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ANALYSIS OF THE RAIL CARGO TRANSPORT VOLUME IN POLAND IN 2010-2021

Summary. Rail transport is one of the branches of transport included in the group of land transport, and its operation is related to the transport of people and cargo by means of rail transport on a specially designated railroad built for this purpose. The article presents the classification of transported cargo in rail transport, the characteristics of the rail transport market in Europe, as well as the results of the analysis of the rail transport volume in Poland in 2010-2021. This analysis included an assessment of the following features: mass of transported cargo, performed transport and operational work, the average distance of cargo transport for a group of cargo transported by rail and the volume of intermodal transport. The obtained results allowed to conclude that the transport of goods by rail is systematically increasing. Moreover, intermodal transport is developing well.

Keywords: rail transport, intermodal transport, transport, traffic engineering

1. INTRODUCTION

The railway infrastructure consists of railway lines and other structures, buildings and devices along with the land occupied for them [3], [16]. A road adapted to the movement of passenger and freight trains is called a railway line. When considering the track width, it is possible to distinguish the so-called normal-gauge, wide-gauge and narrow-gauge lines. The

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most common of these is the so-called standard gauge proposed by George Stephenson, 1435 mm. Broad-gauge railway lines exist in the countries of the former USSR (1520/1524 mm), in Finland (1520 mm), in Ireland (1600 mm), and in Spain (1675 mm) [26]. Each railway line must meet strictly defined operating parameters, including the maximum permissible speed for trains, permissible axle loads, gauge, transport load expressed in teragrams per year. Railway lines can also be divided into smaller components such as [14]:
- segment - i.e. the distance between any two railway stations, between which there is at least one more railway station,
- route - a section of tracks located between any two railway stations, located directly next to each other on a section of a railway line,
- distance - a section of tracks between a railway station and a block post, or between a block post and a railway station.

The vast majority of railway lines are electrified. Over the tracks there is a traction network, i.e. an element of railway infrastructure, the task of which is to provide electricity to traction vehicles [32]. The catenary consists of a contact wire, hangers, and a support line. Trains draw electricity from the catenary using a pantograph.

The railway network in Europe is equipped with several catenary power supply systems. This is due to the historically different approach to supplying the traction network with direct current (DC) or alternating current (AC) of different voltages. As a rule, one power supply system on the main grid was developed in individual countries, depending on the time and circumstances of decision-making. The exceptions in this regard are the Czech Republic and Slovakia, where both DC and AC power systems were used, covering the north and south of the country, respectively. In addition, the initiation of the construction of rail systems with high speed that have so far operated a direct current system forced the implementation of power supply for lines or separate railway networks with alternating current. Therefore, in individual European countries, several catenary power supply systems can be found. In Poland, a 3000 V DC power supply system is used. The advantages of such a system include lower costs of the traction network, thanks to the possibility of using a contact wire with a smaller diameter. Another advantage is the less frequent placement of power substations along the line. They can be located every 30-50 km. The disadvantage of the 3000 V DC power supply system is the lack of efficiency at high speeds, the upper limit of efficiency is 230 km/h.

The article presents the division of transported goods in rail transport, the characteristics of the rail transport market in Europe, as well as the results of the analysis of the rail transport volume in Poland in 2010-2021. This analysis included an assessment of the following features: mass of transported cargo, performed transport and operational work, the average distance of cargo transport for a group of cargo transported by rail, and the volume of intermodal transport. The obtained results allowed to conclude that the transport of goods by rail is systematically increasing. Moreover, intermodal transport is developing well.

2. CHARACTERISTICS OF THE RAIL TRANSPORT MARKET IN EUROPE

Rail transport brings many benefits. The key features affecting the competitiveness of this means of transport include [25], [26], [33]:
- the ability to carry a significant load weight at one time, and the total weight of the load carried simultaneously by the entire train,
- the ability to transport a many passenger at once,

