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P R A C E N A U K O W E - P O L I T E C H N I K A W A R S Z A W S K A . T R A N S P O R T

ISSN: 1230-9265 vol. **135**
DOI: 10.5604/01.3001.0053.6871 2022

Technical, legal, and business conditionings of the functioning of rail operators in the freight transport market

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Abstract: In the article, the authors presented the technical, technological, legal, and business conditions of the functioning of rail freight transport in the international transport market. The authors analyzed the literature, considering this area's most important national and international normative documents. An essential element of the considerations is the presented schematic concepts of models for various forms of rail freight transport. The main ways of organizing freight transport at the eastern border were also indicated. The reasons for barriers that negatively affect the competitiveness of rail transport with other modes of transportation, especially in international transport, were shown. The rail transport market has undergone many changes recently, including investments in railway infrastructure, the growing importance of intermodal transport, and support for a more sustainable transport system. The article indicates the reasons for the occurrence of barriers that negatively affect the possibilities of further development of railways and the competitiveness of rail transport with other modes of transportation, especially in international transport.

Keywords: international rail transport, freight transport, technical conditions, legal conditions

1. Introduction

Regarding technical, legal, and business conditions on the railways, two documents should be mentioned: the Masterplan for rail transport until 2030 [1] and the White Paper [2], which set out prospective principles for the railway sector. The first document concerns Poland and emphasizes strengthening the role of rail transport in the integrated transport system of the country through investments and organizational changes. In freight

Article citation information:

Krześniak, M., Jacyna, M., Wasiak, M., Lasota, M., Wawryszczuk, R. (2022). Technical, legal, and business conditionings of the functioning of rail operators in the freight transport market, WUT Journal of Transportation Engineering, 135, 101-114, ISSN: 1230-9265, DOI: 10.5604/01.3001.0053.6871

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Received 5 March 2022, Revised 9 October 2022, Accepted 11 November 2022, Available online 17 November 2022

transport, it is becoming crucial to ensure conditions for providing complementary services in connection with other modes of transportation. Infrastructure development will favor balancing the branch structure on the transport market. The priority is to offer customers a complete transport chain, allowing them to provide "door-to-door" and "just-in-time" services. The most prospective segments of the freight transport market include intermodal transport, allowing for full use of the advantages of individual types of transport modes, and block train transport, which is the most effective form of moving bulk cargo. The intermodal freight transport system is promising due to its pro-ecological nature, relieving road infrastructure and reducing external transport costs. The second document, the White Paper (Roadmap to a Single European Transport Area), sets out a vision for the future of transport. It aims to ensure the transport sector's growth and promote mobility while achieving the target of reducing pollutant emissions by 60%. An essential aspect of the accepted principles is the optimization of multimodal logistics chains, among other things, through greater use of more energy-efficient means of transport. According to this document, by 2030, 30% of road freight transport over distances greater than 300 km should be transferred to other modes of transportation, such as rail or water transport, and by 2050 – more than 50%. An increase in the efficiency of use transport and infrastructure thanks to information systems is also mentioned. The White Paper discusses the need to implement multimodal solutions based on long-distance means of water and rail transport (effective co-modality). Directional guidelines create space for a single European railway area – removing technical, administrative, and legal obstacles that hinder entry into national rail markets. Taking advantage of technological and legal opportunities, some companies offering services on the transport market focus on transforming into logistics entities providing comprehensive, increasingly integrated transport services using IT tools [3-4]. Logistics companies add to their offer warehousing services, forwarding, loading and unloading activities, and delivery of goods by road transport from/to the warehouse. Providing the services mentioned above at a good quality level is possible thanks to developing new technical and technological solutions.

Legal and technical conditions for increasing the competitiveness of rail transport have so far been the subject of many investigations [5-7]. Although the authors have repeatedly argued that implementing legislative solutions does not always translate into achieving the intended effect (for example: [8]), it should be recognized that it is the first significant step towards improving the competitiveness of rail transport. Rail transport operators are expanding their area of activity and going beyond the borders of their own country while simultaneously expanding the package of services. Companies must be prepared for risks primarily arising from the technological and legal environment. Different legal systems where the interface of these systems is, among others, on the eastern border of Poland means that to operate efficiently on the market; entrepreneurs must acquire knowledge of legal issues regulating economic turnover in the area of transport in various countries.

