

FACTORS AFFECTING THE INTERMODAL TRANSPORT DEVELOPMENT IN THE GREATER POLAND REGION. IN SEARCH FOR AN OPTIMAL PUBLIC POLICY

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Abstract:

Intermodal transport in Poland plays an increasingly important role. It develops despite difficulties it encounters. This article presents results on research conducted on development of intermodal transport in Greater Poland region, where the majority of intermodal terminals in Poland operate. The majority of intermodal terminals would not be open without financial support from the European Union because it is seen as a risky business. The risk is not only derived from infrastructural barriers or low-cost advantage over the road transport, but also because of low awareness of the environmental issues among customers of transport services. As a result, small and medium-sized road haulers dominate the Polish market. Poland has the largest fleet of road freight vehicles in the EU. Only entrepreneurs implementing the corporate social responsibility policy deliberately choose intermodal transport. One can identify four basic business models of intermodal terminals in Greater Poland region. While all business models form part of the logistics market, it is important to develop regional and transport policy of the State in this regard, supporting particular model(s) of intermodal terminals' development. In the same time, helping to better focus the European Union funds.

Key words: intermodal freight, regional transport policy, regional development, supply chains, EU funds,

Introduction

Intermodal transport of goods, defined as a means of delivering goods using two or more transport modes without any handling of the goods itself when changing modes, is a phenomenon that has gained global importance since half a century. This was due to containerisation. Packaging standardisation has facilitated transshipment between different modes of transport. Containers emerged in Europe in the 1960s.

In 1966, ship called Fairland arrived to Europe from USA bringing 226 containers. This date is considered to be the beginning of the container loading process in Europe [Johnson, Garnett, 2017]. The phenomenon of containerisation has come to Poland with some delay and at that time publications were aimed at popularising the technology itself [Gęsiarz, 1976, Krasucki, Neider, 1986]. However, the containers were a niche solution for a long time. Wagons and trailers suitable for transportation of loose and specialised materials dominated the transport. Acceleration of containerisation and intermodal transport within it associated was a period of economic and political transformation in Poland that led to enhanced interconnectivity of Polish economy with global markets.

Since the Second World War, the railway freight network in Poland developed to supply hard coal from Silesia region to power plants and marine ports and to import iron ore. Trains did not have to reach high speeds. Underinvestment of railway infrastructure that had occurred in eighties of XX c. (before the transformation of the Polish economy), diminished the prospects of railway freight. The railway infrastructure used to transport the Warsaw Pact troops to the West was an exception. As a result, the railway business experienced a systematic decapitalization and decline in the average speed of freight trains to the level of about 20-25 km/h observed in the last decade, although for intermodal trains it is about 20% higher, due to data from the Office of Rail Transport (UTK). All these factors have significantly curbed the development of intermodal transport.

Significant acceleration of the intermodal transportation development in Poland took place during the second budget perspective of the European Union (2007-2013). The EU funds stimulated investments in intermodal terminals and the rolling stock necessary to provide services. At the same time, the EU investments have put competitive pressure on rail transport. On the one hand, loose bulk transport decreased, for example due to a significant reduction in hard coal exports. Between 2004 and 2016, the share of hard coal rail freight transport (calculated in ton kilometre) decreased from 39.0% to 29.6%. On the other hand, the fast-moving road network quickly expanded. According to General Directorate for National Roads and Highways (Generalna Dyrekcja Dróg Krajowych i Autostrad - GDDKiA) data, there were only 367 km of motorways and express roads in 1989. It increased to 727 km in 2004 (the year of the Poland's accession to the European Community). In the mid-2017 total length motorways and express roads in Poland reached 3252 km. Prior to the accession to the European Union, the competitive position of the railways was slightly offset by poor road conditions [Waters, 1999]. The railway carriers were forced to find new business models due to increasing competitiveness of road transport. Intermodal transport is one of the opportunities for the railways [Meers, Macharis, 2015].

Global market conditions gave additional impetus for intermodal transport development. Poland is perceived as key country on the New Silk Road. Poland is on the northern transportation route from China through Russia and Belarus, as well as on the southern one, leading from China through Central Asia, Azerbaijan, Georgia and Ukraine. Cooperation with China results in regular transit connections as well as the one targeted on Poland [Szczydlik-Tatar, 2015]. All the above-mentioned factors lead to a question about the recent condition of the intermodal transport in Poland and its perspective.

Literature overview

Most of the research on Polish economic transformations analysed the deindustrialisation and the tartarisation of the economy and the issue of its networking [Holman 1998; Stryjakiewicz 2002; Stryjakiewicz 2005; Źidek 2011; Gierańczyk, Rachwał 2012; Gorzelak 2013]. The above-mentioned works only reflected to a small extent the impact of economic transformations on the transport sector, especially on the implementation of new technologies and new rules of organisation of logistics processes.

Scientific works dedicated to transport have focused to a large extent on the analysis of issues and processes occurring on railroads in the period of economic transformation [Engelhardt 1998; Taylor, Ciechański 2006; Taylor 2006], marginalising issues related to intermodal transport. They assumed that more important issues have occurred in rail transportation, such as transformation of the state-owned Polish State Railways in a group of companies or liquidation of certain railways and the issue of the so-called transport exclusion.

Intermodal transport in Poland has returned on the scientific agenda quite recently. Therefore, there is not too much works on this issue. The majority of works concern functioning or proposed technical solutions in intermodal transport [Mindur, Wronka 2005; Medwid, Cichy 2009]. Another group of works concentrate on the statistical data analysis at national or European level or analysing intermodal transport in the context of logistic systems [Stokłosa 2011, Nowakowski et al. 2010]. The above-mentioned data is the basis of discussions on the role of intermodal transport in Poland [Wiśnicki 2001, Chwesiuk et al. 2008].

The atypical situation occurred in Poland, as companies participating in the global economy transfer the West European technical solutions to Poland, being ahead of the Polish scientific research in this area. Scholar books try to fill in this gap by addressing current state of art to the wide audience. There is lack of Polish publications of the basic research character on the development of intermodal transport

technology and the importance of this branch of transport for the state economy and regional development.

The research presented in this article aims to fill in this gap. The benchmark for the 2014-2016 analyses in Greater Poland was the relation between the construction of intermodal terminals and regional development, especially spatial development. Greater Poland region was selected because it has the largest number of intermodal terminals in its territory. The key research question concerned the development of policy for the intermodal terminals' network. As noted [Santos et al., 2015, Meers et al., 2018], the optimisation of the intermodal terminals and their associated fixed rail links contributes to the attractiveness of this form of transport. Poland does not have strategy in place for this form of transport. Regional governments in Poland have not developed the appropriate strategy.

The aim of this article is to find the answer to the question about the directions of future intermodal policy of the voivodship (regional authority) and the state. The work has focused on identification of terminal location determinants, factors affecting the size of an intermodal terminal or interconnections between the terminal operator and other entities in the supply chain. At the same time, the impact of external factors on the potential attractiveness of intermodal transport was investigated. The analyses concerned both the impact of the European Union funds and the cost factors determining inter-branch competition [Macharis et al., 2010].

Although they argue [Wessel et al., 2016] that from the macroeconomic and institutional perspective, the exchange rate stability, corruption, the rules of law, play a significant role in the functioning of logistics, including intermodal transport, in the context of increasing institutional stability in Poland, resulting from participation in European structures, plays an increasingly important role in i.e. infrastructural and spatial issues. These issues are related to the path of regional development of Poland. Social, economic and environmental factors in regional development policy were indicated [De Jong et al., 2016].

Definition of research problem and purpose of work

Due to the limited number of primary studies on the intermodal freight system in Poland, the authors decided to look at the problem comprehensively, going beyond the existing canon of descriptions and analyses. Based on one of the Polish voivodships, we combined in our research the theoretical and practical knowledge about intermodal transport with recent statistical data. The tool used in the research was rarely used in Poland so far - interviews conducted directly with entities involved

in the development and functioning of intermodal transport, representing different elements in the „supply chain”.

The main goal of this research is to identify development factors and barriers of intermodal freight transport in Poland. On this basis, guidelines for transport policy have been prepared. The study was conducted on the example of one region – Greater Poland, however, the results apply to the entire country.

The Greater Poland region was chosen as the research area. It was considered as good and reasonably representative research area within the national dimension. This is the second largest by area (29,826 km²) and the third largest by population (3,48 million inhabitants) province in Poland. It is one of the most economically developed regions of the country, both in terms of gross domestic product (197 billion PLN) and growth dynamics (7.1%, 2017/2016).

Very high transport accessibility, favourable transport location, proximity to the western national border, fairly good access to the capital of Poland and to the seaport of Szczecin-Świnoujście are indicated in cyclical research conducted by the Institute for Market Economics (Instytut Badań and Gospodarkę Rynkową) as the most important advantages of this region among investors [Szultka et al., 2016]. These attributes are partly due to the organisational culture being the legacy of cultural heritage of its affiliation to Germany in the nineteenth and early twentieth centuries. It has been the historical distinction of the region in Poland.

