



# The Safety Management System of Rail Transport

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## ABSTRACT

The article presents the essence of security management in railway transport and to identify the priorities of Poland's transportation system. The main problem of paper was formulated as follows: How is the Safety Management System of Rail Transport functioning, taking into account national and international legal regulations and existing threats? In the solving of mentioned problem, the following research methods were applied: analogy, definition, analysis, synthesis, induction, deduction, modeling and diagnostic survey with expert research sample. The research was carried out with employees of company PKP PLK S.A. A systemic approach underlies the Safety Management System (SMS) functioning now in Poland. To guarantee the proper conduct of transport, each railway transportation enterprise and each administrator of infrastructure is required to create a system based on effective risk management. Adequately prepared SMS procedures should assure the implementation of risk control means and the monitoring of the effectiveness of the applied solutions in order to warrant the due level of safety. Presently, digital transformation is of major importance to the development of railway transport. New management systems will be based on technologies utilizing the Internet, automatization, robotization, and new tools, such as big data.

**KEYWORDS: safety, railway transport, system, risk management, digital transformation, big data**

## 1. Introduction

The contemporary security environment is characterized by the unpredictability of occurring phenomena. International terrorism, organized crime, a migration crisis and natural disasters are only part of the problems that the world is facing today. New threats, crossing geographical barriers, are increasingly detrimental to transport infrastructure, thus weakening the national security system. They require modernization of troops, updating legal and doctrinal regulations, and reorganizing existing security systems. Ensuring security is treated as the main objective of each country's policy and requires undertaking complex and long-term actions.

The rapid development of other modes of transport has meant that over the last years, rail transport has had to constantly face the problem of competitiveness. The development and modernization of the road network is a serious threat, and at the same time a challenge for today's Polish railways, which in order to keep up with

the ongoing changes must allocate more and more funds for the restructuring of the existing infrastructure. The railway transport system currently in operation in Poland requires a completely different view and application of other management models.

It is necessary to use the system approach based on forecasting and planning models that enable multi-criteria forecasting of causes and effects of undertaken activities. In addition to the systemic approach, it seems indispensable to orientate the safety management system to a process approach. Its goal is to implement the assumptions, while minimizing costs and maximizing safety. The use of a system-oriented and process-oriented approach is considered a means to develop and improve railway safety.

## 2. Rail transport in Poland

### 2.1 Legal conditions

The process of creating documents that condition the use of railway infrastructure, management, modernization and maintenance lasted for many years and resulted in the creation of a large group of legal regulations that are still being updated.

The right of railway transport, valid in the territory of the Republic, can be divided into national and international legal regulations.

The main national act, strictly related to rail transport, is the Act of 23 March 2003 on railway transport (Journal of Laws of 2003 No. 86 item 789). It regulates the matter of creating, maintaining, managing and operating railway infrastructure and organizing railway traffic through the implementation of passenger and freight transport [1]. In addition to the Act on railway transport, the national legal acts concerning the issues of railway transport include:

- Act of December 16, 2010 on public collective transport (Journal of Laws of 2011 No. 5 item 13),
- Act of December 16, 2005 on financing land transport infrastructure (Journal of Laws of 2005 No. 267, item 2251),
- Act of 19 August 2011 on the transport of dangerous goods (Journal of Laws of 2011 No. 227 item 1367),
- Act of December 16, 2005 on financing land transport infrastructure (Journal of Laws of 2005 No. 267, item 2251),
- Act of 16 December 2005 on the Railway Fund (Journal of Laws of 2005 No. 12, item 61).