- high level of transport safety resulting, among others, from separating railway traffic from the traffic of other vehicles and pedestrians [9], [10]. In Poland in 2020, 425 accidents were recorded in rail transport, of which 93 (21.9%) are events whose source lies in the railway system (i.e. omission of employees, incorrect performance of tasks or incorrect functioning of infrastructure or rolling stock) [24]. For comparison, in the same period, 23,540 accidents were recorded in road traffic in Poland [27],
- low land occupancy level in relation to road infrastructure, much more space is needed to achieve the same capacity in road transport,
- susceptibility to the transport of cargo and passengers over medium and long distances, among others, due to the occurring phenomenon of degression of unit costs,
- a network of connections between large and medium-sized cities, relatively adapted to the needs of supply and distribution,
- low environmental impact. Rail transport emits much fewer pollutants into the environment than road and air transport. In Poland, the problem is the source of electricity, the vast majority of which comes from coal-fired power plants. Polish National Railways Energetics launched the "Green Railway Programme" aimed at supplying energy from renewable energy sources,
- high commercial speed (for cargo transport up to 120 km/h, for passenger transport up to 200 km/h for conventional rail, and from 200/250 km/h upwards for high-speed rail).

In turn, the negative features of rail transport include [26]:

- different power systems in Europe - trains cannot cross borders smoothly between countries with different power systems. In order to eliminate stops for locomotive replacement, special multi-system locomotives are used, which can be powered with different voltages,
- different wheel base - time-consuming replacement of wagon and locomotive wheelsets is required. In the case of intermodal transport, containers are reloaded to new platforms, which requires a reloading terminal where congestion may occur, which translates into longer transit times,
- lack of possibility to organize transport directly from the sender to the recipient (i.e. so-called "door to door"), there may be exceptions when both parties have the appropriate infrastructure, e.g. mine-power plant relations,
- much more difficult to organize dispersed transport, consisting in completing the train from many suppliers to many recipients (the solution to this problem may in the future be a more effective form of cooperation between the railway and road transport, so that these branches do not compete, but complement each other in one transport process),
- the requirement to plan the transport in advance due to the need to book a journey in the timetable,
- numerous repairs and modernization of the line, which hinder the smooth passage of trains, which translates into a reduction in operating speed.

Rail transport is considered to be ecological and not very burdensome for the natural environment, but it generates noise in close proximity. Therefore, noise-absorbing screens are installed near residential buildings along the railway line. So as to reduce the noise level on the railway, the European Commission issued a regulation [21] ordering the replacement of cast iron brake pads in locomotives and wagons by the end of 2021 with composite brake pads, the use of which is quieter. At the request of the Polish State Railways, the replacement date was extended to December 31, 2036.

The White Paper [17] published by the European Union assumes a reduction in the level of pollutant emissions to the environment emitted by transport. According to this strategy,

transport will be shifted from road to more ecological modes of transport, which include rail transport. According to the assumptions of the transport policy presented in the White Paper, the transport system is to become competitive and sustainable. It is assumed to achieve a 60% reduction in emissions while developing mobility. In order to implement this strategy, ten objectives were formulated in the White Paper.

Important for the development of rail freight transport is the idea of shifting from road transport of goods over distances longer than 300 kilometers to rail or water transport. To achieve this goal, EU funds will be allocated for the modernization and construction of new railway infrastructure. This will contribute to improving accessibility and shortening the travel time of trains [2].

3. CLASSIFICATION OF GOODS IN RAILWAY TRANSPORT

In 2020, 223.2 million tons of goods were transported in Poland [29]. In order to divide the load groups, the NST-2007 classification was created. This classification applies to goods transported by road, rail, inland waterways, and sea, and takes the form [22]:

- 01 - products of agriculture, hunting and forestry; fish and other fishery and fishing products,
- 02 - hard coal and lignite; crude oil and natural gas,
- 03 - metal ores, and other mining and quarrying products, peat, uranium and thorium,
- 04 - food products, beverages and tobacco,
- 05 - textiles and clothing, leather and leather products,
- 06 - wood, and products of wood and cork (except furniture), articles of straw and plaiting materials, pulp, paper and paper products, printed matter and recorded information carriers,
- 07 - coke, and refined petroleum products,
- 08 - chemicals, chemical products, artificial fibers, rubber and plastic products, nuclear fuel,
- 09 - other non-metallic mineral products,
- 10 - basic metals, finished metal products, excluding machinery and equipment,
- 11 - machinery, and equipment not elsewhere classified, office equipment and computers, machinery and equipment not elsewhere classified, radio, television and communication equipment and apparatus, medical, precision and optical tools, watches and clocks,
- 12 - transport equipment,
- 13 - furniture, other furniture products not elsewhere classified,
- 14 - secondary raw materials, municipal waste and other waste,
- 15 - letters, parcels,
- 16 - equipment and materials used in the transport of goods,
- 17 - goods transported as part of residential and office removals, baggage transported separately from the passenger, motor vehicles being transported for repair, other non-market goods not elsewhere classified,
- 18 - grouped goods: a collection of different types of goods transported together,
- 19 - goods that cannot be defined: goods that cannot be defined for any reason, and thus cannot be assigned to groups 01-20,
- 20 - other goods not elsewhere classified.