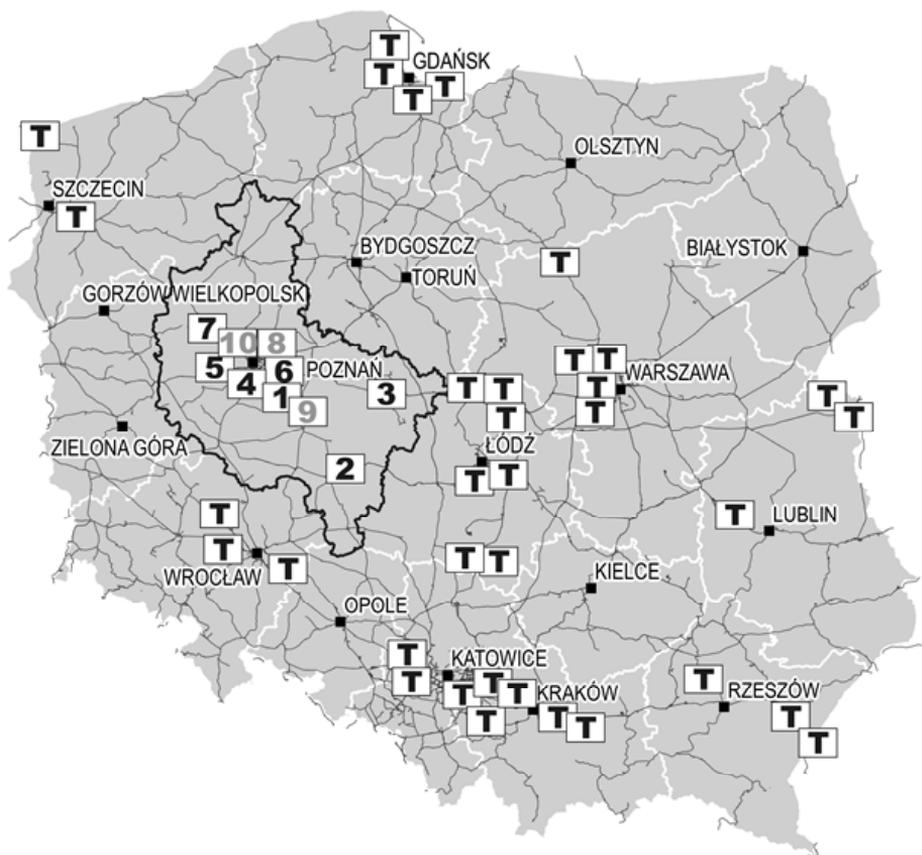
A significant number of intermodal terminals in the country are concentrated in the region - 8 out of nearly 50 functioning in Poland (Fig. 1), which makes them representative for the research. The provincial city (Poznań, 536,400 inhabitants; 2018) is located about 300 km from the sea, which, in the opinion of entrepreneurs operating in the region, makes it possible to use intermodal transport, although in the literature longer distances, e.g. 500 miles are also indicated as suitable [Resor et al. 2004]. It is also important that Greater Poland does not have national borders. The example of the intermodal terminal located in German city Frankfurt (Oder) operated by the Polish company PCC Intermodal S.A. shows that, depending on the benefits, entrepreneurs can choose investment areas each side of the border.

The authors adopted three levels of analysis of the functioning and development of intermodal transport:

- 1) Cognitive - identification of the impact of the EU funds on the development of intermodal transport in Poland. The impact of the EU funds should be seen in two areas: direct - for intermodal terminals and the associated infra-

structure and indirect - regarding the impact of investments in different modes of transport on intermodal transport.

- 2) Applicable - interactions of terminals with the environment, including their role in creating industrial zones. At the same time, this paper aims at outlining possible scenarios for future state policies in the field of intermodal transport development, analysing the potential benefits and risks in the light of current practice.
- 3) Theoretical - classification of existing intermodal terminals and creation of a model of their functioning in Poland.



1 - Gądkki (POLZUG), 2 - Kalisz, 3 - Kolo, 4 - Poznań Franowo, 5 - Poznań Junikowo, 6 - Swarzędz, 7 - Szamotuly, 8 - Kobylnica, 9 - Gądkki (Gargosped), 10 - Poznań Garbary

Fig. 1. Intermodal terminals in Poland

Ryc. 1. Terminale intermodalne w Polsce

Source: own elaborations based on The Office of Rail Transport (UTK) and companies' information.

Źródło: opracowanie własne na podstawie danych Urzędu Transportu Kolejowego (UTK) oraz informacji przedsiębiorstw

In the literature, most of the papers deal with econometric models that set the threshold for the efficiency and appropriateness of an investment. This issue seems to be well explored and recognised, for example by models that consider fuel price increases [Macharis et al., 2015], calculating comparable combined internal and external costs of intermodal and road freight transport networks [Janic, 2007]. Analysis of mode variable choice in short-distance intermodal freight [Reis, 2012]. Such research is difficult to replicate in Polish conditions, as under the conditions of high competition and price pressures, road transport companies keep their actual costs as commercial secret. Conducting research in the Polish context also hinders the policy of the infrastructure manager, who can significantly differentiate track access prices in the following years. Hence, the focus was on the terminals themselves and the models of their functioning.

Methodology

Poland neither Greater Poland region do not have an intermodal policy. Local governments provide in spatial development plans a very large supply of space for the functioning of logistic services. Therefore, there are no significant regulatory restrictions on the development of intermodal terminals. It was crucial to know what motivate entrepreneurs investing in this sector. We perceived direct interviews as the most evident way of getting this knowledge.

Our basic research focused on in-depth interviews with main actors of intermodal freight on all supply chain. We concentrated on companies with high demand on transport, shippers, intermodal terminals and railways. In addition, representatives of local authorities and trade unions were consulted. A total of 56 in-depth interviews were conducted between 2013-2014. Due to confidentiality of business data, summaries of survey's outcome are presented in an anonymous way. As part of the study, we also visited all intermodal terminals in Greater Poland.

These studies were supplemented with the use of EU funds from the financial perspectives 2004-2006 and 2007-2013. Expenditure up to 2013 may be borne by the end of 2015 and finally cleared in 2016. The conclusions of these studies were supplemented by analyses of data from The Central Statistical Office (Główny Urząd Statystyczny – GUS), Ministry of Development (Ministerstwo Rozwoju – MR), EU-ROSTAT public statistics and state transport offices and agencies, such as: The Office of Rail Transport (Urząd Transportu Kolejowego – UTK), General Directorate for National Roads and Highways (Generalna Dyrekcja Dróg Krajowych i Autostrad – GDDKiA) and railway infrastructure manager (PKP Polskie Linie Kolejowe SA – PKP PLK SA). Such a combination of data sources and research methods allowed

for comparison of statistical data with business perception of the situation by entities and companies involved in the operation of intermodal transport.

Interviews were conducted with two groups of interlocutors. The one with clients of the transport system aimed to identify their needs for transport service. The one with transport sector aimed to identify conditions and barriers to the intermodal services development, as well as their capabilities and development plans.

In the structural and territorial selection of respondents' efforts were made to reflect the specificity of the Greater Poland economy. In-depth interviews varied, covering from a few to a dozen of questions, depending on the interlocutors' group. Questions cover issues on: state intermodal transport policy, changes in the industry in recent years, choice of mode of transport and determinants of this choice.

Changes in the Polish transport after 1989

In the Polish People's Republic, the car - like many other products - was an expensive and regulated commodity, available to selected people. Free access to cars, which was obtained at the beginning of the political transformation, led to significant increase in the number of cars in Polish. There were 128 cars per 1,000 inhabitants in 1989. This proportion increased to 314 in 2004 and 586 in 2017. It makes the fourfold increase. Transport of goods was regulated similarly to other sectors of the centrally planned economy. Efforts have been made to limit the carriage of goods by road and to maximise the use of rail. In 1988 the road transport law was deregulated, which contributed to dynamic development of this sector. Similarly to the passenger cars, the number of trucks increased on Polish roads.

There were investments in roads but decrease of investments in rail infrastructure. While the length of railways operated in Poland amounted to 26 644 km in 1989, it decreased to 20,250 km in 2004 and only 19,231 km in 2015 (Fig. 2). Within 25 years, Poland lost 1/4 of its railway infrastructure. Local lines were firstly not operated and then decommissioned. It reduced the availability of railways in Poland. The changes had not only quantitative but also qualitative effect. The scale of regression is difficult to estimate precisely. There is no detailed statistics on the number of sidings to be dismantled, short passes, etc. The problem of freight traffic was noticeable even in the local press, which published protests not only of passengers, but entrepreneurs as well. Additionally, there is about 1500 km of lines officially operated but with maximum speed 0 km/h.