2. Technical conditionings for the implementation of rail freight transport

When considering the technological aspect of the development of the railway sector, attention should be paid to the European Union Action Plan for freight transport logistics

[9]. The Action Plan assumes increasing the integration of rail transport of the European Union, intensifying rail freight and passenger transport, and increasing the efficiency and competitiveness of railways with other modes of transportation. In addition, Directive 2012/34/EU [10] introduced changes in three main areas: financing the development of railway infrastructure, reducing barriers to entry to rail markets, and strengthening the position of the sectoral regulator. The main activities for freight transport logistics are aimed at:

- the creation of electronic freight transport (e-freight),
- intelligent transport systems – advanced ICT (Information and Communication Technologies) can contribute to strengthening the co-modality of transport by improving infrastructure, traffic, and rolling stock management, improving the shipment identification and tracking systems of consignments in transport networks, and better communication between businesses and public administrations. Electronic freight transport is expected to lead to an "Internet for freight transport" – the possibility of observing and comparing information on services provided by different freight transport companies online.
- continuous elimination of bottlenecks in the area of freight transport logistics,
- improving the functioning of transport chains,
- strengthening the concept of "green" corridors for freight transport – ensuring co-modality.

The technical aspect of changes in the railways results primarily from the development of new technical solutions and implemented interoperability [11-15]. Procedures have been implemented for many years to improve the railway system's competitiveness in the market. It also applies to the equalization of competition in various types of transport. The desire to improve the position of rail transport in relation to other modes of transport has led to the crystallization of two pillars of change. The technical and market aspect emerged. In 2016 the principles forming the so-called Technical Pillar of the Fourth Railway Package were presented. To reduce technical obstacles, primarily for manufacturers of locomotives and wagons, as well as carriers, resulting from different standards and regulations in individual countries, documents constituting the Fourth Railway Package have been developed. The technical package included regulations on railway safety and interoperability of the railway system. A European regulator, the European Union Agency for Railways (ERA), was established. The primary purpose of ERA was to centralize power in the field of authorization for placing vehicles in service and safety certification. According to the intentions, this is to improve the efficiency of rail transport significantly. The watchword of this change is the idea of the so-called One-Stop-Shop, where it will be possible to settle all applications in the safety field, authorization for vehicles to be placed in service, and certification. The market part is aimed at the competitiveness of companies operating in this market. It covers the topics of equal access to rail and what is vital in the framework of action in the European Union (EU): comparable conditions for rail companies to compete. The Fourth Railway Package for the rail transport market is a development and complement to what the EU has been implementing for a long time, i.e., the introduction of interoperability of the rail network. In different EU countries, there are still different specificities of the regulations of each EU country, although to a much lesser extent than in previous years, different administrative, legal, operational, operational, and technical conditions. It applies in particular to:

– different rail traffic management rules and procedures,
– different control systems,
– differences in the rules for assessment and placing in service of railway vehicles,
– track gauge,
– loading gauge,
– electric traction power supply.

To achieve compatibility, i.e., "integration" between individual railway systems, the European Commission (EC) pointed to the need for Member States to take action in the legal, administrative, and technical changes, among other things, implementation of interoperability requirements. This involves opening the market for rail transport and services in the territories of the EU Member States.

