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# Rail Transport— Systems Approach

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# Preface

Rail transport is one of the most important sectors for the economies of many developed countries. Its importance can and should increase in the future. This is explained quite simply. In comparison to aviation, rail takes longer, but is significantly less expensive. Marine and river transport are great alternatives, but they are significantly slower than rail transport in moving goods to their destination. In addition, most importantly, transport via by ship often leaves goods short of their final destination, requiring further road or rail transport.

Rail transport's most serious competition comes from truck transport. However, truck transport loses its advantage when delivering cargo over long distances, particularly those in excess of 400 km. In addition, there are important environmental and safety aspects. Again, in this regard, rail transport has an edge.

Thus, developed countries are interested in developing rail transport as an alternative to road transport. This entails having an effective system for delivering goods and passengers on various continents, particularly within Eurasia. It is obvious that the development of this mode of transport cannot be considered in isolation from other transport modes. For example, for the transport of passengers over long, transcontinental distances, air transport has significant advantages. However, the best way to get people and to and from airports is by rail.

Similarly, the transport of large quantities of goods, such as containers, is best carried out by sea or inland waterway, particularly if there are no significant time constraints. But transport to and from the port is also often most efficient via rail. Thus, rail transport may be considered a subsystem of the intercontinental transport system.

Rail transport is a highly complex system consisting of rolling stock, transport infrastructure (track facilities, energy supply systems, numerous buildings, etc.), administration, management and control services. It should be added that the manufacturer of all these elements and fulfilling their maintenance (plants, repair shops, depots, etc.), the relevant educational institutions, which are required to prepare personnel for some extent related to the rail transport.

Each element in this scheme is also a specific subsystem. For example, if we consider an electric locomotive, it consists of a number of highly responsible

subsystems (control systems, power system, brake system, heating system, pressurized air supply system, suspension systems, motor systems, etc.). It should be noted that if we want to consider traffic safety, it is necessary to evaluate not only the interaction of the individual subsystems of the locomotive, but also its interaction with external systems, namely, the track, contact wire, signaling and communication systems, etc. Thus, it becomes apparent that rail transport can be considered only with a systems approach. Moreover, regardless of the level at which one or the other system is considered, an acceptable solution can be found only with the use of a systems approach.

In the present monograph, the authors show how scientists of various countries solve specific rail transport problems using the systems approach. In particular, the book describes the experience of scientists from Romania, Germany, Czech Republic, UK, Russia, Ukraine, Lithuania and Poland. It should be noted that these countries' rail systems have historical differences. In particular, these countries have railways with different gauges, signaling and communication systems, energy supply systems, and, finally, political systems, which affect their approaches to rail management.

Despite the fact that most of the authors work at universities, the monograph is directly aimed at solving essential problems facing the rail industry in different countries. In some cases problems are solved, transforming ideas into concrete technical, economic or organizational solutions. In other cases, potential solutions for problems are identified.

Structurally, the monograph is divided into two parts. Part I provides a systematic analysis of rail transport and its maintenance. Part II is devoted to rail transport infrastructure and management development. Particular attention is paid to security issues.

The book is written primarily for professionals involved in various problems of rail transport. Nevertheless, the authors hope that this book may be useful for rail manufacturers, for technical staff and managers of rail transport operators, and for students of transport specialties, as well as for a wide range of readers who are interested in the current state of transport in different countries.

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