Road transport plays an important role for most groups of transported goods, while rail transport dominates only in the transport of selected groups [28]. An example of a group of goods that is often transported by trucks are food products (11.5% of the total weight transported by road versus 2% of the total weight transported by rail). In addition, the most

important loading and unloading points can be indicated for individual types of cargo. For example, in the case of coal, these are coal storage points at power plants and combined heat and power plants, e.g. Kozienice, Jaworzno, and industrial plants located in the southern part of Poland. Industrial centers located in Upper and Lower Silesia, related, among others, to the steel industry, currently play a huge role in rail transport in Poland. In the case of intermodal transport, these are inland intermodal terminals. In addition to centers generating this type of transport located inside the country, international relations also play an important role [28].

In Poland, approximately 20 million tonnes of dangerous goods are transported by rail annually. About 90% of these goods are crude oil and petroleum products (gasolines, oils), technical gases (mainly propane-butane), and sulfuric acid [31]. Transport of dangerous goods by rail is carried out in accordance with the rules set out in the Act of 28 March 2003 on rail transport [3], and the Act of 31 March 2004 on the transport of dangerous goods by rail and regulations on the transport of dangerous goods, e.g.: RID (Regulations for the International Carriage of Dangerous Goods by Rail), Annex 2 to SMGS - (Regulations on the Carriage of Dangerous Goods to the Agreement on International Rail Freight Transport) [4]. Due to the chemical and physical properties and the types of threats that dangerous goods may cause, their transport is prohibited or strictly defined by law. A prerequisite for allowing dangerous goods to be transported is their identification and classification based on the physical and chemical properties of dangerous goods and taking into account the hazards that given materials may cause [13].

In the RID regulations, dangerous goods have been classified into several classes due to their chemical and physical properties and the hazard they may cause. In general, these are [5]:
- 1 - explosives, and items with explosives,
- 2 - non-toxic combustible gases, poisonous gases,
- 3 - flammable liquids, desensitized explosives,
- 4 - desensitized explosives, packing group I,
- 5 - toxic substances of packing group I, category A infectious substances,
- 6 - organic peroxides,
- 7 - radioactive materials,
- 8 - corrosive materials.

If the transported cargo is characterized by only one of the possible hazards, then the defining digit is followed by a zero.

Tab. 1

UN codes (i.e. numbers assigned to substances and dangerous goods)

UN codes	Dangerous substance
1202	Fuel oils (e.g. heating oil, diesel fuel)
1203	Petrol
1223	Kerosene
1230	Methanol
1266	Flammable perfumery products
1268	Crude oil distillates
1789	Hydrochloric acid (hydrochloric acid), aqueous solution
1805	Phosphoric acid
1830	Sulfuric acid with a concentration of more than 51%
2031	Nitric acid with a concentration below 55%

Source: own study based on [11]

However, if a given hazard is particularly severe, the appropriate number is doubled (e.g., 88 means corrosive material, very corrosive). In addition, if the hazard number is preceded by the letter "X", it means that in the event of a fire, water cannot be used to extinguish it. The number at the bottom of the table is the UN code of the substance being transported. It does not carry information about the threat, but defines the type of cargo transported [11]. Table 1 shows the classification of dangerous substances with their UN codes. Each wagon, tanker, container must be properly marked. RID plates are used for this, which are mounted on the side walls of cars. Like the ADR plates, the RID plates are orange. The hazard number is located at the top of the plate, and the UN code at the bottom.

4. INTERMODAL TRANSPORT

Intermodal transport is a desirable direction for the development of rail transport. According to J.J. Coyle and E.J. Bardi [8], intermodal transport is a transport system based on the successive use of at least two modes of transport, in which the intermodal transport unit is not changed by the mode of transport. Intermodal transport has recorded a systematic increase in transport in recent years. This is related to the policy of the EU promoting sustainable evolution of transport. The transport of goods from China via the New Silk Road to Poland and further to other European countries is becoming more and more popular. The main advantages of intermodal transport include [1], [12]:
- no manipulation of the goods when changing the means of transport,
- high level of safety of transport and cargo thanks to control during reloading and storage operations in terminals,
- low costs of cargo storage in transshipment terminals,
- possibility of customs clearance from the border to the starting/end terminal (important in the case of international transport),
- in the case of transporting the whole vehicle by rail (e.g. road tractor plus semi-trailer), the driver may count the travel time as a daily rest.