As mentioned, over the past decades, the railway systems in EU countries have developed independently, using different technical solutions. The implementation of interoperability should lead to a train crossing the border of several Member States without stopping to perform any technical operations (e.g., changing locomotives). These activities aim to eliminate barriers and reduce rolling stock maintenance costs by using the same rolling stock along the entire transport route. These actions are to improve the transport offer - the lack of the need to change the rolling stock at the borders also means saving time for passengers and operators transporting goods by rail, decarbonizing the European economy, and ensuring greater environmental protection. The key to success is the integration of all railway subsystems to carry out transport operations in different countries without interrupting, among other things, the change of traction crews or traction vehicles. The implementation of interoperability is part of the EU's policy to improve competitiveness. It also contributes to reducing the duration of transport services, strengthening the competitive position of rail transport in relation to other modes of transportation. The Fourth Package also increases transport safety by supervising the admission of wagons and traction vehicles for service. This is very important because trains run in a single railway area. Mutual recognition of documents is a step towards increasing the competitiveness of rail transport. The technical level differs in different EU Member States, which delays the implementation of interoperability. Improving railways is problematic for various reasons. One of them is the consent of all market players to technical and technological changes, which require high investment outlays. An example would be the condition of low noise. Carriers with modern rolling stock do not have to invest and can be more privileged than carriers with older rolling stock, which is entirely natural and understandable.

The technical conditions of the functioning of rail transport operators also include all innovative solutions improving the efficiency of rail transport, such as SUW technology, multi-system locomotives, e.g., CargoSprinter trains [16], or implementation of IT and organizational solutions [17].

3. Legal conditions for the operation of rail freight transport

Regulatory conditions in east-west transport must take into account two legal systems. One is the legal regulations in force east of the Polish border, and the other is the legal system in force in the European Union. The law is constructed within two organizations

operating based on international agreements, i.e., the International Organization for International Carriage by Rail and the Organization for Cooperation of Railways.

3.1. Legal Systems

Among the provisions enabling the implementation of rail transport outside Poland should be mentioned the Convention concerning International Carriage by Rail COTIF [18] and the Agreement on International Goods Transport by Rail SMGS [19], European Union Directives [20-24] and other regulations [25-26]. Legal conditions must follow the technical solutions and the concept of a single rail transport market within the EU and should consider the legal requirements in force in non-EU countries. Regulations for rail transport are created within two organizations operating based on signed international agreements. Figure 1 shows organizations established under international agreements, i.e., OTIF (Intergovernmental Organisation for International Carriage by Rail) and OSJD (Organization for Cooperation of Railways).

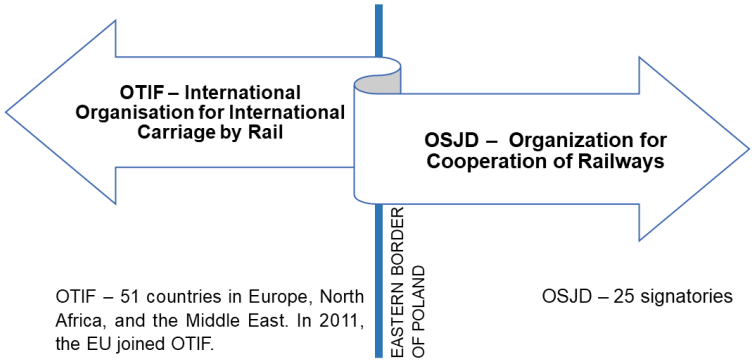

Fig. 1. Organizations established to create regulations on railways based on international agreements (source: own study)

3.2. European Union Directives

The first step towards regulating the European rail transport market by opening it up to international rail freight was the following European Union directives:

- **Council Directive 90/440/EC** on the development of the Community's railways (separation of network management from network operations) [20], amended by Directive 2012/34/EU of the European Parliament and of the Council establishing a single European railway area [10],
- **Council Directive 95/19/EC** of 19 June 1995 on the allocation of railway infrastructure capacity and the charging of infrastructure fees [22],
- **Council Directive 95/18/EC** of 19 June 1995 on the licensing of railway undertakings, amended by Directive 2001/13/EC of the European Parliament and of the Council of 26 February 2001 [21].

These Directives regulate the management of the railway network in terms of ownership and separation of the functions of infrastructure manager from services. This is of fundamental importance in terms of competitiveness in rail transport. The directive put an

end to railways, which dealt with both infrastructure management and carriage. These directives aimed to:
- guaranteeing the independence of the management of railway entities,
- separation of railway infrastructure management from rail operation,
- restructuring the financial structure of railway companies,
- guaranteeing access to Member States' rail networks for railway undertakings.