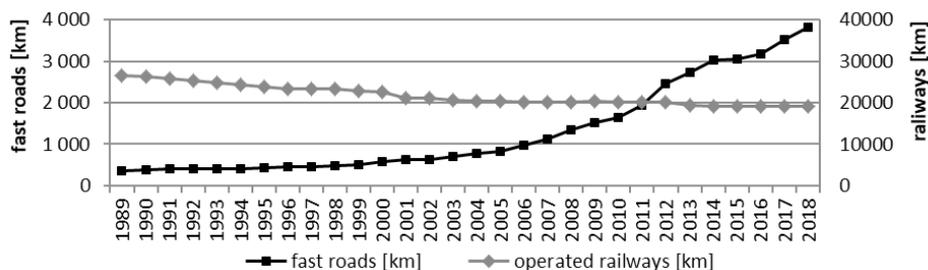


Fig. 2. Comparison of lengths of railway lines and high-speed roads (motorways, expressways) between 1989-2018

Ryc. 2. Porównanie długości linii kolejowych oraz dróg szybkiego ruchu (autostrady, drogi ekspresowe) w latach 1989-2018

Source: own elaboration based on GUS / Źródło: opracowanie własne na podstawie GUS

The lack of financial resources on railways made it difficult for the infrastructure manager - Polish State Railways (PKP) and later Polish Railway Lines (PKP PLK SA) - to maintain acceptable parameters not only in passenger traffic (maximum speeds), but also in freight traffic (permissible axle loads) even on major routes and sections of the network of significant importance for the country. It is estimated that Poland's railways are lagging behind the railway in EU-15, and the distance to make-up is estimated at 30 years [Bartosik, Wiak 2016].

The consequence of the deterioration of technical state of infrastructure is the systematic increase in driving time for passenger and freight trains. The situation on the main routes improved only after repairs made with the support of EU funds. In years 2004-2015 the share of the fastest lines, with maximal speed 120 km/h or higher has been doubled, from 17,6% up to 31,2%. Considering additional factors, such as a significantly higher priority in routing passenger then freight trains and lack of high-speed routes for freight resulting in very low average speed of freight trains, the road cargo increased its importance.

Road carriers quickly exploited the poor situation on rail. They began to dynamically gain market share and develop their fleet of vehicles considerably (Fig. 3). They got importance not only on the national but also the European market. While there were 1,010 million registered trucks in 1990, the number increased to 3,429 million in 2015. As a result of this 25-years' change in the transport market, Poland has become one of Europe's leading supplier. It achieved leading position on the registration of road tractors (280 thousand in 2013), and second behind Germany on the registration of semi-trailers (277 thousand in 2012), due to EUROSTAT. The dynamic development of this industry took place after the accession of Poland to the EU, as Polish companies gained access to the common EU market.

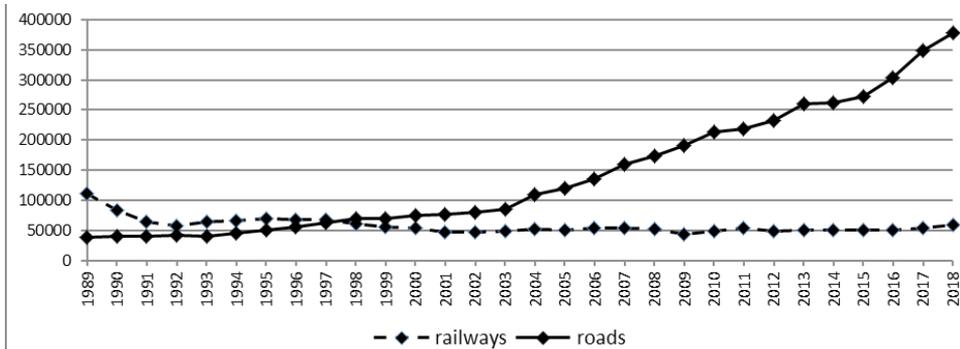


Fig. 3. Distribution of freight between rail and road transport in Poland [million of tonne-kms]

Ryc. 3. Podział zadań przewozowych w transporcie towarowym w Polsce między transport kolejowy i drogowy (miliony tonokilometrów).

Source: own elaboration based on GUS. / Źródło: opracowanie własne na podstawie GUS

The long-term transport investments were the reason of dynamic development of motorisation in Poland. The similar length of the road network (i.e. motorways, expressways and other main roads) and the railway lines (about 20 thousand km) allow for comparisons (Fig. 4). The amount of 177 billion PLN spent on roads from the National Road Fund between 2004-2016. In the same time 46 billion PLN was spent on railway lines (one billion PLN spent by the independent railway infrastructure manager was excluded).

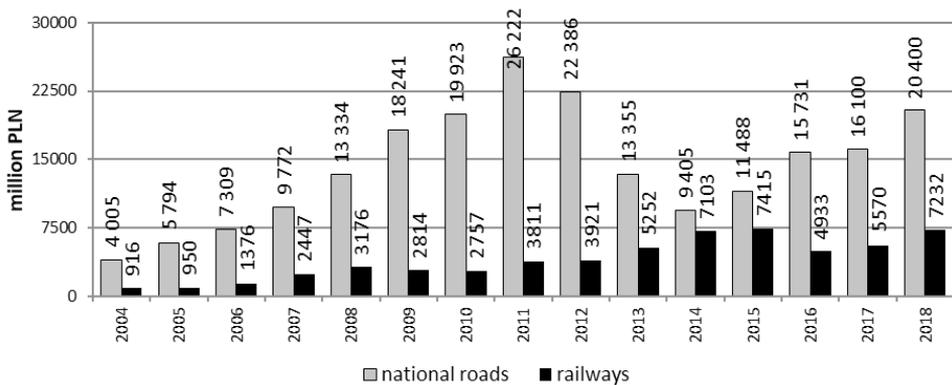


Fig. 4. Expenditure on investments on national roads and railways in Poland (in million PLN).

Ryc. 4. Nakłady inwestycyjne na drogi krajowe oraz linie kolejowe w latach 2004-2018 (w milionach PLN)

Source: own elaboration based on data of GDDKiA and PKP PLK SA
Źródło: opracowanie własne na podstawie danych GDDKiA oraz PKP PLK SA

The White Paper on Transport (2011) proposed division of investment spending between rail and roads in proportion of 60/40. The execution of spending reveals that the proportion was 20/80 in the period between 2004 and 2018. Therefore, contrary to the provisions of key strategic documents, investment spending diminishes the role of rail. At the time of Poland's accession to the EU (2004), there were 785 km of motorways and express roads. After 12 years the length of the highest category of roads has increased to 3430 km. The increase was fourfold. At the same time, 35 km of new railway lines were built, including 18 km of the Pomeranian Metropolitan Railway (PKM), an independent railway infrastructure manager.

Intermodal transport was seen as the factor of growth for rail transport. Despite the increasing share of intermodal transport in rail freight, it continued to play a smaller role than in Western Europe. According to the Transport Office, intermodal transported 0.85 million tonne-kilometres in 2003 (1.7%). In 2015 it was already 3.72 million tonne-kilometres (7.3%). The increase in volume was largely attributable to non-PKP carriers. This demonstrates how important market liberalisation is. Although rates for access to railway infrastructure are only part of intermodal transport costs, a change in the policy of the national infrastructure manager - PKP PLK is also visible. Between 2005 and 2009, there was a preferential rate of access to train infrastructure. The intermodal transport was similar to that of passenger trains (Fig. 5). In subsequent years, the scope of the reduction was considerably reduced – only 25% of the cost of access to full-line warehousing was granted.

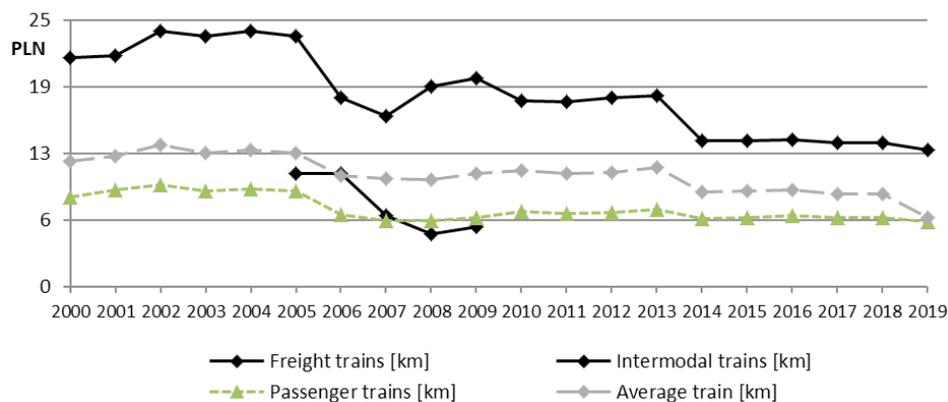


Fig. 5. Average rates for access to railway infrastructure (in PLN for 1 km)

Ryc. 5. Średnie stawki dostępu do infrastruktury kolejowej (w PLN/km)

Source: own elaboration based on PKP PLK SA data

Źródło: opracowanie własne na podstawie danych PKP PLK SA

The outcome of many activities undertaken in order to develop the intermodal transport, like the social campaign “Trucks on Railways”, was more on the social nature. They did not show real logistical solutions that could be implemented in enterprises in the supply chains of goods.

Seven core barriers to the development of intermodal transport at European level have been identified in the SPIN Research Project commissioned by the European Commission [Tsamboulas et al. 2007]:

- Different rail gauges between terminals and networks, or between neighbouring countries;
- Freight pricing system is not harmonised across Member States especially for rail / terminal / port operations;
- Railway operation and management is not always effective under the control of the government and the operational costs are also high;
- Different labour practices are in terminal operations across Member States;
- Diesel fuel tax different in different EU countries;
- Lack of flexibility regarding the cut-off time of the services;
- Terminal location is not always financially and operationally viable.