The second group of documents constituting the rail transport law are international legal regulations. In Europe, they are conditioned by a number of conventions, regulations and directives whose aim is to create a unitary legal system in the area of transporting people, goods and the principles of using infrastructure in rail international traffic. The basic legal act is the Convention on International Rail Transport (COTIF) established in 1980 in Bern, establishing the Intergovernmental Organization for International Carriage by Rail (OTIF). In addition to the COTIF Convention, international law regulating the issues of rail transport, among others, creates:

- Directive 2004/49 / EC of the European Parliament and of the Council of 29 April 2004 on safety on the Community's railways,
- Directive 2008/57 / EC of the European Parliament and of the Council of 17 June 2008 on the interoperability of the rail system within the Community,
- Directive 2008/68 / EC of the European Parliament and of the Council of 24 September 2008 on the inland transport of dangerous goods,
- Directive of the European Parliament and of the Council (EU) 2016/797 of 11 May 2016 on the interoperability of the rail system in the European Union.

Regarding safety management in rail transport, this issue is regulated by the provisions of Directive 2004/49 / EC of the

European Parliament and of the European Council on the safety of the Community's railways. According to this document, railway market entities should be subject to the same, precisely described requirements. Pursuant to art. 9 of the Directive, each railway undertaking and infrastructure manager is obliged to apply safety procedures and assess the risk of the transport process by implementing the Safety Management System. This system must comply with national and international safety regulations and is to ensure supervision over all types of risks related to the operation of railway undertakings [3].

### 2.2 Entities responsible for the safety of rail transport

Railway safety is conditioned by numerous factors. A number of entities supervise its proper level, among which the President of the Office of Rail Transport exercises the decisive role. It performs the function of the national security authority and carries out a series of tasks whose aim is to ensure uniform conditions for the safe operation of rail transport. Responsible for the inspections carried out in the scope of the introduced safety management systems and for the supervision of the entire railway market in Poland. In addition, it is the competent authority in the matters of railway traffic organization, railway transport licensing and technical supervision over railway infrastructure [6].

In addition to the President of UTK, the leading role in ensuring the safety of the railway sector is exercised by PKP Polskie Linie Kolejowe S.A. Its priority goal is constant investment activity as well as modernization and development of railway infrastructure. In order to increase the safety level on the railway, the Company is also a contractor of many railway traffic safety improvement programs, and also runs a series of campaigns aimed at reducing the number of accidents occurring within rail and road crossings. PKP PLK S.A. it also conducts extensive cooperation with other railway infrastructure administrators and international organizations. As a member - CER, EIM, ERA and UIC, the Company's specialists participate in international congresses, trainings and conferences affecting the aspect of railway safety. Thanks to participation in these meetings, they improve their skills and qualifications, gain knowledge, exchange experiences and acquire practice in a given field [16].

The Railway Protection Guard (SOK) plays a key role in ensuring railway safety. It is a specialized, uniformed formation, created and functioning on the basis of the Act on railway transport. The main task of the Railway Security Guard is to monitor the observance of order standards in vehicles and on railway areas and to protect human life. In the area of safety, SOK officers are entitled to [1]:

- securing the railway space against entry of unauthorized persons,
- taking order activities,
- identification of persons staying in the railway area,
- imposing a fine for offenses committed,
- controlling means of transport located in the railway area.

Among the institutions responsible for railway transport safety, we can also distinguish control and supervisory entities, including: Railway Transport Office, the Supreme Audit Chamber, Minister

of Infrastructure, National Railway Accidents Investigation Commission, Advisor on the safety of dangerous goods transport.

These bodies have the task of controlling the activities of railway market entities, overseeing the implemented safety management systems, checking the technical condition of railway infrastructure, testing serious railway accidents and incidents and monitoring organized transport. The inspections carried out according to the highest standards are to indicate defective and defective elements of the railway sector, the repair of which will allow to maintain the highest possible level of railway safety.

In addition to the indicated bodies, the following groups of entities are involved in the process of ensuring railway safety [4]:

- railway carriers,
- railway infrastructure managers,
- siding users,
- rolling stock manufacturers,
- entities responsible for maintaining the railway infrastructure,
- maintenance workshops.