3.3. Convention concerning International Carriage by Rail - COTIF

Due to the change in the approach to the railway market introduced by the directives mentioned earlier, it was necessary to amend the Convention concerning International Carriage by Rail COTIF to adapt it to the new situation in the EU transport market. In Vilnius in 1999, the Intergovernmental Organization for International Carriage by Rail (OTIF) signed the Protocol on amendments to the COTIF Convention. The Convention was ratified in Poland on 16 September 2002 and brought into force in 2007. The COTIF Convention in its current form consists of 7 appendixes [18]:
- **Appendix A (CIV)** – Uniform Rules concerning the Contract of International Carriage of Passengers by Rail,
- **Appendix B (CIM)** – Uniform Rules Concerning the Contract of International Carriage of Goods by Rail,
- **Appendix C (RID)** – Regulation concerning the International Carriage of Dangerous Goods by Rail,
- **Appendix D (CUV)** – Uniform Rules concerning Contracts of Use of Vehicles in International Rail Traffic,
- **Appendix E (CUI)** – Uniform Rules concerning the Contract of Use of Infrastructure in International Rail Traffic,
- **Appendix F (APTU)** – Uniform Rules concerning the Validation of Technical Standards and the Adoption of Uniform Technical Prescriptions applicable to Railway Material intended to be used in International Traffic,
- **Appendix G (ATMF)** – Uniform Rules concerning the Technical Admission of Railway Material used in International Traffic.

OTIF includes 51 countries representing Europe, Africa, and the Middle East. As of 30 June 2022, the COTIF Convention was in force in 48 OTIF member states. The COTIF Convention allows the carrier to choose the form he wishes to participate in the international carriage. The carrier may carry out the transport itself and decide to cooperate with other carriers. It may act as a carrier or a subcontractor carrier or, on behalf of the carrier, can perform specific activities related to the carriage. These rules introduced by the COTIF Convention have brought about a transition in the rail transport sector towards liberalization. They allowed carriers to choose the forms of their cooperation freely. These regulations made it necessary for the railway carrier to conclude appropriate cooperation agreements:
- with railway carriers – for the implementation of joint transport of consignments along the entire route,
- with a subcontractor carrier – in the case of ordering transport in whole or in part,

– with railway infrastructure managers for the use of the infrastructure for international railway services.

Based on the described regulations, each railway undertaking can determine the conditions of carriage and accept consignments for carriage. These conditions can be freely negotiated.

4. Models of realization of rail freight

In recent years, we have observed a change in the cooperation of railway carriers. In the beginning, when the national railways functioned, cooperation was very formalized. Currently, every railway carrier has a free hand in determining the terms of cooperation with other participants in the rail transport market. The conditions can be freely set.

4.1. The classic model of freight transport

The first variation of the classic model was the cooperation of railways, which combined the function of infrastructure manager and, simultaneously, carriers, carrying out transport only on their railway. Its further modification is the cooperation of the carriers themselves. Figure 2 shows a diagram of the classic model of rail freight transport.