At the same time, several barriers hindering the development of intermodal transport has been identified [Mindur 2010]:

- The technical condition of the line does not correspond to the requirements of the AGTC;
- Poor quality of train services - too long transport time, frequent delays, too long time of stopping of trains at the border;
- Lack of price competitiveness of intermodal transport in relation to road transport;
- Lack of logistics centres, which has caused dispersed distribution of the load stream, making it difficult to start full-service connections in the intermodal transport system;
- Lack of regulations and comprehensive and effective instruments promoting intermodal transport within the framework of the state transport policy;
- The unfavourable image of combined transport in Poland - insufficiently technically flexible, too slow and unreliable in terms of delivery time, not a viable alternative to road transport, expensive and difficult to assess, difficult to assess in terms of cost and benefits for the entrepreneur.

Comparison of the lists shows that intermodal transport in Poland lags behind its European peers, having also different problems at stake.

Intermodal terminals in the Greater Poland region

The official database operated by the Railway Transport Authority contains data on 36 intermodal terminals in Poland. Unfortunately, this database does not include all terminals, so the actual number is estimated at nearly 50. However, part of them is inactive, even in locations considered as attractive. There is no way to accurately classify them based on other sources. There were seven terminals operating in the Greater Poland region (2013-2015), serving intermodal transport: Gądki, Kalisz, Poznań-Franowo, Poznań-Rudnic, Swarzędz and Szamotuly. Following the closure and settlement of the 2007-2013 EU financial perspective, new (eight in Greater Poland) terminal was created in Kolo. Plans for the construction of the terminal in Konin were not executed. Apart from Kolo and Kalisz, other terminals are located in the Poznań agglomeration. The location of the terminals is shown in Fig. 1 and the characteristics are shown in Table 1.

At the same time, the necessary terminal infrastructure is also located in three other locations in the Poznan agglomeration, i.e. in terminals with are not operational (Gądki, Kobylnica and Poznań-Garbary). Paradoxically, they were the oldest terminals in the voivodship. They existed in the 1990s. The suspension of operations in the first two locations was due to the fact that the PKP Cargo Group was commissioned to operate a modern terminal in Poznań Franowo. Liquidation of the terminal in the third location - in the centre of Poznan - was the result of plans to change the destination of the land - the realisation of residential and office buildings.

The scale of operations varies. The largest terminal in Gądki operates the cargo volume of 385,400 TEU per year. Some terminals operate only several thousand TUE per year. Diverse scale of operations is the result of: particular business model, acquired EU funds and particular competitive conditions. Dominant position of POLZUG in Gądki derives from the fact that it is a hub for all other terminals of the company in Poland.

A notable feature of Greater Poland terminals is that none of them are equipped with overhead cranes. The entire handling is done exclusively with reach stackers. The lack of investment in rail cranes can be interpreted as a feeling of instability in the intermodal transport market. Terminals equipped with reach stackers are an exception also outside Greater Poland (eg Kutno, two overhead cranes with a maximum terminal volume of 250,000 TEU per year).

The terminal's capacity limitations are imposed mainly by the capacity limitations of the sidings/transshipment track sub-system rather than by the handling equipment

given that there are technical solutions to provide the required support for the handling operations [Ballis, Golias, 2002]. Meanwhile, only two terminals (Gądki and Swarzędz) have extended tracks, more sidings or long sidings (Table 1).

Table 1. Characteristics of intermodal terminals in the Greater Poland region

Tabela 1. Charakterystyka terminali intermodalnych w Wielkopolsce

Container terminal (localization in Fig. 1)	Operator	Year of commencement	Annual transshipment capacity (TEU)	Terminal equipment and facilities	Main directions of operation freight and other considerations
1. Gądki (POLZUG)	POLZUG	2011	385 400	railways 4x 610 m, 6 x reachstaker, 2 x terminal tractors	Ports in Hamburg, Bremerhaven, Rotterdam, Trójmiasto, other terminals of POLZUG in Poland (Kąty Wrocławskie, Dąbrowa Górnicza, Pruszków), and terminals in Russia
2. Kalisz	Ost-Sped	2013	about 10 000	1 x reachstaker, in-load place is used as the terminal infrastructure	No fixed connections, Connections open on customer's request.
3. Koło	Laude Smart Intermodal	2016	about 10 000	1 x reachstaker, in-load place is used as the terminal infrastructure	Terminal Laude.pl in Zamość (near LHS)
4. Poznań Franowo	PKP Cargo Connect	2013	117 000	railways 2x 610 m, 3 x reachstaker	Gdańsk, Gdynia
5. Poznań Rudnicze (Junikowo)	Loconi	2012	40 000	railways 2x150 m, 2 x reachstaker, 1 x forklift	Gdańsk, Gdynia
6. Swarzędz	CLIP	2012 / extension 2015	250 000 (before extension)	Siding 4,5 km with branches, 3 x reachstaker	Krefeld, Rotterdam, Milan
7. Szamotuly	Ost-Sped	2015	15 000	2 x reachstaker, railways 3 x 300 m	Gdańsk, Gdynia, Hamburg
8. Kobylnica	PKP Cargo Connect	90th of XX c.	20 000	railways 3x300 m	terminal in 2016 not used
9. Gądki (Cargosped)	PKP Cargo Connect	90th of XX c.	30 000	railways 1x748 m	terminal in 2016 not used
10. Poznań Garbary	Spedcont	90th of XX c.	30 000	railways 3x150 m	terminal in 2016 not used

Source: own elaboration, using the data of the Railway Transport Authority

Źródło: opracowanie własne, przy wykorzystaniu danych Urzędu Transportu

Factors determining the choice of intermodal transport

Intermodal transport operators have confirmed during the survey the dominance of road transport in business service. Among the above respondents there are three main groups.

The first is the large entities that consciously form a network of logistics links. They often use dedicated rail connections, which are included in a fixed timetable. In the second group there are medium-sized entities operating on a regional, national or European scale. These entities do not necessarily aspire to become leaders in the market. This group can be described as dominant among small and medium enterprises. The third group are innovative entities that implement corporate social responsibility (CSR). With regard to them, it is difficult to identify the specific nature of the industry (various sectors). Typically, this group includes branches of foreign companies or Polish entities strongly cooperating with foreign companies.

A common feature in the field of transport and distribution services is to entrust this area to specialised entities. The criteria for the selection of partners are varied. The emphasis is on price and long-term, good cooperation. In some cases the outsourcing of the transport service of the entity was so strong that it was difficult to find a person who would be able to provide more information on the perceived perspective of the development of intermodal transport.

In the first group, the scale of operations was conducive to the selection of railways, both in the form of dedicated connections and intermodal connections. This was especially the case when the directions of economic links coincided with the network of intermodal connections. These entrepreneurs were particularly sensitive to costs and were able to accept a change of mode of transport if rail or intermodal connections would be more expensive than road connections.

Among the entities from the second group low level of knowledge related to intermodal transport prevailed. This was largely due to the satisfaction of the current situation, where all of the external transport was handled satisfactorily by car transport. Final price and on time delivery was more important for them than other factors. Environmental issues did not play a significant role. Moreover, some companies mentioned temporary shortages of specialist rolling stock, which forced the use of intermodal solutions as hindering their business. Those entrepreneurs endowed intermodal transport with less confidence than road freight, due to involvement of railways in the logistics chain.

Due to their scale of activities and digressive unit costs, large entities use railways for transport of materials, components and products. Smaller entities showed their interest in intermodal transport. Entities that enclose corporate social responsibility in their business strategies also enclose long-term social effectiveness into management decisions.

Corporate social responsibility is a prerequisite for decision-making by a third group of entities. These entities or their contractors undertake activities related to the protection of the environment, including the protection of the climate. As a proof of their attitude they obtain appropriate certificates as well. These entrepreneurs have full knowledge of the logistics process and are critical of the state's transport policy. They are looking forward to expanding the scope of intermodal services to include new directions and improving the attractiveness of these services, especially shortening delivery times.

Significant development of logistic services based solely on road transport constitutes a barrier to better development of inter-branch freight transport. Distribution centres and storage areas are located in places that do not have access to the railway network and have convenient access to the road network. Amazon Fulfilment Poland in Tarnowo Podgórne, which serves customers in Germany is an example. Their development means that investments in intermodal distribution centres using rail transport, including intermodal fixed-frequency trains, do not have a satisfactory rate of return. This problem affects both new entrants in the logistics market as well as the old ones. Poczta Polska S.A., which completely abandoned rail transport in 2011 is best example to proof this statement.

To conclude, there are a number of conditions that the development of intermodal transport will have to fulfil. One of them is the economic justification for choosing intermodal transport rather than road. The importance concerns here the unit costs and the long transport distances. Competitive pricing of intermodal transport is also important in relation to road transport or rail only throughout the route, shorter delivery times, time flexibility and volume of goods transported. These conditions are particularly important for large load streams, where high frequency, regularity and timeliness are important, especially for block trains [see Wiśnicki, 2001].