The task of the above institutions is to apply safety procedures, develop internal legal acts regarding the use of railway infrastructure, and also to assess the risks associated with the transport process PKP transport potential. In recent years, a downward trend in the use of railway infrastructure for transporting people and goods has been a noticeable phenomenon. The year 2017 was for rail transport, a breakthrough year, and is considered the best period in the last 15 years, both in terms of transported passengers and transported loads. This was caused by the increased demand for transport resulting from the dynamic development of mining sectors and the greater interest of Poles in traveling by rail.

In the past year, passenger carriers transported nearly 304 million passengers, which is nearly 3.8% more than in 2016. In this case, operational work was carried out at the level of 162.3 million train kilometers. In comparison to the previous year, this value increased by 1.4%, which indicates that passenger trains traveled about 2.3 million km more. As for the transport work carried out, it was higher by nearly 6% than in 2016 and amounted to 20.3 billion passenger-kilometers. This situation is the result of rolling stock investment and quality changes among transport companies. New, comfortable trains, faster travel times as well as refurbished stations are only a part of the activities that contributed to encouraging the choice of rail transport as a means of communication [7].

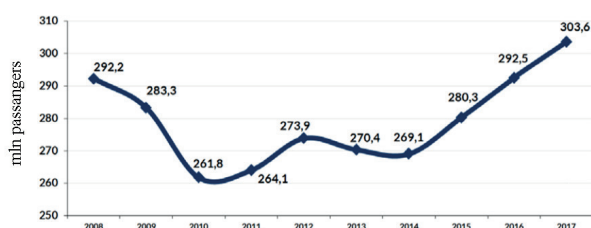


Fig. 1. The number of transported passengers in 2008 - 2017 [7]

According to data published by the Office of Rail Transport, at the end of 2017, 35 active carriers had active licenses for rail passenger transport, of which only 15 companies carried out

regular passenger transport on a standard-gauge infrastructure. In comparison to the previous year, the number of licensed carriers decreased by 4, or nearly 10%. The largest share on the passenger transport market is held by: Przewozy Regionalne - 26, 31%, Koleje Mazowieckie - 20.44% and PKP Intercity - 14.11%, which service over 60% of all travelers [7].

As far as freight transport is concerned, here too there has been a dynamic development. As underlined by UTK, in 2017 there was an increase in transport and operational work, and the mass of transported goods was the highest in the last 5 years. The carriers transported a total of 239.9 million tonnes, or 7.9% more than in 2016 (222.2 million tonnes). The transport performance amounted to 54.8 billion tonnes and was higher than in 2016 by 4.2 billion tonnes, or 8.3%. Freight carriers performed operation work in the amount of 80 million train-kilometers - by 8.2% more than a year earlier. According to UTK, positive changes in the transport of goods are a consequence of undertaken investments, and also result from greater demand and general revival of many branches of the economy [7].

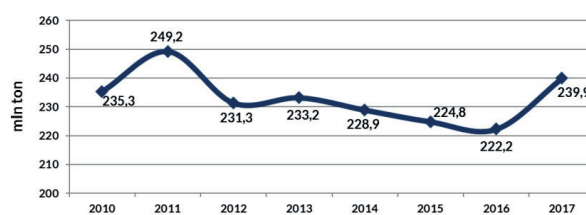


Fig. 2. Masa przewiezonych ładunków na kolei w latach 2010 - 2017 [7]

In 2017, active licenses were granted to 91 rail operators, of which 69 were in fact transporters. Compared to the previous year, the number of licensed carriers decreased by 3. Undoubtedly, unchanged for years, the PKP Cargo company remains the leader on the freight market, which in 2017 transported over 106.1 million tonnes of cargo (44.24% of all transported goods). In the case of other carriers, DB Cargo Polska had the largest share of the transported weight - 17.88% and Lotos Kolej - 5.56% [7].

## 3. Safety Management System

### 3.1 Safety management in rail transport

Since 2010, each railway undertaking and infrastructure manager has been tasked with implementing the Safety Management System. This obligation stems from the provisions of the European Parliament and European Council Directive on the safety of the Community's railways of 2004 and is intended to increase the level of railway safety.