The advantage of intermodal transport is the low negative impact of transport on the environment compared to other forms of transport. Thanks to intermodal transport, it is possible to reduce the emission of CO_2, and other pollutants, as well as reduce the consumption of oil-derived fuels. The use of intermodal transport by enterprises brings measurable financial benefits thanks to:
- reducing the fleet of cars and semi-trailers,
- employing fewer drivers with licenses to drive heavy goods vehicles,
- savings in fuel consumption.

The need for costly investments in terminals, reloading equipment, e.g. overhead cranes, cranes, self-propelled machines, is the biggest disadvantage of intermodal transport. However, these are one-time investments and after some time the incurred expenses pay off. In Poland, there are premises for the intensive development of intermodal transport, due to its location at the intersection of the main European transport corridors, the development of the Polish economy and the improvement of the standard of social life, as well as the processes of European integration and the development of cooperation between EU countries. These factors influence the growth of domestic and international transport, as well as transit traffic [15], [19].

Regulation No 1315/2013 of the European Parliament and of the Council on Union guidelines for the development of the trans-European transport network (TEN-T) [23] defines the requirements and priorities for the development of transport infrastructure for the member states. This regulation defines the structure of the network in two-tier terms, consisting of a comprehensive network and a core network, as well as indicates its route. The requirements include, inter alia, the need for member states to ensure that modes of transport are interconnected at freight terminals, inland ports and maritime ports in order to enable multimodal transport of goods. Actions involving, inter alia, ensuring effective interconnections and integration of the comprehensive network infrastructure and removing the most important technical and administrative obstacles hindering the development of intermodal transport are treated as priority [7]. In Poland, 7,720 km of railway lines have been qualified for the TEN-T network (core and comprehensive). Rail Freight Corridors (RFCs) are an integral element of the TEN-T core network. The purpose of creating rail freight corridors is to increase the attractiveness of rail transport compared to other modes of transport, mainly road transport [7].

Three freight corridors running through the territory of Poland are of key importance for rail transport, including intermodal transport [7]:

- RFC5 corridor Baltic Sea - Adriatic Sea on the north-south axis, which starts in Gdynia (Poland), and runs through Tczew (Poland), Bydgoszcz (Poland) (CE65), Warsaw (Poland) (E65), Katowice (Poland), Ostrava, Vienna, Trieste to Ravenna. The most important Polish investments along this corridor include the modernization of the E65 and E59 railway lines, which are key train lines in Poland along the north-south axis,
- RFC8 North Sea-Baltic Sea Corridor connects Bremerhaven, Amsterdam, Rotterdam/Antwerp via Berlin, Warsaw and Terespol (E20) with Kaunas in Lithuania. This corridor mainly transports goods from China to Western Europe,
- the RFC11 Amber corridor connecting south-eastern Poland, Slovakia, Hungary and Slovenia with the Belarusian border in Terespol, running through three capital cities (Budapest, Bratislava and Ljubljana), and industrial centers in the vicinity of Krakow, Katowice (Upper Silesian Industrial District), Warsaw, Kosice, and Miskolc. To the south, the corridor leads to the port of Koper on the Adriatic Sea in Slovenia.

Another important legal act for the development of rail transport is the AGTC Agreement [20]. It is a European agreement on important international lines of combined transport and accompanying facilities, drawn up in Geneva on February 1, 1991. The agreement establishes a legal framework, specifying the agreed plan for the development of combined transport and the infrastructure necessary for its implementation, based on international parameters and standards. In Poland, the agreement entered into force in 2002. Within its framework, a network of railway lines has been designated for international container transport by rail and container terminals located on the railway network.

Currently, the main transport corridors, important from the point of view of intermodal transport, are in good technical condition. Restrictions on the infrastructure side are local or result from crossing larger railway junctions. However, it should be taken into account that part of the traffic is carried out along alternative routes, which results from the impossibility of routing along the main route (collision with passenger traffic, modernization of the route). Alternative routes are usually characterized by a greater or much greater transport distance and often worse technical parameters and capacity [6], [7].