Assessment of the transport policy from the intermodal perspective

Due to suppliers and recipients of goods, it is difficult to create a multimodal long-distance transport chains with the use of rail transport. Intermodal transport also creates barriers, due to shipping companies [see Mindur, 2010]. The positive image

of this transport is the undeniable advantage. The campaign „Trucks-on-Railways” prepared by the Institute of Citizens Affairs (Instytut Spraw Obywatelskich), emerged as giving fully impression about intermodal transport, even among people not related with the logistics industry.

At present, attempts are being made to step up the perennial negligence in the development of railway infrastructure. This causes problems in the smooth flow of cargo. Even respondents from the railway environment perceive some of these phenomena. Lack of time synchronisation of particular investments in the tracks is the most destructive. Investments on parallel communication railways in the same direction are often carried out. This results in difficult access to the Baltic ports in the Tri-City region (metropolis consisting of three cities: Gdańsk, Gdynia and Sopot). As an example, at the end of the EU financial perspective 2007-2013, simultaneous modernisation work on all railway lines departing from the Tri-City was carried out. This was significant for Greater Poland intermodal business, despite the great distance from this region.

The respondents agree that the intensive development of intermodal transport in Greater Poland would not be possible without the support of EU funds. For many entrepreneurs, the possibility of obtaining external financing was a direct impulse for an investment decision. The respondents emphasised that intermodal transport is an investment of very uncertain return. Banks are also reluctant to provide loans if the intermodal terminal operator does not have EU funding or does not link the business to other activities, such as rail transport. Intermodal terminal operators have criticised the formalities involved in acquiring these funds, such as the lack of flexibility in the applications submitted to meet the needs of a changing market or the lack of funds allocated at regional level.

Respondents also pointed to the lack of consistent state policy on the development of intermodal terminals. A decisive decision at the state level is whether public support should develop a large network of small intermodal terminals or several large ones, for example 1 or 2 in the region. Factors limiting the demand for small intermodal terminals are: the location of the industry in the largest agglomerations and the cost of operating terminals. High potential was seen at the terminal providing integrated logistics services.

According to the respondents, rail investments in recent years have not always favoured the development of intermodal transport. An example is the shortening of tracks on stations due to the development of crossings with a larger arc radius. They allow higher speed travel to the direction of return, which is desirable from the point of view of

passenger traffic. This, however, causes difficulties in freight traffic, as the shorter tracks at the stations make the standard 600 m trains in Poland do not fit within the station. This has important implications for the traffic management of these trains.

The problem is also the elimination of sidings during modernisation of the line. The reason for this is the search for savings in the investment process. From the point of view of entrepreneurs planning to develop logistics activities, the barriers are disproportionately high costs of building new turnouts for sidings and incorporating them into rail traffic control systems. This problem mainly concerns modernised railway lines with the support of EU funds in recent years.

Planning the development of intermodal transport makes it difficult to calculate the cost of access to railway infrastructure. Preferential rates are set each year. These are usually set only a few weeks in advance. Lack of stability of costs in this respect, with a slight difference in the cost of intermodal transport compared to road transport, cast doubt on the viability of investment plans.

Infrastructure barriers in the development of intermodal transport are not only found in rail transport but also in road transport. On national roads higher load sections are interlaced with sections with poorer quality parameters. This makes it difficult to overcome the so-called “last mile”. During modernisation, their full load capacity is not performed. They do not achieve the required load of 11.5 tonnes per axle. The European Commission expects Poland to adjust its national roads to a capacity of 11.5 tonnes per axle. Due to GDDKiA, the estimated costs are about 50 billion PLN. This cost seems too high for the government. The construction of motorways and express roads has become a priority. These priorities have been set in 2015 by the Resolution of Polish Government on National Road Construction Program. It is expected socially, especially by car drivers. An extensive network of top-class roads is treated as an antidote to all transport problems in the country.

Freight forwarders are expected to introduce a standard load capacity of 11.5 tonnes per axle also in relation to voivodeship roads and selected district roads. From the point of view of transporting goods, priority is given to ring of the cities' roads. High-speed roads (expressways and highways) are not a priority. Businesses using intermodal transport have pointed out that the lack of effective control of axle loads leads to unfair competition on the part of road transport. This is despite the established mass controls on port departure.

Representatives of intermodal terminals pointed out the need to protect the planning of industrial and logistic areas from uncontrolled suburbanisation. The presence of

logistic facilities lowers the value of neighbouring land, which favours speculation on the real estate market. This encourages the acquisition of land for the purpose of housing development and starting court dispute procedure against operators of intermodal terminals due to noise. In the Polish conditions it is very difficult to achieve the profitability of intermodal terminals when they are not working in the 24 hour system, all days of the week.

EU support as a stimulus for the intermodal transport development

Intermodal transport in Poland has been gradually developing since the 1990s. Since 1993, the rolling highway has been operating for several years between Hanover and Gądkki. But its significance was niche. Poland's accession to the European Union and the associated possibility to use EU aid funds has reinforced the development of intermodal transport. This support was of direct relevance, i.e. for the development of intermodal transport as such, as well as indirect, as the overall improvement in the quality of railway infrastructure has influenced the attractiveness of this type of transport.

In the first period after the accession of Poland to the European Union, four projects have been implemented to support intermodal transport under the Sectorial Operational Program "Transport" for 2004-2006 (subsidy granted at national level, EU budget 2000-2006). All were located outside of Greater Poland region, at the natural interconnection points of different modes of transport: in the Baltic sea port or in places with access to wide-gauge railway lines. In the period immediately after the accession of Poland to the European Union, four intermodal projects were implemented: two projects in Sławków (LHS terminal) with total value exceeding 110 million PLN and ERF subsidy at 20.8 million PLN (18.63%), Małaszewicze terminal of total value of PLN 57 million and ERDF support of PLN 6.5 million (11.36%), as well as in the port of Świnoujście with the total value of PLN 21 million, and the ERDF support of PLN 12.7 million (60.28%). Beneficiaries were companies totally or partially state-owned. Between 2004 and 2006, there was no possibility of supporting intermodal transport with EU funds at regional level.

In the next financial perspective of the European Union (2007-2013), there have been significant changes in the scope of implemented investment projects in the field of intermodal transport. Besides investments located at interconnection points of various transport modes, investments in new areas commenced. Diversification supported projects provided stimulus for development of logistic services also in the areas previously legged behind. It has led to the creation of more coherent transport network in Poland.

The European Union Cohesion Fund, provided within the Operational Program “Infrastructure and Environment” for the period 2007-2013 (distributed at national level), co-financed a total of 26 projects concerning intermodal transport, amounting in total of PLN 2 309 million (the EU support of PLN 628 million, 27.2%). Among these projects, three were done in the Greater Poland region, as indicated in Table 2.

Table 2. Intermodal investments in the Greater Poland region, co-financed with the EU funds
Tabela 2. Inwestycje w transport intermodalny w Wielkopolsce, współfinansowane z funduszy UE

Name of the project	Date of finalisation	Beneficiary	Total value of the project (PLN)	Social Fund contribution (%)
Operational Program “Infrastructure and Environment” – project conducted in Greater Poland region				
Construction and equipment of the intermodal railway terminal at Poznan station Franowo-Stage IA	2015	PKP Cargo SA	31 647 457	36,49%
Construction of an intermodal container terminal in Jasin near Poznan	2015	Centrum Logistyczne Inwestycyjne Poznań II Sp. z o.o.	73 676 271	32,45%
Construction of an intermodal terminal in Kórnik near Poznań	2012	HHLA Intermodal Polska Sp. z o.o.	165 399 804	33,43%
Total			270 723 532	33,52%
Multilocation projects, partly located in the Greater Poland region (values of whole projects)				
Purchase of shunting locomotives for operation of intermodal terminals	2015	POLZUG	38 266 900	24,36%
Purchase of new and used sub-container platforms (intermodal wagons) to handle selected intermodal routes	2015	POLZUG	135 713 027	24,37%
Increasing the competitiveness of intermodal transport by using wagon for transporting heavy containers	2015	Laude Smart International Sp. z o.o.	44 847 842	20,83%
Total			218 827 769	23,63%

Source: own elaboration based on the Ministry of Development data
Źródło: opracowanie własne na podstawie danych Ministerstwa Rozwoju

Out of the total amount of expenditure on projects supporting the development of intermodal transport, one third of the EU funds went to coastal locations, half to

terminals located in the interior of the country and the remaining funds were used by applicants for purchase of rolling stock. The average share of the EU Cohesion Fund in the projects supporting the development of intermodal transport reached just over 27%, while it was lower - at the level of 24% - in the case of rolling stock projects (Table 3).

There is a relatively high concentration of intermodal terminal investments in the Greater Poland region. The region accounts for 14.35% of investment expenditures for intermodal terminals, within the Operational Program "Infrastructure and Environment" for the period 2007-2013. Excluding investments in the seaports, the share of the region is up to 31.24%. This demonstrates the very good perception of the region by investors as a stable distribution base with high economic potential.

Table 3. Investments in the development of intermodal transport realised with the financial support from the EU funds (in million PLN).

