It is quite obvious that transport played a key role in the process of this “shrinking of the world.” Qantas currently operates nonstop flights from Perth, Australia, to London in less than 18 h.² One cannot but recall the famous races of tea clippers from China to England in the middle of the nineteenth century. At that time, the delivery of such a specific cargo took 99 days.³

Nowadays, the speedy delivery of goods from the regions of Southeast Asia to Europe is also very important. This is explained by the fact that due to the economic division of production and services in the world, it is the countries of Southeast Asia that have become the main producer of many goods since many world-famous companies have launched their own production there. Obviously, such an approach would not have been possible without the development of transport links on transcontinental routes.

¹ Marvel SE, Martin T, Doering CR, Lusseau D, Newman MEJ (2013) The small-world effect is a modern phenomenon. URL: <https://arxiv.org/pdf/1310.2636.pdf>.

² The fastest way to Australia. URL: <https://www.qantas.com/gb/en/promotions/fly-non-stop-to-australia.html>.

³ Great Tea Race of 1866. URL: https://en.wikipedia.org/wiki/Great_Tea_Race_of_1866.

Currently, several sea and land routes for the delivery of goods have been developed, which are described in this monograph. At the same time, despite the three times longer delivery time, preference is given to sea transport. The main criterion is a significantly lower price. At the same time, for the delivery of urgent cargo, land transport is preferable, first of all, rail. The choice of transportation method depends on the customer, but in any case, the customer, based on his own considerations, chooses the main delivery vehicle and route. To a large extent, in this choice, he will be assisted by logistics operators. Nevertheless, according to the usual scheme, the goods must be initially shipped from the manufacturer, delivered to the main means of transport, and upon arrival at the final destination (port and station) must be reloaded onto the vehicle for delivery to the customer. This is a simplified scheme, since during transportation additional transshipments, the presence of goods in warehouses, etc., are possible.

Currently, there are many ways to deliver goods on long-distance routes. This is reflected in the name of the transportation methods: combined, bimodal, multimodal transport, piggyback transportation, running highway, etc. The official definitions of these different modes of transport are given in an official UN document.⁴ The monograph offered to the readers' attention will be devoted to intermodal transport. According to this document, intermodal transport is defined as «The movement of goods in one and the same loading unit or road vehicle, which uses successively two or more modes of transport without handling the goods themselves in changing modes. By extension, the term intermodality has been used to describe a system of transport whereby two or more modes of transport are used to transport the same loading unit or truck in an integrated, without loading or unloading, in a [door to door] transport chain». There is also an additional link to another document here: «Commission Communication COM(97)243 Final used the term intermodality to describe a system of transport where at least two different modes of transport are used in an integrated way to complete a door to door transport chain».

It should be noted that there are several definitions of this concept. The main thing in them is that the delivered cargo, despite the change of means of transport, is not reloaded from the loading unit (most often, it is a different type of container). However, this term is often supplemented with other requirements. For example, the customer of transportation concludes only one agreement with the logistics operator, which in turn organizes the entire transportation process, providing for additional contracts with transport companies, customs costs, cargo insurance, etc.

The editor of the book, when discussing its content with the authors of individual chapters, tried to provide an opportunity for readers to get acquainted with the achievements of scientists dealing with transport problems, who represent different countries and areas of research. Only such an approach can, to one degree or another, reflect the multifaceted nature of the problem. Therefore, specialists from Romania,

⁴ Terminology on Combined Transport (1 February 2000) United Nations. Economic and Social Council. TRANS/WP.24/2000/1. URL: <https://unece.org/fileadmin/DAM/trans/wp24/documents/wp24-00-1e.pdf>.

Bulgaria, Poland, Kazakhstan, USA, Lithuania, Germany, Great Britain, Italy, and Russia were involved in writing the book.

In the first chapter, scientists from Romania described some of their mathematical models of logistics processes. The authors paid special attention to the mathematical formalization of the tasks. Various aspects of intermodal transport were considered. Particular attention was paid to modeling the operation of container terminals, as well as port railway stations. All the developed mathematical models were embodied in specific algorithms and used in the development of special software.