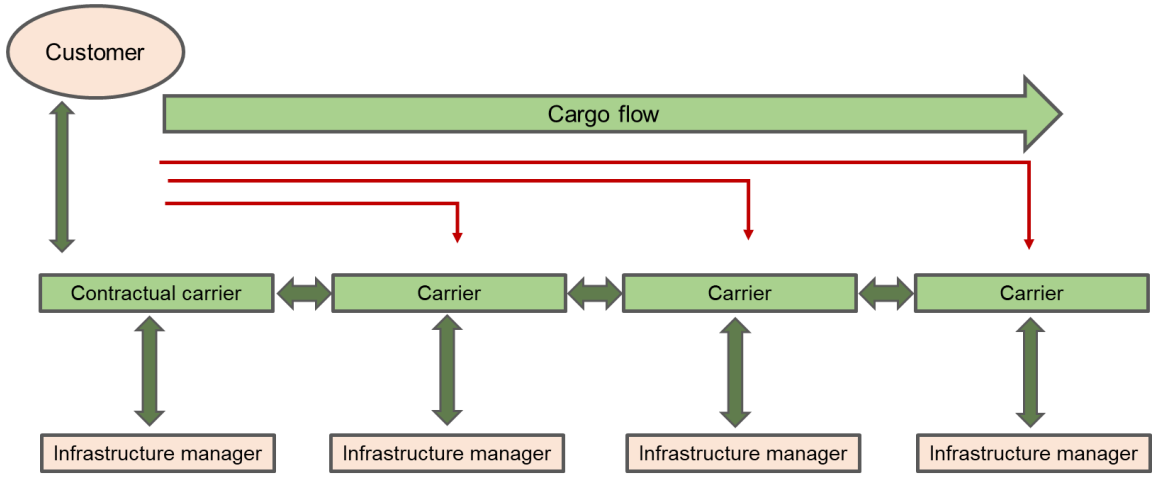

Fig. 2. The classic model of cargo transport by rail transport (source: own study)

In this model, the first carrier concludes a contract with the customer, thus becoming a "contractual carrier" that carries out the carriage on lines subsidiary to the infrastructure manager in their country and transfers the consignment to the next carrier, which enters into the rights and obligations of the contractual carrier (Figure 3). To implement such a transport model, it is necessary to conclude cooperation agreements in advance: a contract for joint transport with successive carriers along the entire traffic route and infrastructure use agreements with infrastructure managers of individual countries. Therefore, there are three types of contracts: customer–carrier, carrier–carrier, and carrier–infrastructure manager.

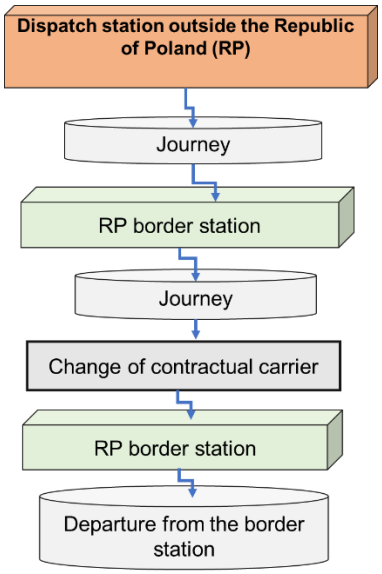

Fig. 3. Scheme of transport implementation in the classic transport model (source: own study)

4.2. Carrier – subcontractor cargo transport model

In the carrier–subcontractor transport model, the contractual carrier on the section where it should perform the carriage does not have to perform the transport itself. Figure 4 shows a diagram of the carrier-subcontractor transport model.

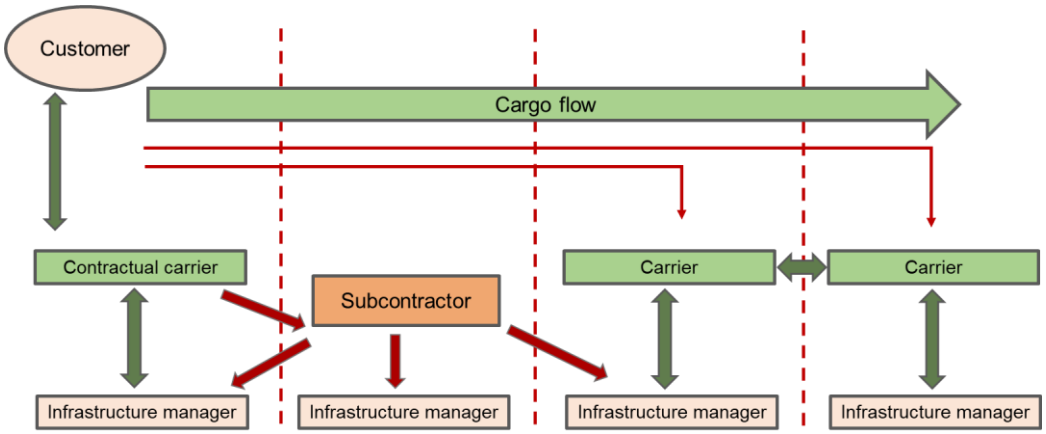

Fig. 4. Carrier-subcontractor transport model (source: own study)

The carrier may, but does not have to, transfer the carriage performance based on a separate agreement to one or more subcontracted carriers. This model has many possible contracting combinations (Figure 5). The following combinations of contracts can be mentioned: customer – carrier; carrier – carrier; carrier – infrastructure manager; subcontractor carrier – infrastructure manager. Below is an example of the implementation of the COTIF Convention principle cited earlier, which concerns the carrier's free choice in what form it wants to participate in international transport.