5. THE RAIL TRANSPORT OF GOODS MARKET IN POLAND IN THE YEARS 2010-2021

Transport is an important sector in the Polish economy. It has a measurable impact on its development. In particular, rail transport in Poland plays an important role in the movement of goods. Coal is transported by trains from mines to power plants. The efficiency of these connections has a significant impact on the country's energy security. In Poland, rail transport is quite often the chosen method of transporting people and goods. The number of all performed transports places rail transport in Poland in the second position, right after road transport [34], [18]. The popularity of rail transport is influenced, among others, by good accessibility to infrastructure. The aim of the study was to analyze the volume of freight transport using rail transport in 2010-2021 in Poland. The following features were analyzed:
- mass of transported loads,
- performed transport work and operational work,
- the average distance of cargo transport in the group of cargo transported by rail, and
- volume of intermodal transport.

In the Fig. 1, changes in the volume of freight transported by rail in Poland in 2010-2021 are presented. It should be noted that at the time of the analysis, only data for the first quarter of 2021 (i.e. from January to March) was available for 2021.

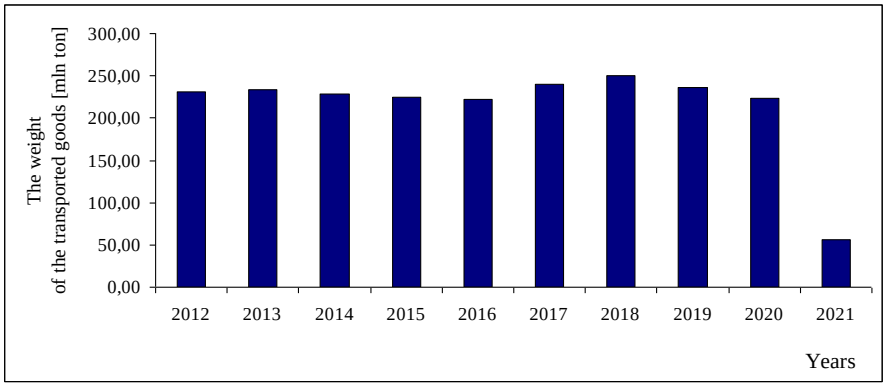

Fig. 1. The weight of the transported cargo [million tonnes]
by rail transport in Poland from 2012 to 2021
(data for 2021 are available only for the three first moths, i.e., from January to March)
Source: own research based on data presented by the Railway Transport Office in Poland [29]

In the analysis period was 2,146.78 million tonnes of transported goods, with the most goods transported in 2018 (250.25 million tonnes), and the least in 2020 (223.24 million tonnes). Nevertheless, it should be noted that 2020 is the peak of the pandemic, and a significant economic slowdown in many countries around the world, including Poland. In turn, the main reason for the increase in transport in 2018 was the implementation of many large domestic investments in Poland, and the related demand for the transport of building materials. The average value of goods transported by rail transport in the analysis period was 214.68 million tonnes per year.

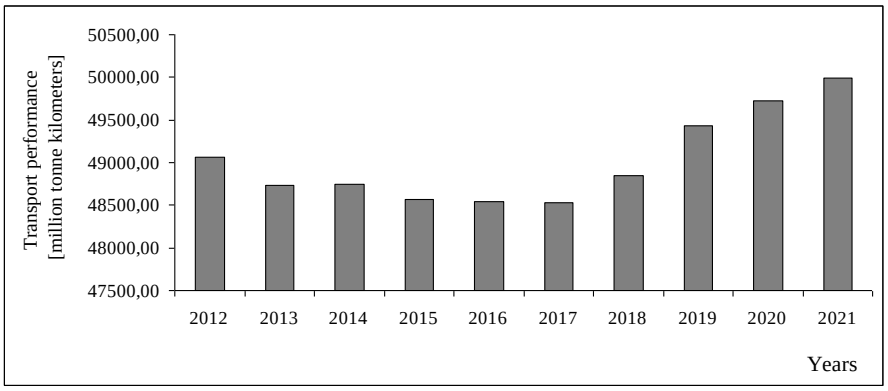

Fig. 2. The transport performance [million tonne-kilometers]
by rail transport in Poland from 2012 to 2021
Source: own research based on data presented by the Railway Transport Office in Poland [29]

On the other hand, the volume of transport performance understood as the sum of transport works performed in the transport of goods by rail, after a slight decrease in the years 2015-2017, has been steadily growing in recent years (Fig. 2). Throughout the analysis period, the total transport performance amounted to 486,693.57 million tonne-kilometers. In turn, the average value in the analysis period was 48,669.36 million tonne-kilometers per year. Changes in the amount of operational work are shown in Fig. 3.