In domestic law, this directive was reflected in the provisions of the Act on railway transport and in the Ordinance of the Minister of Transport of March 19, 2007 on the safety management system in rail transport. By virtue of these documents, under the term "safety management system" we mean "organization and measures adopted by the infrastructure manager or railway undertaking to ensure safe management of its operation" [3]. This system

must meet the requirements of Annex III of the Directive of the European Parliament and of the European Council adapted to the specificity and size of the activities carried out, and it should perform a detailed analysis of existing and likely risks.

In addition to SMS, an important issue in ensuring safety is the use of identical indicators by certified railway undertakings. The coefficients developed allow assessment and comparison of rail transport safety in individual European countries, as well as monitoring the development of the railway sector. These factors include [12]:

- common safety requirements (CST) - minimum levels of safety that should be achieved by different parts of the railway system,
- common safety indicators (CSIs) - including statistical information on railway accidents and incidents, accident effects, technical safety of railway infrastructure and safety management,
- common safety assessment methods (CSMs) - established to describe how to assess the level of safety, meet safety requirements and compliance with other safety requirements.

Railway safety management system introduced by rail market entities should meet common safety requirements (CST), be consistent with national and international safety regulations and should use common safety assessment methods (CSM). The scope of the SMS must cover all levels affecting rail transport and requires technical, organizational and operational analysis of the railway infrastructure in order to indicate the critical points of the system. In relation to the indicated areas, in the development of SMS, issues related to human resources management (including skills and competences of personnel) as well as issues related to incidents and railway accidents management (including procedures that determine the work of state accident investigation commissions) must be taken into account. [9].

The process of creating safety management systems includes three stages of operations: hazard analysis, threat assessment and risk minimization. The first two stages together form risk assessment, while the entire process is called risk management.

When building an SMS, the main safety objectives, hardware and technical requirements and requirements for employees of the railway sector must be indicated. Safety management systems developed and implemented should contain the following elements [13]:

- programs to improve safety indicating the main objectives of the system, as well as parameters for obtaining a certain level of safety,
- descriptions of procedures that have been implemented or will be implemented in order to achieve the adopted assumptions in the programs to improve safety,
- procedures for achieving technical standards related to the maintenance of railway infrastructure,
- descriptions of methods for risk assessment and risk supervision,
- personnel training programs related to rail traffic, extraordinary transport, dangerous goods transport and maintenance and maintenance of railway vehicles and equipment,
- procedures for reporting and documenting incidents and accidents,
- periodic audits of safety management systems carried out within the institution.

Elements of safety management systems implemented should be documented and should indicate the stages of supervision and control over the implementation of SMS at each management level. Moreover, all infrastructure managers and railway undertakings are obliged to submit an annual safety report for the previous year. This report should be submitted by 30 June at the latest and should include an assessment of the rail transport performance taking into account the development of national safety indicators, the results of audits carried out and system failures and failures affecting the rail sector [3].

### 3.2 Risk management in rail transport

Risk, as defined, is understood as the probability of a desired situation or not in connection with its consequences. It is calculated as the product of the probability of achieving or unintended goals and the size of losses / profits. The basic tool is the risk map, which serves its evaluation.

If the risk is unacceptable, we call this condition a threat that could lead to an accident [17]. Accidents in the railway sector include: train derailment, train collisions, accidents taking place at level crossings, rolling stock fires, accidents caused by moving rolling stock (eg accidents occurring when crossing the tracks in an unlawful place), accidents related to the transport of dangerous goods.

Safety is the overriding need of both individuals and social groups. According to the adopted law, it is identified with the lack of threats. In order to achieve it, it is necessary to manage safety including safety monitoring, preceded by risk management. Under the concept of risk management, we understand the planned use of procedures, methods and policies in the area of risk analysis to achieve its acceptable level. In practice, risk management is identified with the processes of diagnosis and risk management in order to create conditions conducive to the further development of the system [8].