It is not by chance that the second chapter follows the first described above, since it is mainly devoted to the problems of intermodal transport in Bulgaria. It is a neighboring country with Romania, and the transport problems are similar. And although both the first and second authors try to apply mathematical modeling, nevertheless, their approaches differ. In particular, this chapter proposes to solve optimization tasks based on three main criteria: direct costs, time, and external costs. It is proposed to use graph theory as a mathematical apparatus. The authors provide solutions to specific transport problems using MATLAB R2017b software.

The next chapter, written by professors from Poland, has a global character since the authors analyzed the situation with the development of intermodal transport in different regions of the world. In particular, the authors compare the situation in Europe, Asia, North America, and Australia. It is known that national governments in many countries help in the development of transport infrastructure. Accordingly, the authors analyze the main transport routes in these regions, as well as methods of state support for intermodal transport.

The fourth chapter, which is devoted to the development of intermodal transport in Kazakhstan, complements the previous section. Kazakhstan is a very important transit country through which land routes connect China with the EU. The state of the infrastructure still leaves much to be desired, but the local government is making great efforts to correct the existing situation. The authors in the chapter use the DEA method in order to assess the regional situation and rank macroregions, to further prioritize investment in logistics infrastructure.

The regional situation with transport was the subject of research by American scientists, who in the fifth chapter examined the state of affairs in their region—metropolitan San Jose, California, USA. For their analysis, they took into account the specific demographic situation, its impact on the development of transport communications. For multimodal or intermodal transport, the problem of the so-called first or last mile is of great importance. The authors have paid particular attention to this problem in the chapter. Passenger traffic and its impact on the network of transport hubs were also considered.

Colleagues from Lithuania in the sixth chapter discussed the key aspect, which is the impact of transport, including intermodal transport, on the environment. Their

particular focus was on modern vehicles that have a minimal impact on the environment. It is quite obvious that this material is largely a continuation of the research that was considered in the monograph previously published by Springer.⁵

The seventh chapter, written by prof. Wolfgang Roesch from Germany, is devoted to the problems of railway transport. This aspect is very essential for the development of intermodal transport in the EU. The author claims in his section that preventive maintenance was to be provided for such vehicles. This will optimize many operational operations. The author bases his statement, first of all, on the analysis of the operation of railway wheelsets.

In order to ensure the carriage of goods by intermodal transport, flows of information and finance must follow in parallel. English scientists in the eighth chapter deal with the problem of servicing such flows of information. At the same time, the greatest scientific interest of the authors was associated with IT applications and databases. It is quite obvious that this topic is very extensive and can relate to various stages of freight transportation. Accordingly, the authors mainly focused on rail transport.

In the ninth chapter, Italian scientists also deal with the problems of railway transport, as the main component of intermodal transport. At the same time, the authors were most interested in the process of reloading in ports or at terminals connecting rail and road transport. Along with the analysis of market problems or investments in this type of transport, the authors also considered some environmental issues, in particular, the noise impact of vehicles. In particular, the authors were interested in the noise that occurs during reloading operations at intermodal terminals.

In the tenth chapter, the authors analyze various technical solutions that can and are successfully applied for intermodal transport. Based on the well-known multi-criteria assessment methods DEMATEL and MARCOS, the authors proposed a combined method that can then be used by carriers using rail transport to select the preferred vehicle on various routes of cargo delivery.

In conclusion, I would like to wish for readers, who are interested in transportation issues, to receive new useful information that may be useful for practical use in the field of developing transport systems, creating transport infrastructure, logistics for delivering goods, information support of the transportation processes, and much other useful information. Obviously, scientists, teachers, and students can and should be readers of this book. But despite the scientific nature of the book and its rather specialized orientation, it can also be recommended for a wider circle of readers who are interested in aspects of intermodal transportations and the achievements of modern science in various countries.

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⁵ Śładkowski A (ed.) (2020) Ecology in transport: problems and solutions. Lecture notes in networks and systems 124. Cham: Springer Nature Switzerland AG. 575 p. ISBN 978-3-030-42322-3.