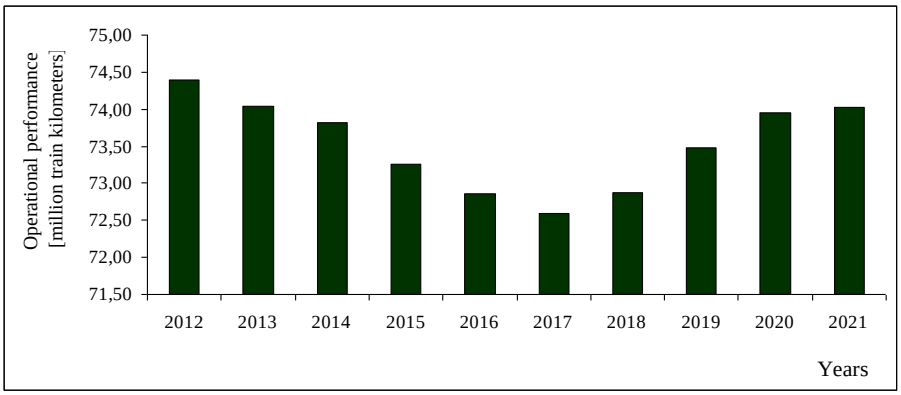

Fig. 3. The operational performance [mln train kilometers]
by rail transport in Poland from 2012 to 2021
(data for 2021 are available only for three first moths, i.e. from January to March)
Source: own research based on data presented by the Railway Transport Office in Poland [29]

The unit of measurement of operational work is the train-kilometre, which corresponds to the movement of one train over a distance of one kilometer. In the analysis period, operational work amounted to 719.96 million train-km, and the annual average was 72.00 million train-km per year. There was a significant decrease in the operational performance by realized rail transport in Poland in 2017, and since 2018 the amount of operational work has been systematically growing. The highest value of the operational performance was recorded in 2012 (74.40 million train-km). Nevertheless, in 2021, during the first three months of the year, operational work already amounted to 74.02 million train-km, which allows us to assume that throughout 2021 it will exceed the value obtained in 2012. The upward trend in operational work means that the transport of goods using rail transport is carried out over ever-longer distances.

The average distance of transported cargo by rail transport in Poland from 2012 to 2021 have been presented on Fig. 4. A systematic increase in the distance over which cargo is transported by rail is noticeable. This is a desirable trend from the point of view of implementing the objectives of the EU policy presented in the White Paper on Transport.

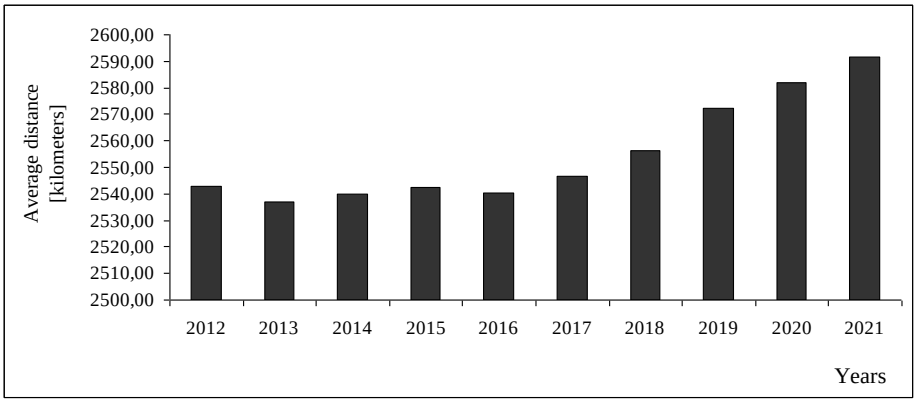

Fig. 4. The average distance of transported cargo [kilometers] by rail transport in Poland from 2012 to 2021
(data for 2021 are available only for three first moths, i.e. from January to March)
Source: own research based on data presented by the Railway Transport Office in Poland [29]

Various groups of goods are transported by rail in Poland. These are mainly bulk cargoes, such as hard coal and lignite, other petroleum products, metal ores, mining products, liquids and chemicals, metallurgical products and container loads. On the Fig. 5 the weight of transported loads in million tons in the division into groups of transported loads by rail transport in Poland from 2012 to 2021 have been presented. The Office of Rail Transport in Poland divides the transported loads into six categories.