Tabela 3. Inwestycje w transport intermodalny zrealizowane ze wsparciem funduszy UE (w milionach PLN)

	Sectorial Operational Program Transport 2004-2006		Operational Program Infrastructure and Environment 2007-2013		Other operational programs, including the regional level (2007-2013)	
	Total expenditures	The EU support	Total expenditures	The EU support	Total expenditures	The EU support
Total support, incl.:	189.6	39.9	2309.9	628.9	145.7	48.3
terminals, incl.:	189.6	39.9	1886.6	527.5	65.3	22.7
seaside	21.0	12.6	1020.1	254.6	-	-
inland	168.6	27.3	866.5	272.9	65.3	22.7
rolling stock	-	-	423.3	101.4	-	-

Source: own elaboration based on the Ministry of Development data

Zródło: opracowanie własne na podstawie danych Ministerstwa Rozwoju

It is important to point out that it is difficult to identify projects from which intermodal transport contributes which are not strictly focused on this sector. For many investments, information is provided that does not allow for a clear qualification of the project. However, there is a very wide range of thematic projects implemented by intermodal sector entities. They use inter alia resources for the development of information systems, where specialised B2B software is purchased, from the funds for the implementation of technological innovations and even for their patent protection. This demonstrates not only the great needs of the industry, but also the great flexibility and creativity in search for external funding.

A significant change in the period of 2007-2013 is also the possibility of applying for financial support from the EU for the purchase of rolling stock and the support for intermodal projects from the Regional Operational Programs. It draws attention to the diversity of projects of this type. The projects included both rail container platforms, shunting locomotives and interchangeable bodywork. Divergence of projects co-financed by the EU funds leads to two significant, although at the first sight contradictory conclusions. First of all, it demonstrates the huge investment needs arising from the existing shortcomings in many areas of intermodal transport. Secondly, it points to the lack of strategy for the development of intermodal transport, allowing for a more precise allocation of resources.

It is emphasised in the literature that at the initial stage of development of intermodal transport, investment support is an important factor in the formulation of development strategies. At the same time, this may lead to the appearance of small terminals that are unable to cope with competition [Liedtke et al., 2012]. Comparison of the German and Polish market in this area indicates slightly different trends of development. The emergence of small terminals, using even fairly degraded infrastructure, reflects the high absorption of intermodal services from the market. At the same time, large terminals are being developed, whose impact on the socio-economic environment is multiplied. This is because of the far greater complexity of the services they can offer.

The expansion of large intermodal terminals takes place with the use of the EU funds. It allows the use of natural competitive advantages of specific locations and strengthens development potential. Based on the research conducted, two scenarios can be identified at this stage of intermodal transport development. Firstly, the appearance of small intermodal terminals based on existing railway infrastructure (sidings, station tracks) and based on the minimisation of initial expenditure. Their emergence is sometimes related to the provision of intermodal service to the particular business entity. Secondly, the development of large intermodal terminals, providing more comprehensive services, with a diversified portfolio of partners and taking advantage of their locations. In this case, investment costs are bigger, which is linked to the use of bigger support from the EU funds.

Both of these situations occurred in Greater Poland region. The genesis of the first path of development is flexibility. The genesis of the second path is stability. In some cases, small terminals also benefit from the EU funding. According to respondents, due to the fact that intermodal transport for many entrepreneurs in Poland is at the verge of profitability, the availability of the EU funds was an additional impetus for engaging in this activity.

Diversification of projects financed by the EU funds raises the question about the possibility of systematic approach to the intermodal transport development policy. The examples from other EU countries (Germany, Belgium) mentioned in this paper show that a consistent and rational policy towards the location of intermodal terminals allows for the multiplication of its effects. In the light of the experience of Greater Poland region, it can be stated that appropriate policy stimulates the development of intermodal transport, supports specific types of terminal equipment or provides financing to investments only in specific locations. This kind of support contributes to the development policy that creates nationwide network of intermodal terminals. It enhances intermodal transport development by stable connections between the major economic centres of the country and links these areas with seaports and key industrial centres abroad. However, it would be necessary to have an in-depth diagnosis of the needs and directions of intermodal transport development.

Also, intermodal transport is supported using EU funds for Poland for 2014-2020. Initially, the amount of approx. PLN 1.1 billion has been allocated in the Operational Program "Infrastructure and Environment". The results of the first call have been scheduled for the fourth quarter 2018 but finally were presented in October 2019. Only 12,25% of funds were allocated to investments in the construction or development of terminals. Nine terminals received financial support. None of them are located in Greater Poland. The rest was allocated to the purchase of rolling stock (spine cars, locomotives, semi-trailer). CLIP is among this group of beneficiaries. The purchase of spine cars was granted with 43 146 500 PLN, flatcars for transport of semi-trailers – 27 817 000 PLN and compatible semi-trailers – 5 586 000 PLN.

In addition, depending on the efficiency of absorption of EU funds, it is possible to double the budget. If this happened, the second call will be announced in 2020 or 2021. It is worth to mention, the Greater Poland Regional Operational Program 2014-2020 does not provide any financial support for intermodal freight.

In spite of the various barriers to get the EU financing or the methodological doubts about the direction of optimal support for intermodal transport from the public funds, more and more entities develop intermodal terminals with the EU financial support. An example from Greater Poland region is Laude.pl and one of the projects - a new terminal in Kolo (co-financing from the Operational Program "Infrastructure and Environment" for the years 2014-2020, under measure 3.2 Development of maritime transport, inland waterways and connections multimodal).

Business models of intermodal terminals

Due to our research, Greater Poland region has great potential in intermodal transport development. On the one hand, it is influenced by a dynamically developing regional economy, operating on the basis of international relations. On the other hand, the advantage lies in its location as in the centre of transportation network. The role of intermodal transport is however limited. Entrepreneurs do not appreciate its benefits. There is a large dichotomy in the choice of means of transport. Relatively few, but at the same time large entities are willing to use full-line transport directly to the siding of the plant instead of intermodal transport.

At the other end of the spectrum there are smaller entities, among which road transport prevails. The factor that may influence that company to choose intermodal transport is the strategy of corporate social responsibility. Under this strategy, the selection of contractors is done not only on the cost-effective, but also environmental measures. That strategy may influence the decision-making process of freight forwarders, shippers, couriers or final customer. The concept of decision-making process in this regard is indicated below (Fig. 6).

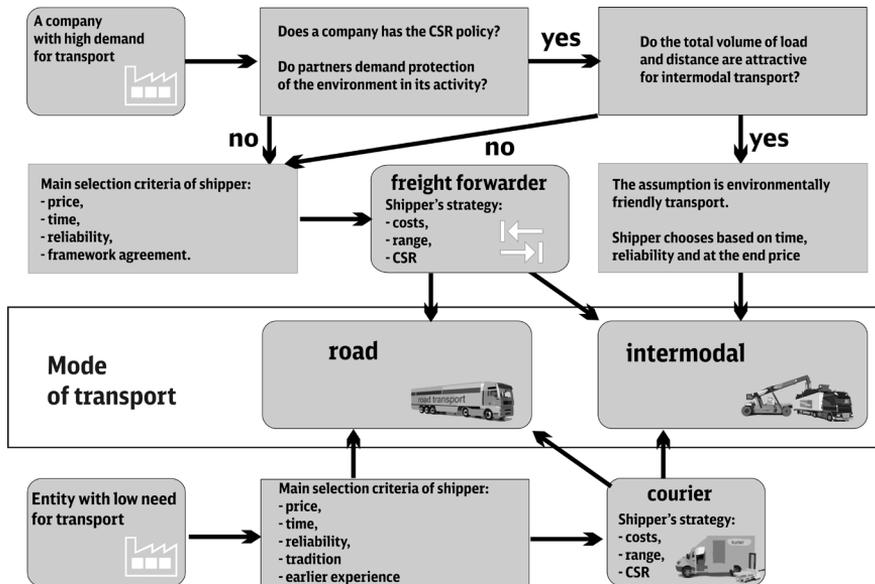


Fig. 6. Decision making process (not applicable if company uses a railway siding).
Ryc. 6. Proces decyzyjny (nie dotyczy sytuacji, w której przedsiębiorstwo korzysta z bocznicy).

Source: Beim et al. (2015)
Źródło: Beim i in. (2015)

There are four general business models of intermodal terminals (Fig. 7). In the first one, intermodal terminal is part of the sea port's business. Such terminal is an extension for services provided by the sea port, being part of the logistic chain inland. The vast majority of connections take place between the port and the region. The POLZUG terminal in Gądko and the Locini terminal in Janikowo (Poznań) are the examples. This business model works when terminal is in the same capital group as the sea port, as well as it is owned by other entity.

In the second model, intermodal transport becomes an extension of the freight railways' offer. Although the terminal remains independent as a railway service infrastructure (in line with the EU railway regulatory package), but is in fact regarded as a competitive advantage for the railway company. This segment is controlled by PKP Cargo Group companies (PKP Cargo Connect and Cargosped, to which some terminals were transferred in 2016) in Greater Poland region.

Considering the stimulation of economic growth, the third business model is the most interesting - complementing the offer of an industrial park or a special economic zone. Potential investors benefit from comprehensive support, including in the intermodal transport segment. One example from Greater Poland region is the Logistics and Investment Center Poznań, located in Swarzędz. It is operated by CLIP Logistics. This center is an immanent element of the economic zone and is the most advanced one of this type in Poland.

