RAILWAY INTEROPERABILITY AS A FACTOR
OF DEVELOPING TRANSPORTATION FLOWS
IN 21ST CENTURY SUPPLY CHAINS

Introduction

It is a place to say that the basis of all integration processes in the international dimension, is the free movement of all resources such as: information, staff, materials, raw materials, finished products. Free movement of these resources is conditioned and stimulated on many levels, particularly the economy level (including demand and supply of these resources), location of production level, legal considerations level (especially the current international economic law), trade level and many other factors. However, it is important, that the necessary resources should be physically available in the right place and time, in sufficient quantity and at the right price (cost). The implementation of these proposals corresponds to logistics. It is more and more difficult to implement the logistics demands (briefly known as 6R) in the global economy. The global economy causes: greater time distance (the phenomenon of outsourcing of production), shorter lead times of logistics tasks, lower prices (costs) due to competition, together with simultaneous need to ensure the highest standards of customer service. In that way, the problem of international economic cooperation, the bilateral one and cooperation within the framework of systems and economic groups, is focused on the problem of logistic support for the modern economic systems and their internal processes such as: economic, cultural, commercial, leisure time, etc. All these processes require efficient (in terms of praxeology) logistics support. The efficiency of logistics support is determined by both the efficiency of logistics processes and the efficiency of logistics systems. The logistics systems are necessary to implement any of the logistics process. The logistics process contains many activities and subprocesses, such as ware-
housing, storage, picking stocks, and more. It is hard to imagine the logistics process without transport. It is usually the most important part of the logistics process, due to its costs, lead time and need to ensure the safety of transported resources. Since the transport process is almost constant component of the logistics processes, it is obvious that transport systems are components of logistics systems in the individual national economies, and within the cooperating countries. Within so expanded economic systems, it is impossible to have efficient transport services and the efficient logistics service without standardization at various levels, both the transport processes and transport system. Standardization as a tool of rationalizing the logistics service found its deeper understanding in most transport modes such as shipping, aviation, and trucking. The least standardization process occurred in rail transport. At this moment, rail transportation system functioning in Europe is very far from the features that allow to determine it as an interoperable one. Despite of adoption the three packages of rights and principles of railway operation in the EU, rail transport is still regulated by domestic law of individual countries where operate more than 20 signaling systems, several systems of traction power supply, five widths of tracks and five standards for axle load on the track and gauge rolling stock and civil engineering. There are significant differences between national regulations and technical specifications used on the railways. The source of these differences is individual in each country-specific techniques and solutions of local domestic industry. This situation prevents the smooth passage of trains throughout the Community. Closure of the national railway management, over the decades resulted in a very close business relationship between the national railway industry and the national railways, closing the market for the supply of railway equipment and subsystems against the competition. In order to improve their competitiveness, it is necessary to open up the national markets for the Community market. Already, these few examples provide a knowledge about wide-ranging disaggregation of European railways, and give sufficient justification to take up the work on interoperability of the European railways.

**Conditions for the standardization of the European rail system**

Logistics is very strongly linked to the concept of integration. Integration is a fundamental process of economic co-operation within countries and regions, an objective and a tool for cooperation within the European Union. Logistics cannot be operated in efficient way without integrated activities across all levels
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and across all components of logistics systems\(^1\). A rail transport is an important part of the European logistics system. It is co-responsible for the physical implementation of EU rules on free movement of goods and services. Rail transport is a component of the internal market in logistics services. The process of standardization, interoperability and finally the integration is a direct result of the provisions included in the Treaty on European Union (TEU) establishing the European Community (in particular Article 71 and 156), which aim is to enable the Union citizens, entrepreneurs and regional and local authorities to participate in total benefits of establishing an area without internal borders. The tasks of interoperability, are specified in art. 155 of the TEU. Furthermore, on 12 December 1997 was signed the Kyoto Protocol, where the European Union committed itself to reducing greenhouse gas emissions in the closest future. Transport is a major emitter of these gases. Railway transport has the essential advantage at that aspect and the interoperability of rail is a way to increase this advantage.