The sizes of all transported groups of cargo slightly fluctuate during the analysis period. Throughout the analysis period, the hardest coal, lignite, oil, gas were transported (total 931.9 million tons), followed by metal ores, mining and quarrying products (total 611 million tons). In turn, metals, and metal products were transported the least (94 million tons in total). In recent years, there has been a slight increase in transport in all categories of transported cargo.

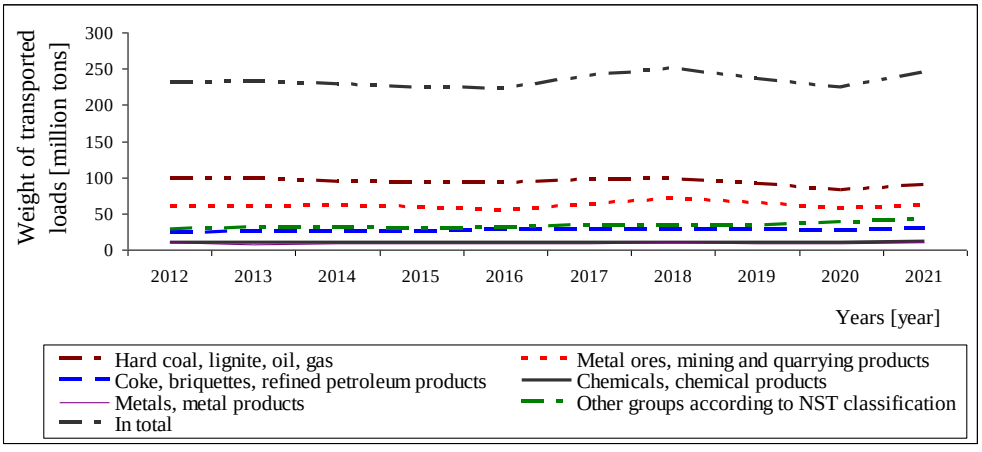

Fig. 5. The weight of transported loads [million tons] in the division into groups of transported loads by rail transport in Poland from 2012 to 2021
Source: own research based on data presented by the Railway Transport Office in Poland [29]

The volume of transport realized by intermodal transport was also analyzed, broken down into the number of transported units, the number of Twenty feet Equivalent Units (TEU), the mass of transported cargo, and transportation work (Fig. 6). In general, it can be stated that all these values increased during the analysis period. Rail intermodal transport is characterized by constant growth. Transports are developing from terminals and ports as well as from China to the so-called Silk Road. Over the past ten years, the intermodal rail market has more than quadrupled. Every year, the volume of transported cargo increased from several to several dozen percent per year.