In the last model terminals are located near transport-intensive industrial plants. In the last two decades many companies have not established their own siding. Simple intermodal terminals are designed for their needs, often low budget, using existing unloading yards. In Greater Poland region, these are mainly the terminals in Szamotuły (Ost-Sped company working for the Samsung factory in Wronki) and in Koło (Laude Smart Intermodal company serving mainly the Geberit porcelain factories). Coexistence of all four intermodal transport business models can be observed in Greater Poland region [Beim et al., 2017].

Regardless of the support for the development of transport from European Union funds, in recent years another strong impulse for the development of intermodal services has been created. Poland, along with Greater Poland, are located on the main route of the Silk Road, which is an element of the Chinese Belt and Road Initiative. Since 2015 the number of container trains has been growing rapidly [Jakóbowski et al. 2018]. Most of trains go via Russia, Belarus, Poland (corridor Brest – Warszawa – Poznań – Frankfurt an der Oder) to other EU countries. Transit dominates at present. More and more Polish companies are interested in reloading trains or other

services related to imported or exported goods. Perhaps, in the near future a new type will develop new – the fifth one – type of terminals related to the service of the Silk Road. Expectations regarding the development of intermodal terminals serving the trade with China are formulated by Polish politics as well. In the politicians' opinions, Poland would become a logistics centre serving the countries of Central Europe [Bartosiewicz Szterlik 2019; Beim 2018].

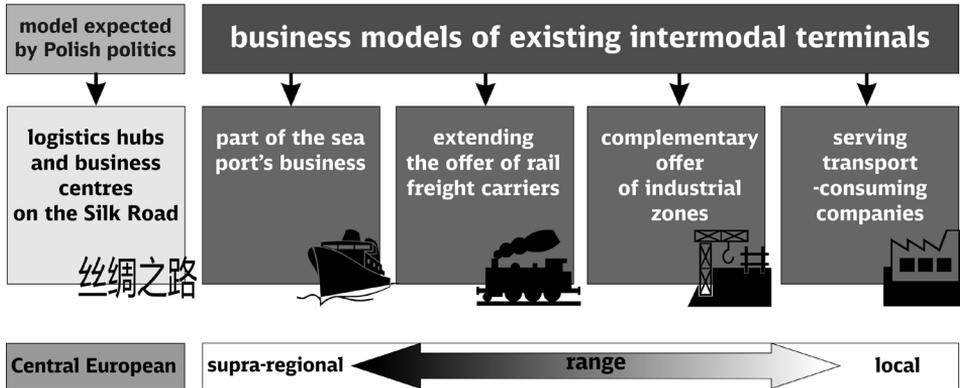


Fig. 7. Business models of intermodal terminals – four existing models and one expected by politics

Ryc. 7. Modele biznesowe terminali intermodalnych – cztery istniejące i jeden oczekiwany przez politykę

Source: own elaboration on base Beim et al. (2017)

Źródło: opracowanie własne na podstawie Beim i in. (2017)

The challenge remains, how to wisely support them from the public funds. Essential questions of the transport policy as well as of the regional policy is, to what extend the support should be focused on one or all of these business models? Large investments in intermodal terminals, including the creation of a logistics centre that complements the industrial park portfolio, are the result of the availability of the EU funds and allocating them to areas with natural advantages in regard to location. These advantages are due to the proximity of the western border, the Baltic coast and the internal market. At the same time, there are small terminals in Greater Poland region, aimed at providing services to specialised customers. It confirms the flexibility of this sector.

Discussion about development of intermodal policy

Empirical studies in various European countries indicate that development of intermodal transport policy at national level is a key issue. It optimises transport costs while minimising the share of road transport [Santos et al., 2015]. Optimising the

deployment and size of intermodal terminals, while enabling the creation of a high-frequency rail network at all key transport links in the region, under market conditions, is a difficult task. Poland, seeking to increase the importance of intermodal transport, must adopt directional approaches to the model of intermodal transport development. According to the research, national and regional authorities in Poland have a powerful tool of EU funds, which may give impetus for the development of intermodal transport.

Based on the research carried out by the authors, it can be stated that among entrepreneurs using intermodal transport and shippers, there are two visions of the organisation of intermodal transport in Greater Poland region and in Poland. The first is based on centralised system consisting of one to three large terminals in each region. The second is based on more dispersed system in which each region has up to ten intermodal terminals of different size.

In the first variant, emphasis is put on development up to three large intermodal terminals in the region. The number depends on the economic potential of each province. According to the respondents, two or three terminals would be needed in the Greater Poland province, located in the Poznań agglomeration. In this concept, thanks to concentration of load and infrastructural potential, the scale cannot only ensure a stable economic position, but also regular use of trains. These trains would provide transport services not only in some of the most important directions of commodity exchange, but would also provide services in directions that are currently underperforming and the dispersal of service providers makes it impossible to create an attractive offer for market participants.

The concept of distributed intermodal terminal system was pointed out among respondents. This concept was indicated as interesting by a minority of respondents. The strongest argument for this concept was to strengthen competition both in the intermodal terminals and in rail transport markets. Respondents pointed out that the development of railways would not have been possible without demonopolisation. In addition, solutions were invoked from Germany and Switzerland, where there are relatively many terminals in relation to the size of the country. It was also pointed out that it is a chance for smaller terminals, located outside the agglomeration of Poznań, as the ones existing in Kalisz and Szamotuly or planned in Zbąszyń. Smaller terminals located outside agglomerations are more beneficial for the balanced development of the region.

Due to respondents transporting mainly highly processed goods, but in smaller quantities, not only the location and size of terminals will matter, but their opera-

tion model as well. In its view, road haulage at distribution points must be based on “door-to-door” transport (regular arrivals to terminals) and intermodal transport should include smaller loads than containers (e.g. several or more pallets). In this approach, it is assumed that costs of intermodal services will be calculated on the lump sum, kind of monthly fee (subscription fee), and only a portion will depend on the work done. Organising such a distribution requires awareness, organisational capacity of the intermodal centre and limited distances, whose radius will be limited by the driver’s ability to leave the centre and return to it within one day with handling of several unloading and loading areas along the way. In practice, it is a radius of 30-40 km from the base with a small number of vehicles in the fleet and 50-70 km in large fleets where directional optimisation can be made.

Respondents in favour of the concept of distributed terminals indicate that the concept of terminal centralisation is based on an erroneous assumption that in such a concept road distribution from such intermodal centres is easier. The weakness of the concept of large intermodal centres is the fact that road transport, as well as rail, is characterised by a strong increase in mileage rates over short distances. The longer the distance in the straight line from the transshipment centre, the more difficult it is to complete the load to fill the car. And then the key factor of transport reliability and the resulting economic calculation based on predictability of costs are dropped. In the model of few large terminals, intermodal transport is strictly limited to the transport of whole containers or semi-trailers.

Summary

Both public and private sector respondents agreed that the development of intermodal transport is one of the key challenges determining the competitiveness of the Polish economy. A large number of intermodal terminals in the Greater Poland region are the result of a combination of relatively good transport network parameters and a favourable location for trans-European supply chains. The relatively high organisational culture of the regional economy was an important factor. It was a cultural legacy of the region’s membership to Germany in the nineteenth and early twentieth centuries. These conditions had relevance in all areas of economic life. These conditions were also repeatedly emphasised by the respondents.

Research shows that the main impetus for the development of intermodal terminals is the possibility of receiving European Union funding. It reduces the investment risk of the developing branch of transport. Among the barriers to the development of intermodal transport are the railroad situation and the low-price advantage of intermodal transport over road transport. This advantage can change at any time to

the detriment of intermodal transport. As such, the development of intermodal terminals is possible in combination with other economic activities. In Greater Poland region, four major models have been identified in this area. Terminals operate in conjunction with seaports, as an extension of the railway's portfolio, as an additional service within industrial parks, or as an alternative to the lack of a railway siding for businesses using transport to large extent. Each of these models have found its market niche. However, it does not create an integrated system of intermodal terminals.

An important condition for the development of intermodal transport is the creation of a long-term governmental strategy for the development of rail freight transport, including intermodal transport. Such a strategy should be very strongly linked with the economic realities of Poland and consistently implemented by successive governments. This solution must have a systemic character, consisting of: the spatial planning of the location of intermodal terminals, the definition of the main railway routes serving intermodal terminals with their qualitative parameters, the long-term nature of the economic solutions supporting intermodal transport, interested parties, cooperation with the domestic industry and public authorities and promoting the importance of intermodal transport for sustainable development of the country. The shaping of entrepreneurs' awareness is a very important task in Greater Poland region as well as throughout the country.

According to the authors, the perspective area of research is the increasing importance of corporate social responsibility and its impact on decisions made within transport and logistic sectors. The logistic industry is prone to introducing corporate social responsibility. This policy can give additional value for their customer. There is also a gradual development of a legal and regulatory framework for corporate social responsibility. It should be noted that the degree of perception of the significance of this issue is different. In particular, developing countries like Poland continue to outweigh the importance of short-term financial benefits at the expense of long-term development. Formal declarations of implementation of corporate social responsibility are in many cases rather vague, as they do not have reference in day-to-day business.