Integration of rail systems is able to provide additional benefits — synergistic effects, impossible to achieve without interoperable actions. Integration is the goal to achieve, it is a certain ideal, which is virtually unattainable in a sustainable manner, due to continuous process of technical and organizational innovation, creating ever new ways of deepening the integration process. Therefore, in practice, we can talk rather about the process of synchronization, coordination, standardization, or the consistency. The aim is to ensure interoperability. “Interoperability” means the ability of the rail system to ensure the safe and uninterrupted movement of trains which accomplish the required levels of railway lines performance. This ability depends on the legal, technical and operational conditions which have to be provided to meet the essential requirements\(^2\). Interoperability in turn means a state of technical-technological, organizational and legal system that will provide the necessary capacity of the railway system and the conditions for the safe and uninterrupted movement of trains, according to the needs. In practice, it means that the interoperable rolling stock will be able to navigate the interoperable rail infrastructure of the individual countries without having to stop at the borders in order to exchange locomotives or drivers and without taking any activities by drivers.

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\(^2\) *European Parliament and Council 2008/57/EC on the interoperability of the rail system within the community*. 


Thus interoperability will raise the value in use of rail transport in the EU economy, not only because of the higher efficiency of rail use, but also through practical realization of sustainable development, because rail transport is considered to be more environmentally friendly. Interoperability is achieved by standardizing the individual components of the rail system starting from standardization of the parts and assemblies included in the locomotives, cars, roads, railways, up to the standardization of procedures, rules of railway traffic and the legal conditions of rail. The basis for standardization are aspects of legal, technical and operational associated with the fulfillment of the requirements specified in the relevant Directives. One of the main principles of the European Union functioning is to create conditions for free movement of goods and services. However, this freedom of movement cannot take place without any evaluation and supervision. Each entering the market requires an assessment of compliance and supervision. Interoperability is one of the main conditions for free movement of goods and free movement of services. It is a new, global approach to technical harmonization, research, standardization and certification of the products, logistics processes and components of logistics systems. Therefore, it is assumed that in the future, the trans-European rail system will consist only of those components of the national conventional rail systems that were designed, constructed and installed according to essential requirements of the system into which they will be enabled.

An important prerequisite that determines the need to ensure compatibility of national systems for rail transport is the need to ensure the health, safety and security of passengers and goods. Standardization of trans-European networks contribute to the attainment the major Community objectives, such as:

- improving the efficiency of the internal market,
- increasing economic and social cohesion of the Community,
- social benefits, interoperability will raise the standards of logistics in social processes that require greater mobility of the population of the Community,
- additional jobs offers,
- realization of sustainable development, through the use of a greater range of more environmentally friendly and high performance security transport mode.

It is assumed that, European railway interoperability policy will be unable to reach the following goals:

- doubling in passenger traffic on European rail market,
- tripling freight flows on European freight market (calculated in tonne-km),

– triple increase in efficiency of rail transport,
– elimination of rail disasters in European traffic,
– increase in energy efficiency in 50%,
– reduction of harmful emissions in 50%,
– increase rail network capacity.

Interoperability combines aspects of different areas such as:
– policies and different aspects of economic policy,
– differentiated technical right of individual countries,
– effective administrative cooperation with the European administration (different information systems),
– standardization,
– quality management systems,
– accreditation,
– conformity assessment within:
  – research,
  – certification of products,
  – inspection and supervisory activities.

A representative example of interoperability in EU is the European Rail Traffic Management System (ERTMS). This system includes a unified radio communication GSM-R (Global System for Mobile Communications-Railway) and a unified European safety control system ETCS (European Train Control System). Those systems are important components of European policy of removing barriers, increasing the capacity of railway lines, and assure the safety of transport in terms of limitation technical barriers and creating common rail market. The ETCS system is responsible for ensuring a high level of security. It provides a traffic information to the driver's cab of the devices installed on the railway lines. In Poland, there are ETCS and GSM-R systems which are used as a medium for the information transmission to the train. Both systems are prepared to operate the conventional trains at speeds up to 200 km/h and high-speed trains. ETCS replaced a number of previous national systems. ETCS not only improves the rail safety, but also eliminates the barriers resulting from the previous use of dozens of national solutions in the data transmission between track and train, and many systems of drivers communication, both with respect to the driving cab signaling and rail-track signaling. GSM-R system is a digital radio communicator designed to provide both voice (between dispatchers and drivers), and digital data transmission (necessary in operating various systems supporting railway transport processes).
Formal and legal basis for the creation of interoperability in the EU

In the context of previous issue may arise a question about any rules and regulations leading to technical and organizational standardization of international railways. That is obvious, that international rail traffic has existed since decades and since then, wagons with both passengers and freight have crossed borders. Serious operational problems arise from the diversity of technical solutions. The restrictions in the efficient movement of goods were sometimes sought to be removed. In most cases solutions were limited only to the mutual agreement made on a forum of international railway organizations such as International Union of Railways (UIC), international agreements such as regulations of the reciprocal use of wagons in international traffic – RIV, RIC (International Wagon Regulations and International Coach Regulations), OPW (Common Wagon Park), RID (Regulations concerning the international carriage of dangerous goods by rail). Those activities were always limited to selected issues, and therefore not comprehensive, limited to regulate the particular behavior no full harmonization of international railways. In practice the activities were based on the following scheme: certain needed areas have been the subject of specific regulation of international agreements (eg. COTIF, AGC, AGTC); on the basis of those acts have been made international specifications (UIC, RIV, RIC, EN standards) and finally the national legislation have decided about acceptance of those international regulations.