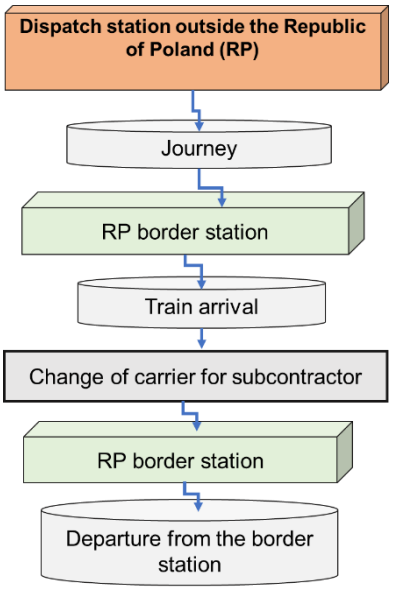

Fig. 5. Scheme of transport implementation in carrier-subcontractor model (source: own study)

4.3. Model of cargo transport in the case of one carrier

In the latest development of the transport model (one carrier), the contracting carrier concludes a contract of carriage with the consignor. It performs the carriage exclusively along the entire transport route, i.e., without transferring it at the border station to the next carrier for further carriage. Figure 6 shows a diagram of the transport model for one carrier.

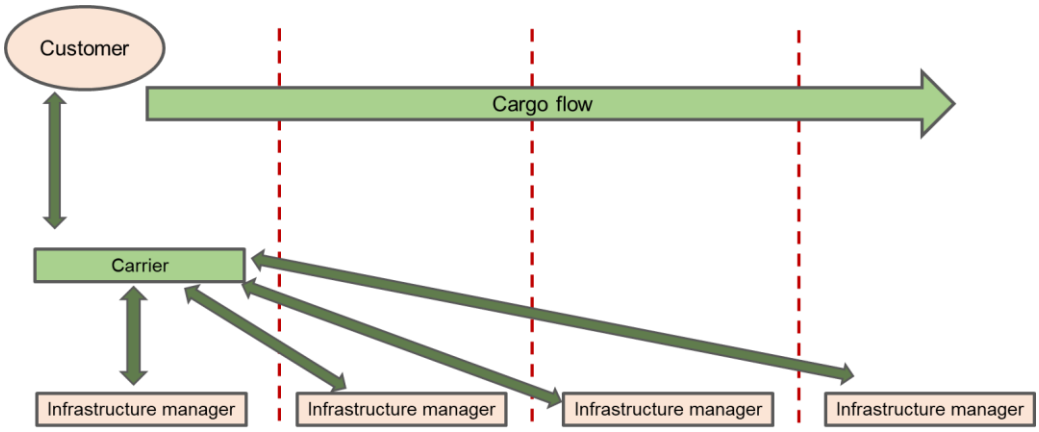

Fig. 6. Transport model - one carrier (source: own study)

However, in Figure 7, a transport scheme in the case of one carrier is presented. There are contracts: contract of carriage (customer – carrier) and agreement on the use of infrastructure (carrier – infrastructure manager).