Risk management in rail transport is responsible for shaping its level of safety. Risk forecasting, in turn, is considered to be safety management to anticipate the risks that may exist. Identifying risks requires an in-depth analysis of available information and an assessment of whether the risk falls within the acceptable risk range or not. Put simply, calculate whether a given situation will be a threat or not to the system [9].

The risk in rail transport is monitored by tracking hazards and monitoring the occurring and possible disturbances in the system. Effective risk management makes it possible to determine the safety measures necessary to minimize the frequency and impact of crisis situations and is a major challenge for rail sector entities. Requires qualified personnel based on relevant legal regulations. Controlling the risk and monitoring the effectiveness of the actions taken enables the creation of an integrated management system necessary to guarantee an adequate level of safety.

Infrastructure managers and railway undertakings are obliged to keep hazard registers in the form of databases containing information about identified threats, their sources and related safety measures. These registers should take into account both situations that occur rarely (causing catastrophic consequences), as well as threats that often occur, the consequences of which are not so serious (eg passing

the train's composition beyond the "STOP" signaling device). The registers must be updated and the risks monitored. For this purpose, infrastructure managers and railway undertakings shall develop plans, procedures and strategies for monitoring processes as well as technical, operational and organizational risk control measures. The consequence of risk monitoring is the creation of action plans whose effectiveness and efficiency is assessed. The risk monitoring process is controlled by the National Safety Authority, ie the Railway Transport Office [8].

### 3.3 New technologies in rail transport

Today, the railway is undergoing digital transformation. Under the concept of digitalization we understand the adaptation and growth processes of the use of computer and digital technologies by individuals, society, enterprises, sectors of the economy and entire countries in order to achieve better business results [10].

Technological development has reached all branches of transport, including rail transport. The use of modern information technologies, based on the collection and analysis of data, as well as the anticipation of threats, contributes to an increase in the safety level of the railway sector. As a result of the new solutions, the operating costs of the infrastructure are reduced and the reliability of the transport services offered is increased.

Information and teleinformation technologies have been used in railway transport since the 1970s. Their applications can be found in all areas of the railway sector: production, rail traffic control, infrastructure and rolling stock management, as well as the organization of the transport process. These activities are aimed at increasing the level of safety and increasing international competitiveness of Polish state railways. Currently, among the key technologies supporting digital transformation, we distinguish: Internet of Things, Big Data Analytics analysis, artificial intelligence, cloud computing, automation and robotization ) [10].

Digital transformations affect three areas of rail transport: relations with clients, operational processes and organizational model of the organization. They enable shaping relations with passengers by understanding their needs and introducing many applications that enrich the form of self-service. In addition, they streamline the internal processes of the organization and strengthen the mechanisms for monitoring the performance of the railway infrastructure.

The potential for using digital solutions in rail transport turns out to be unlimited. The most important is the use of new technologies in the field of passenger service and the operation and maintenance of vehicles and equipment. The introduction of information systems and online sales services are only part of the activities aimed at modernizing Polish railways. Ensuring safe and punctual transport is a vision that can be realized thanks to the ubiquitous use of the Internet, constant analysis of infrastructure and rolling stock, and intelligent prediction using big data tools.

## 4. The future of PKP – results of own research

The future of the railway depends to a large extent on how quickly PKP will adapt to the changes associated with the digital revolution. Modernization of the railway sector should bring positive effects to passengers, infrastructure managers, railway undertakings and rolling stock manufacturers.

On the grounds of the pilot studies conducted among the employees of PKP PLK S.A, several main directions of the development of the Polish rail sector can be distinguished. In order to talk about the technological development of railway transport, first of all, the technical condition of the infrastructure (significantly hindering the implementation of modern technologies), raising professional qualifications of employees and the purchase of modern equipment and replacement of existing equipment should be ensured.