This kind of principle in operating could not be maintained in a situation of the EU integration procedures. The membership in the European Union rises the number of entities involved in the process of harmonization of the national railway system. This is done on the basis of a fairly complex package of regulations necessary to implement the projects interoperable, with keeping the fixed procedures. Of key importance in this regard have had:


Formally, the harmonization aspect is a point of interest the European Union, in practice, represented by the European Commission and the European Railway Agency (ERA) established by Parliament and Council Regulation
No. 831 of 2004. Thus, the national railway system has become an integral part of the community rail system. Its objectives, conditions of existence and development are subordinated to the common terms and conditions, according to the rules laid down in the EC Treaty and the Act of Accession. It means that the technical and organizational development, changes on the transport market and political factors (in economic terms) make up the external conditions for existence of the national railway system, as well as the integrity of the internal conditions of the system. In this context, interoperability in meaning of EU legislation can be understood as the basis for the cohesion of the Community. In relation to the national system, interoperability became the basis for consistency with Community rules applicable to the railway system of the country.

Finally, there is a group of basic normative acts related to the implementation, application and monitoring of the interoperability principles application at the national level:

- Law of 28 March 2003 on railway transport (Journal of Laws of 2003 No 86, item 789, as amended),
- Law of 29 August 2003 amending the low of conformity assessment system (Journal of Laws No 170, item 1652 of 2003, as amended),
- Regulation of the Minister of Infrastructure dated 7 January 2008 amending the Ordinance on essential Requirements for interoperability and Conformity Assessment Procedures for the trans-European high-speed rail system, Journal of Laws of 2008 No. 11, item 64,
- Regulation of the Minister of Infrastructure dated 7 January 2008 amending the Ordinance on essential Requirements for interoperability and Conformity Assessment Procedures for the trans-European conventional rail system, Journal of Laws of 2008 No. 11, item 65.

The main regulations of the railways harmonization at community level are:


In a broader look at the interoperability should also be noted that in practice other regulations that directly relate to the conditions governing the internal integrity of the national rail system are still applied. It refers to construction law and law on construction of products used for construction of railway infrastructure. The main assumptions of the current approach to interoperability in the Directive 2008/57/EC reflects the policy of the European Parliament and the Council in the field of the rail system interoperability within the Community. The procedure for adopting EU directives ensures a political consensus for the solutions because Directive adopted by the European Commission and the Council had to be passed by the European Parliament. To determine the technical and organizational conditions needed to meet in order to guarantee interoperability, the railway system is divided into subsystems, which requirements are determined and presented in the TSIs (Technical Specifications for Interoperability). The trans-European rail system is divided into:

1) Structural subsystem:
   a) infrastructure,
   b) energy,
   c) control,
   d) the rolling Stock.

2) Operational subsystem:
   a) rail traffic,
   b) maintenance (procedures, associated equipment, logistics centers for maintenance work and reserves allowing the mandatory corrective and preventive maintenance to ensure the interoperability of the rail system and the required performance),
   c) telematics applications for passenger and freight. According to Annex 1 to Directive 2008/57/EC, this subsystem comprises two elements:
   – applications for passenger services, including systems providing information before and during the journey, reservation and payment systems, luggage management and management of connections between trains and other modes of transport,
   – applications for freight services, including information systems (monitoring of freight and trains in real time), marshalling and allocation systems, reservation, payment and invoicing systems, management of connections with other modes of transport and preparation of electronic documents.
Moreover, the railway system structure consists also of:

- interoperability constituents – for each subsystem or part of subsystem is proposed list of constituents and aspects relating to interoperability at the time of drafting the relevant TSI and
- interfaces, constituting the relationship between the individual subsystems.

Technical Specifications for Interoperability (TSI) are the main platform of the regulatory rules. TSI are the European legislations rules which override the national acts of the particular scopes. The European standards draw on the TSI. Only on the basis of the TSI and European standards national railway legislation can be created.