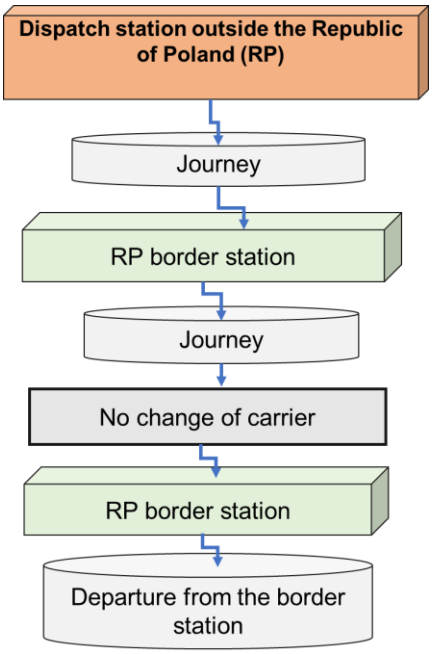

Fig. 7. Diagram of transport implementation in one carrier model (source: own study)

To carry out such transport, the carrier must be prepared to have appropriate locomotives. Often these are multi-system locomotives. Train drivers also need to know the routes on foreign sections. There are also licensing and legal requirements. This transport model is characterized by accelerated transport. Crossing borders does not require the replacement of traction units and traction crews.

5. Organization of rail freight transport at the eastern border

We are dealing with a different transport specificity on the eastern border than on other Polish borders. The difference is due to many factors. The eastern border is the external customs border of the European Union; on the eastern border, there are also two gauges of tracks, and the legal system is changing.

5.1. SMGS and customs regulations at the eastern border of the Republic of Poland

The SMGS Agreement is an international multilateral agreement. It regulates the legal relations occurring in the carriage of consignments by Eastern Railways in international traffic, both between the parties to the contract of carriage and between the railways (organizations) managing the railways. Poland's eastern border is one of the places where the provisions of the COTIF Convention, the SMGS Agreement, and the Customs Law meet. Poland lies at the crossroads of two customs areas: the EU and the Eurasian Economic Union (Russia, Belarus, Kazakhstan, Armenia, Kyrgyzstan) and other third countries. The sources of European Union law on the customs system are:

- The European Union Customs Code (UCC) – the UCC sets out the general rules and procedures that apply to goods brought into or taken out of the customs territory of the EU,
- The UCC Delegated Act – supplements or amend specific UCC provisions,
- The UCC Implementing Act – ensuring uniform conditions for the implementation of UCC rules,
- Convention on a common transit procedure.

The location of Poland determines the performance of the necessary customs, sanitary, phytosanitary, and veterinary procedures at the external border of the EU, resulting in further decisions on admission to trading in the EU. As already indicated in Poland, two different systems of international transport law are used for international rail transport law, regulated by the following provisions:

- COTIF Convention and Uniform Rules Concerning the Contract of International Carriage of Goods by Rail (CIM), Appendix B to COTIF,
- Agreement on International Goods Transport by Rail (SMGS).

As in the EU, we talk about interoperability, but it is difficult to find it on Poland's eastern border. There are different technical standards. At this point, there is a junction of varying track gauges (1520 mm, 1435 mm), therefore for the implementation of cross-border transport, it is necessary, for example:

- Transfer of goods from one track gauge wagon to another track gauge. This involves the necessity of performing a number of shunting works, operating traction rolling stock (1520 mm, 1435 mm), and providing specific technologies and handling equipment.
- Conversion of wagons to bogies of different track gauges. This method of transport is complicated because there are differences in the size of 1520 mm wagons to 1430 mm wagons, resulting in the need to agree on technical conditions of transportation on the PKP network in terms of critical parameters of the structure gauges. The need to secure an appropriate number of transfer bogies and coupling wagons is no less significant barrier in moving wagons. The need to ensure a proper number of transfer bogies and coupling wagons is no less critical barrier in moving wagons. Changeover technology is more expensive than the technology of cargo handling of goods at the eastern border and is unlikely to be used.

The EU's external border, different traffic rights at the eastern border, and different track gauges cause capacity constraints at border crossing points. Capacity constraints lead to an accumulation of wagons on both sides of the border.

5.2. Specificity of transport technologies at the eastern border of Poland

The different technology of work at railway border crossings connecting railway systems with different track gauges results from the fact that it is necessary to reload wagons or implement another more advanced solution. In the case of import, reloading takes place in Poland from broad-gauge wagons to standard-gauge wagons. Figure 8 shows the technology for transporting goods through the border crossing in Małaszewicze.