Poland has one of the longest railway networks in Europe (just behind France and Germany), but its condition does not meet the expectations of passengers and has a negative impact on travel comfort. Employees themselves also negatively assess the technical condition of railway infrastructure in Poland. The research conducted among employees of the PKP PLK SA company shows that over 83% of respondents assess the technical condition of the railway infrastructure, sufficiently, badly or very badly.

**Table 1. Assessment of the technical condition of railway infrastructure in Poland [own study]**

How do you assess the condition of railway infrastructure in Poland?	
Note:	Participation%
Very good	0%
Good	16,6 %
Enough	41,6 %
Bad	33,3 %
Very bad	8,5 %

The study showed that only 16.6% of respondents assess the condition of railway infrastructure as good, as many as 41, 6% - as sufficient, 33.3% - as bad, and 8.8% - as very bad. As you can see from the results presented, none of the respondents assess the infrastructure status as very good.

Of all persons participating in the survey - 27.3% think that rolling stock needs modernization. A significant part of respondents - 22.7% say that railway crossings require reconstruction. In turn, 18.2% of respondents modernizing the Polish railway would focus on the modernization of railway lines and stations. As for the last element, the place of loading / reloading, its modernization would be subject to 13.6% of the surveyed.

**Table 2. Elements of railway infrastructure requiring modernization [own study]**

Which elements of the railway infrastructure do you think need modernization?	
Elements:	Participation%
Technical condition of rolling stock	27,3 %
Technical condition of railway tracks	18,2 %
Technical condition of railway crossings	22,7 %
Train stations	18,2 %
Loading / handling locations	13,6 %



Modernization, restructuring and expansion of the Polish rail network is the most important challenge facing railway market entities. It requires appropriate legal regulations and rich investment programs related to the financing of infrastructure and rolling stock [5].

Currently, Polish railways are a party to many investment programs that aim to reduce transport costs. The effect is to modernize over 3800 km of tracks and increase the speed of trains to 200 km / h on over 500 km of the railway network. As a result, the railway will gain better travels, higher service comfort at stations, increased train speeds and more efficient and safer transport of loads. An additional advantage will be greater competition with road transport on the domestic market and strengthening the position of the Polish rail market on the international arena. In connection with the establishment of the Central Communication Port in the Baranów commune, Poland is also to receive nearly 1,300 km of new railway lines that will allow the launch of over a dozen new routes ensuring access to the proposed port from almost every part of the country [11].

Regarding the density of railway networks (calculated as 100 km<sup>2</sup>), the average value of operated railway lines for the entire territory of Poland is 6.1 km / 100 km<sup>2</sup>. For individual regions, this coefficient varies from 3.6 to 15.8 km / 100 km<sup>2</sup> [14].

The density of railway networks in the territory of Poland is unevenly distributed and decreases from north to south-east. This phenomenon leads to serious disturbances in the functioning of rail transport and signals the diversity of transport. The problem of uneven network deployment is related mainly to financial problems of individual regions, as well as due to terrain, industrialization and population of individual areas. A major challenge for the railway sector is to minimize the disproportions of the Polish rail network by expanding the railway infrastructure.

The next challenge for rail transport is the aspect of raising the professional qualifications of the staff and supporting the education of future employees. Among the surveyed group, as many as 66.6% of respondents believe that the employer should increase the frequency of training, 20.9% - claims that the current number is sufficient, and 12.5% of respondents - declared that he has no opinion. For this purpose, PKP should invest in training, modern equipment and scholarships for students of railway departments. Conducting recurring classes will allow you to maintain high safety standards, by checking knowledge of applicable regulations and consolidating and practicing the right reactions and algorithms.