The market surveillance. The acceptance of the railway systems into service

The very definition of the TSI does not determined yet the implementation and application of the contained findings. Requirements of achievement the rail system interoperability contained into the EU directives include activities related to designing, building, commissioning, upgrading, renewal and maintenance of infrastructure and rolling stock. To achieve the set goals there are some procedures and organizations laid down in the EU directives:

- holding the market surveillance,
- giving the authorization of conformity assessment Dobies,
- procedures for authorization the subsystem into service stadion.

Market surveillance is an important instrument for the implementation of New Legislative Framework (NLF). The aim of surveillance is to ensure compliance with the provisions of the relevant Directives throughout the Community. Citizens have the right to an adequate level of protection within the Single Market, regardless of the origin of the product. Market surveillance is also to prevent unfair competition. Member States of EU are obliged to designate or establish authorities that are responsible for market surveillance. Market surveillance involves monitoring by the supervisory authority of conformity of products placed on the market with the relevant provisions of national law (taking into account the NLF), and if necessary take appropriate action to ensure compliance. Assessment of compliance may include:

- internal control of design and production by the manufacturer,
- examination of the type by a third party in connection with the internal control of production by the manufacturer,

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examination of the type or project together with the approval of product or production quality assurance system or the product verification by a third party,
- design verification and production by a third party, or
- approval of full quality assurance system by a third party.
Conformity assessment system consists of:
- horizontal Laws,
- national acts transpose EU law (Polish acts transposing national law into EU legislation which are called the “acquis communautaire”. These are mainly the Old Directives and the New and Global Approach Directives,
- Polish national acts.
Institutional structures of the conformity assessment system are:
- Ministry,
- Polish Accreditation Center,
- Polish Standardization Committee,
- notified bodies,
- market surveillance.

At the design stage, the producer has to determine which directives are related to his product. The product must comply with the directives at the first time it is placed on the market and/or put into use. The NFL directives specify the products and detail requirements referring to that product and to the procedure of testing. Those directives are prescriptive. They provide detailed requirements for the product, which greatly facilitates the control of compliance. There is a difference between the Old Approach Directives and the Directives of the New and Global Approach. The amendment processes of the Old Approach Directives were very slow and they inhibited technological development. Therefore, there was a need to change approach to conformity assessment. The New Approach, supplemented later by the Global Approach has led to some simplification and harmonization of conformity assessment procedures. Issues included in new directives are so general that contain all possible cases relating to their subject matter. First of all, directives indicate aims to be achieved, and courses of actions to reach them. New regulations leave free choice how to achieve the

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stated objectives. Therefore do not impose the solutions, in terms of achieving its objectives - require invention and activity of the users. Most New Approach Directives specify requirements relating to safety of use the products by elimination of threats to life and health of humans and animals, private property and environment. Some of them take into account other aspects, such as energy savings, the accuracy of meteorological measuring instruments, transport safety devices.

New Approach directives are total harmonization directives and supersede all corresponding national regulations, which should be repealed. Member States of EU are required to move these rules to the proper level of national legislation.

For the confirmation of product compliance with the New Approach Directives is provided the CE mark. The New Approach improved the conformity assessment procedures. The Global Approach entailed a modular approach, which means the division of the conformity assessment procedures on a number of separate operations (named modules). These modules differ according to: the stage of the product development (e.g., design stage, prototype, full production), the method of evaluation (inspection of documents, type approval, quality assurance) and the person conducting the assessment process (a producer or a third party).

Producer can prove that his product is compliant with the requirements through the use of harmonized standards. That gives him the privilege of presumption of conformity. Application of harmonized standards is not obligatory. That means a manufacturer may not use them and has a possibility to prove the compliance of a product in different ways, eg on the basis of other specifications, their own or other. Some products may be covered by several New Approach directives. This requires from producer a general overview of the existing directives and arrangements applicable to a given product, as well as assigned to them harmonized standards. Despite of voluntary, they are recommended to use, because it is the easiest, surest and cheapest way to demonstrate conformity to product requirements.

The authority guarding the products marketed in Poland is the President of the Office of Competition and Consumer Protection. The supervisory authority carries out its tasks with the help of specialized organs, which control the properties of products to be marketed. Specialized bodies are:

- Trade Inspection,
- National Labour Inspectorate,
- Chairman of the State Mining Authority,
- President of the Office of Telecommunications and Post,
- The Chief Inspector of Building Control,
- other bodies specified in separate acts, if they are listed as specialized bodies, including the Office for Railway Transport.
Specialized authorities carry out checks on products marketed in meeting the essential requirements of the products specified in the regulations or in separate laws. If, in the result of the inspection, it is found that the marketed product does not meet the essential requirements specified in the regulations or in special laws, the authority may:

- order the removal of the product non-compliant with the essential requirements, within the prescribed period,
- order, by decision, the withdrawal from the market the products which do not meet the essential requirements,
- prohibit, by decision, to place on the market the batch of the product that does not meet the essential requirements.