In the case of export, transport in standard-gauge wagons is carried out to stations serving border stations on the eastern side. Further transport is then carried out by the

eastern railways. The PKP CARGO locomotive, together with the wagons, enters another country (usually a distance of several kilometers). There, standard-gauge wagons are reloaded into broad-gauge wagons. Then, they return empty to the territory of Poland.

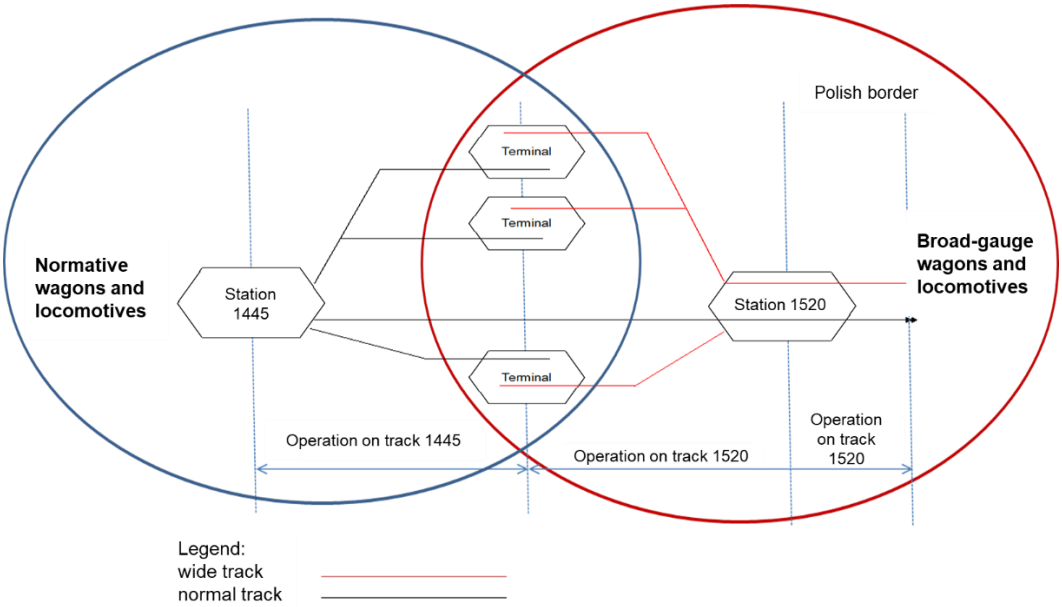

Fig. 8. Transport model – one carrier for transport in Małaszewicze (source: own study)

6. Conclusion

The organization of rail freight transport, due to a number of technical and legal conditions, is a complex issue, especially in the case of international transport relations. In addition, technical and legal barriers between different railway areas significantly negatively impact the competitiveness of rail transport compared to other modes of transportation. These barriers significantly complicate rail transport, extend the implementation time, and increase costs. This fact is a primary stimulus for creating a single railway area within the European Union. The legislative solutions described in the article are the first step towards overcoming barriers to the development of international rail transport. Thanks to them, individual countries are obliged to adopt technical and organizational solutions in the field of rail transport to specific standards. Nevertheless, there are no solutions to eliminate barriers between the countries associated with OTIF and the OSJD countries.

The above-mentioned barriers result from different track gauges, locomotive power supply systems, control systems, or organizational solutions. Overcoming these technical barriers requires implementing various innovative solutions, such as SUW technology or, e.g., multi-system locomotives, telematics, and IT solutions. Nevertheless, as business practice shows, implementing innovative technical solutions only sometimes allows to achieve savings, ensuring the competitiveness of these solutions in relation to the most straightforward traditional practices. As a consequence, eliminating these barriers by

implementing specific solutions in the case of certain processes may turn out to be unjustified from the point of view of rational management. This means that rail freight operators must be free to implement specific technical solutions, and the obligations imposed on them should define the general operating framework for making rail services competitive.

The situation is different in the case of organizational barriers, which can be effectively eliminated through legislative changes adapting the solutions used in individual countries to a specific standard. The unification of legal conditions for the functioning of rail transport operators in different countries significantly facilitates their access to local markets.

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