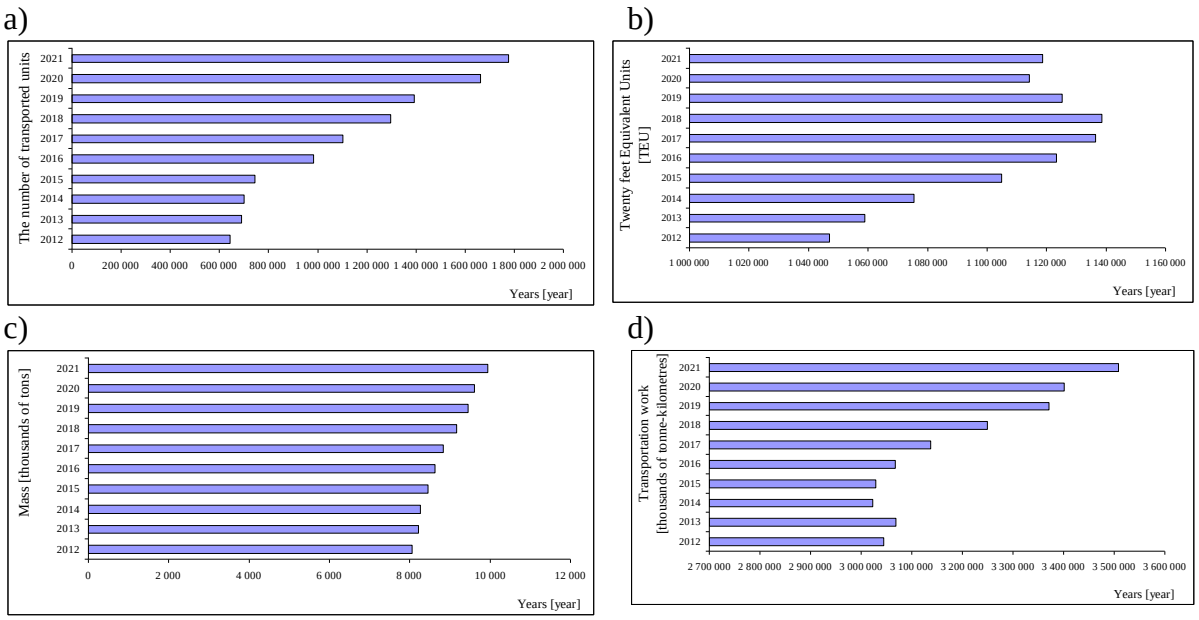

Fig. 6. Rail transport realized in Poland from 2012 to 2021: a) the number of transported units, b) the number of Twenty feet Equivalent Units (TEU), c) the mass of transported loads, d) the transportation work realized by rail transport
Source: own research based on data presented by the Railway Transport Office in Poland [29]

To provide transport services on Polish tracks, a railway operator's license issued by the Office of Rail Transport is required. In the past, the main carrier was Polish National Railways, but in recent years more and more new carriers have entered on the Polish market. This contributes to increased competition, which in turn translates into improved transport services. Polish National Railways Cargo is a definite leader in rail freight transport in Poland. Then they are: Lotos Rail, DB Cargo Poland, Polish National Railways LHS, CTL Logistics, Orlen KolTrans, Freightliner PL, PUK Kolprema, Rail Polska, Pol-Miedź Trans. The number of all carriers performing freight transport in Poland is gradually increasing. This number has more than doubled in the last ten years. This proves that the offer of carriers providing transport services so far was incomplete or the quality of services was insufficient. New companies that want to enter the Polish railway market notice these gaps, and effectively fill them by offering attractive transport and transport conditions, e.g. transport on previously unfrequented routes, offering lower rates or better logistic service.

6. SUMMARY

Based on the analysis presented in the paper, the following conclusions can be stated:

- the total weight of goods transported in Poland in the analysis period was 2,146.78 million tonnes, with the most goods transported in 2018 (250.25 million tonnes), and the least in 2020 (223.24 million tonnes),
- the average value of goods transported by rail in the analysis period was 214.68 million tonnes per year,
- the volume of transport performance, after a slight decrease in 2015-2017, has been steadily growing in recent years,
- in the entire analysis period, the total transport performance was 486,693.57 million tonne-kilometers. In turn, the average value in the analysis period was 48,669.36 million tonne-kilometers per year,
- in the period of the analysis, operational work amounted to 719.96 million train-km, and an annual average of 72.00 million train-km per year. There was a significant decrease in the operational performance by realized rail transport in Poland in 2017, and since 2018 the amount of operational work has been systematically increasing,
- the highest value of the operational performance was recorded in 2012 (74.40 million train-km). Nevertheless, in 2021, during the first three months of the year, operational work already amounted to 74.02 million train-km, which suggests that throughout 2021 it will exceed the value obtained in 2012. The upward trend in operational work means that the transport of goods using rail transport is carried out over increasingly long distances,
- a systematic increase in the distance of transported cargo by rail transport in Poland in the following years is noticeable. This is a desirable trend from the point of view of implementing the objectives of the EU policy presented in the White Paper on Transport,
- the volumes of all transported groups of cargo slightly fluctuate during the analysis period. Throughout the analysis period, the hardest coal, lignite, oil, gas (total 931.9 million tons) were transported, followed by metal ores, mining and quarrying products (total 611 million tons). In turn, metals, and metal products were transported the least (94 million tons in total). In recent years, there has been a slight increase in transport in all categories of transported cargo,
- during the analysis period, the volume of transport realized by intermodal transport increased, broken down into the number of transported units, the number of TEU, the mass of transported cargo and transportation work,
- rail intermodal transport is characterized by constant growth. Transport from terminals and ports as well as from China along the Silk Road is still developing. Over the past ten years, the intermodal rail market has more than quadrupled. Every year, the volume of transported cargo increased from several to several dozen percent.

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