Under the circumstances indicating that the product does not meet the essential requirements, the power body recommends the specialized laboratory to conduct the tests. If the investigation confirms that the product does not meet the essential requirements, the authority may require the decision to withdraw the product from the market. The costs of the product examination are covered by the manufacturer or his authorized representative or the importer. The supervisory authority is obliged to gather information about not in conformity with the essential requirements products, derived from domestic and foreign entities, and make them available to authorized agencies and entities. When non-conforming with the essential requirements product poses a threat to life, health, property and the environment, a specialized body transmit forthwith to the competent customs offices information about these products. If the customs authority during the customs control of products which are to be covered by the marketing authorization procedure, finds that the product is incompatible with the essential requirements or may pose a threat to life, health, property and the environment, stops the product and dedicates it to the authorities for an appropriate review. If the authority issues a qualified opinion confirming that the product is incompatible with the essential requirements or poses a threat to life, health, property and the environment, the customs authority shall withdraw the product abroad.

The third institution of market surveillance is an authorization of conformity assessment bodies system. The authorization relies on qualification by the minister or the head of the central body proper for the object of conformity assessment, the individual or laboratory applicants to the notification process. The notification means notifying to the European Commission and to the Member States of the European Union authorized certification bodies and inspection bodies and laboratories authorized to perform the appropriate actions specified in the conformity assessment procedures. Authorization is granted at the request of the certification body, inspection body or laboratory, meeting certain criteria. In the railway industry in Poland, the President of the Railway Office can authorize by way of administrative decision, as appropriate:
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- the inspection body,
- product certification bodies,
- testing laboratories.

The third element of the supervision of the rail system interoperability is the procedure for exploitation of the subsystems. The infrastructure manager, railway company and railway siding user, as well a company performing transport within the siding can operate only on the types of buildings and equipment admitted for railway traffic operation and can use the types of rail vehicles, which got a certificate of release to service from the President of Railway Office (subject to Article 23, paragraph 2 of the Law on rail transport). In the Polish legal system, certification of release to service is regulated by the Law of 28 March 2003 on railway transport (unified text: Journal of Laws No. 16 item 94, as amended. Amended.), and in particular Article 23

To get the certificate of release to service may be requested by:
- producers,
- rail carriers,
- contractors of the modernization,
- infrastructure managers,
- railway siding user,
- companies performing transport within the railway siding.

Every subsystem, after releasing to service need to be subject to a verification procedure to ensure that it is operated and maintained in accordance with the essential requirements which apply to the subsystems constituting the rail system. The verification should guarantee the authorities responsible for authorizing their placing in service assurance at the design, construction and exploitation that the result is in accordance with existing technical and operational regulations. The verification should enable manufacturers to equal treatment regardless of the country. It is therefore necessary to create a module or modules that define the terms and conditions applying to verification of EU subsystems.

Moreover, the procedures in the implementation of provisions relating to certificates of release to service are governed by the following acts:

Minister of Infrastructure Regulation of 26 September 2003 on the list of types of buildings and installations designed for railway traffic and the types of railway vehicles, which are issued a certificate of release to service (“Journal of Laws”, No. 175, Item 1706).

Regulation of the Minister of Infrastructure of 30 April 2004 on certificates of release to service-type buildings and installations designed for railway traffic operation and the type of railway vehicle (“Journal of Laws”, No. 103, Item 1090, as amended).

Regulation of the Minister of Infrastructure of 12 October 2005 on the scope of studies necessary to obtain licenses for exploitation of types of buildings and installations designed for railway traffic and the types of railway vehicles (“Journal of Laws”, No. 212, Item 1771, as amended).

Regulation of the Minister of Infrastructure of 29 February 2008 on the activities performed by the President of the Railway Transport Office, for which charges are made, and these charges and their collection mode (“Journal of Laws”, No. 47, pos. 276).
References

17. Regulation of the Minister of Infrastructure dated 7 January 2008 amending the Ordinance on essential Requirements for interoperability and Conformity Assessment Procedures for the trans-European high-speed rail system. “Journal of Laws” 2008, No. 11, item 64.
18. www.mg.gov.pl