**Table 3. Evaluation of the frequency of courses and trainings organized by the employer [own study]**

Do you think that the organization of courses and trainings in the field of tasks on the railway is sufficient?	
Note:	Participation %
Yes	20,9%
No	66,6 %
I have no opinion	12,5 %

Another issue raised in the study was the technical condition of the devices used. A significant part of the respondents - as many as 41.7% evaluate it as satisfactory, 33.3% respondents as good, while 25% - as bad. The problem is particularly noticeable in small towns, where the equipment used on railway control rooms is outdated and heavily exploited. Today, the railway should focus its

activities on the replacement of existing equipment and purchase of new equipment.

**Table 4. Evaluation of the technical condition of the devices used [own study]**

How do you assess the technical condition of devices?	
Note:	Participation %
Very good	0%
Good	33,3%
Enough	41,7%
Bad	25 %
Very bad	0%

Technological development of railway transport also concerns the provision of digital services for travelers. In recent years, the greatest progress has been made in the field of communication with the client. The railway websites have been expanded and modernized, and many mobile applications have been created containing precise data on the train traffic, possible delays or disruptions on railway routes. In the future, intelligent systems will be created to analyze travel scenarios using various means of transport, booking and purchasing tickets, including access to places, congestion level, changes in traffic organization, or unplanned events [2].

Regarding the digital transformation of railways, PKP primarily needs to integrate computer support systems for commercial and operational processes with industrial automation and the environment. The data collected should be translated into new services via cloud (cloud computing). The introduction of automatic traffic monitoring systems may result in higher efficiency and punctuality of rail transport by optimizing the parameters of driving and stopping trains [10].

Another way to use digitalisation is to constantly monitor the consumption of infrastructure and rolling stock via electronic systems. Sending information about the current wear status of individual devices increases the life of the rolling stock up to 99%, thus enabling the detection of potential failures in advance. The result of these activities will be increased system reliability and greater efficiency of the rolling stock used.

## 5. Conclusion

Rail transport is used for both passenger and freight transport and is a key element of the national economy. In the size of transports carried out, it loses only with transport by car. It is an important element of the national security system and is responsible for the proper functioning of the state. Its development strengthens international infrastructure connections, facilitates and accelerates trade, and raises the position of the state in the international arena.

The year 2017 turned out to be a breakthrough moment for Polish railways. Investments related to the modernization of rolling stock and railway lines have contributed to the increase in the number of transport operations. The activities undertaken by UTK and railway infrastructure managers led to a dynamic increase in the volume of transported goods and the number of passengers. Positive changes were also noted in intermodal transport on the domestic and international market.

The development of the transport industry entails the need to undertake undertakings aimed at ensuring an appropriate level of safety. For the transport of people and cargoes not to be identified with the simultaneous increase in hazards and the likelihood of accidents, it is essential to enforce existing legal provisions in railway practice.

The current legal regulations impose on the railway sector the obligation to create a Safety Management System based on effective and effective risk management. This system is to meet the requirements described in Directive 2004/49/EC of the Parliament and the European Council. It is to provide supervision over all types of risks related to the activities of the infrastructure manager or railway undertaking, including the maintenance and supply services provided to them. Properly prepared SMS procedures should ensure the implementation of risk control measures and monitor the effectiveness of the solutions used, in order to ensure a proper level of safety of the conducted activity.

Contemporary technological progress and the all-embracing digital transformation also affected rail transport. The new management systems are to be based on technological solutions using the Internet, automation and robotization, as well as new tools, such as big data, or the analytics of large data sets. The use of digitalization in rail transport will allow to meet the expectations of customers, and will also improve the efficiency of manufacturing, maintenance and operation of infrastructure and rolling stock. Digital transformation creates great opportunities for the development of rail transport. It must be remembered, however, that constant adaptation to changes and technological progress is both an opportunity and a threat to the railway industry. With the technological development and implementation of new railway sector safety management systems, new, previously unknown threats will emerge. A major challenge for Polish railways is the transition from electromechanical to electronic devices, and consequently the time for digital devices. The use of new traffic control tools using the Internet requires, above all, a change in the thinking philosophy of railway entities and ensuring safety in cyberspace.

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