In the longer term, the success of intermodal transport will not be achieved in Poland without the involvement of numerous road transport operators in Poland. Although the research did not directly reveal it, the fate of the owners of these companies and drivers is a very sensitive political issue.

References

- Ballis A., Golias J.**, 2002, *Comparative evaluation of existing and innovative rail-road freight transport terminals*. *Transportation Research Part A*, 36, pp. 593-611.
- Bartosiewicz A., Szterlik P.**, 2019, *Łódź's Benefits from the One Belt One Road Initiative*. *International Journal of Logistics Research and Applications*, Vol. 22, Iss. 1, pp. 1-17.
- Bartosik M., Wiak S.**, 2016, *Multi-annual program "By Railway to the 21st Century" as key factor in the development of rail transport in Poland*. *Transportation Research Procedia* 14, pp. 518-527.
- Beim M.**, 2018, *So near and yet so far. The challenges of transport cooperation between the European Union and Eastern Partnership countries*. Ministry of Foreign Affairs of the Republic of Poland in coedition with Klub Jagielloński, Warszawa-Kraków.
- Beim M., Mazur B., Soczówka A., Zajdler R.**, 2015, *Transport intermodalny w województwie wielkopolskim w latach 2004-2014. Przemiany, stan obecny i perspektywy rozwoju*. Wielkopolskie Regionalne Obserwatorium terytorialne, Poznań.
- Beim M., Mazur B., Soczówka A., Zajdler R.**, 2017, *Modele funkcjonowania i rozwój terminali intermodalnych na przykładzie województwa wielkopolskiego*. *Prace Komisji Geografii Przemysłu Polskiego Towarzystwa Geograficznego*, 31 (3), pp. 95-113.
- Borowicz A., Kostyra M., Dzierżanowski M., Szultka S., Wandalowski M.**, 2016, *Atrakcyjność inwestycyjna województw i podregionów Polski*. Instytut badań nad gospodarką rynkową, Gdańsk.
- Chwesiuk K., Kotowska I., Wiśnicki B.**, 2008. *Perspektywy przewozów intermodalnych w Polsce*. Wydawnictwo Naukowe Akademii Morskiej, Szczecin.
- De Jong G.C., Tavasszy L., Bates J., Gronland S.E., Huber S., Kleven O., Lange P., Ottmoller O., Schmorak N.**, 2016, *The issues in modelling freight transport at the national level*. *Case Studies on Transport Policy*, 4 (1), pp. 13-21.
- Engelhardt J.**, 1998, *Transport kolejowy w Polsce w warunkach transformacji gospodarki, t. 1, Kolej w polityce transportowej państwa, t. 2, Działalność przedsiębiorstwa PKP*. Kolejowa Oficyna Wydawnicza, Warszawa.
- Gęsiarz Z.**, 1976, *Kontenery oraz urządzenia do ich przeladunku*. Wydawnictwo Komunikacji i Łączności, Warszawa.
- Gierańczyk W., Rachwał T.**, 2012, *Structural Changes in the Industry of Poland Against the Background of Eastern European Union States*. *Quaestiones Geographicae*, 31.2, 83-93.
- Gorzela G.**, 2013, *The dilemmas of regional policy in transformation countries and the territorial organization of the state*. [in:] Gorzelak G., Gunther M., Petrakos G. (eds.), *Integration and transition in Europe: the economic geography of interaction*. Routledge. pp. 131-149.
- Holman, O.**, 1998, *Integrating Eastern Europe: EU expansion and the double transformation in Poland, the Czech Republic, and Hungary*. *International Journal of Political Economy* 28.2, pp. 12-43.
- Jakóbowski J., Popławski K., Kaczmarek M.**, 2018, *The Silk Railroad. The EU-China rail Connections: background, actors, interests*. Ośrodek Studiów Wschodnich, Warszawa.
- Janic M.**, 2007, *Modelling the full costs of an intermodal and road freight transport network*, *Transportation Research Part D* 12, pp. 33-44.

- Johnson K.M., Garnett H.C.**, 2017, *The Economics of Containerisation*, G. Allen & Unwin, London.
- Krasucki Z., Neider J.**, 1986, *Konteneryzacja w transporcie międzynarodowym*. Państwowe Wydawnictwo Naukowe, Warszawa.
- Liedtke G., Guillermo D., Murillo C.**, 2012 *Assessment of policy strategies to develop intermodal services: The case of inland terminals in Germany*. *Transport Policy*, 24, pp. 168-178.
- Macharis C., Van Hoeck E., Pekin E., van Lier T.**, 2010, *A decision analysis framework for intermodal transport: Comparing fuel price increases and the internalisation of external costs*. *Transportation Research Part A: Policy and Practice*, Volume 44, Issue 7, August, pp. 550-561.
- Medwid M., Cichy R.**, 2009, *Analiza porównawcza wybranych systemów transportu intermodalnego*. *Pojazdy Szynowe*, 1, pp. 6-14.
- Meers D., Macharis C.**, 2015, *Prioritization in modal shift: determining a region's most suitable freight flows*. *European Transport Research Review*, vol. 7, no. 3, 23, pp. 1-12.
- Meers D., van Lier T., Macharis C.**, 2018, *Longer and heavier vehicles in Belgium: A threat for the intermodal sector?* *Transportation Research Part D*, Vol. 61, pp. 459-470.
- Mindur L.**, 2010. *Uwarunkowania rozwoju rynku transportu kombinowanego / intermodalnego w Polsce (w latach 1993-2009)*. [in:] Nowakowska M. (ed.), *Tiry na tory. Towary na kolej*. Instytut Spraw Obywatelskich, Łódź, pp. 10-23.
- Mindur L., Wronka J.**, 2005, *Transport kombinowany / intermodalny w Polsce*. *Przegląd Komunikacyjny*, 12, pp. 65-71.
- Nowakowski T., Kwaśniewski S., Zając M.**, 2010, *Transport intermodalny w aspekcie realizacji modelu Systemu Logistycznego Polski*. *Prace Naukowe Politechniki Warszawskiej*, 76, pp. 103-111.
- Program Budowy Dróg Krajowych na lata 2014–2023 (z perspektywą do 2025 r.)*. Uchwała Rady Ministrów nr 156/2015 z dnia 8 września 2015 r.
- Reis V.**, 2014, *Analysis of mode choice variables in short-distance intermodal freight transport using an agent-based model*. *Transportation Research Part A* 61, pp. 100-120.
- Resor R.R., Blaze J.R., Morlok E.K.**, 2004, *Short-Haul Rail Intermodal: Can It Compete with Trucks?* *Transportation Research Record: Journal of the Transportation Research Board*, vol. 1873, pp. 45-52.
- Santos B.F., Limbourg S., Carreia J.S.**, 2015, *The impact of transport policies on rail-road intermodal freight competitiveness – The case of Belgium*. *Transportation Research Part D*, 34, pp. 230-244.
- Stokłosa J.**, 2011, *Transport intermodalny technologia i organizacja*. Wydawnictwo Naukowe Wyższej Szkoły Ekonomii i Innowacji, Lublin.
- Stryjakiewicz T.**, 2002, *Paths of industrial transformation in Poland and the role of knowledge-based industries*. [in:] Hayter R., Le Heron R. (eds.), *Knowledge, industry and environment: Institutions and innovation in territorial perspective*. Ashgate, Aldershot, pp. 289-311.
- Stryjakiewicz T.**, 2005, *Contrasting experiences with business networking in a transition economy: The case of Poland*. [in:] *Linking industries across the world: Processes of global networking*. Ashgate, Aldershot, pp. 197-219.

- Szczudlik-Tatar J.**, 2013, *China's New Silk Road Diplomacy*. Policy Paper, 34 (82), 1-8
- Taylor Z.**, 2006, *Railway closures to passenger traffic in Poland and their social consequences*. Journal of Transport Geography, 14, pp. 135-151.
- Taylor Z., Ciechański A.**, 2006, *Deregulation in Polish rail transport*. Transport Review, 26, 3, pp. 305-324.
- Tsamboulas D., Vrenken H., Lekka A.-M.**, 2007, *Assessment of a transport policy potential for intermodal mode shift on a European scale*. Transportation Research Part A 41, pp. 715-733.
- Waters C.D.J.**, 1999, *Changes to road transport in Poland during a period of economic transition*. International Journal of Physical Distribution & Logistics Management, vol. 29, issue: 2, pp.122-138.
- Wessel F., Kinra A., Kotzab H.**, 2016, *Macro-institutional Complexity in Logistics: The Case of Eastern Europe*. Lecture Notes in Logistics: Proceedings of the 4th International Conference Ldic, 2014 Bremen, Germany, pp. 463-472.
- White Paper on Transport*, 2011, Publications Office of the European Union, Luxembourg.
- Wiśnicki B.**, 2001, *Wielokryterialna analiza lokalizacji terminalu międzynarodowych przewozów multimodalnych w węźle szczecińskim*. Praca doktorska. Uniwersytet Szczeciński. Wydział Zarządzania i Ekonomiki Usług.
- Żidek L.**, 2011, *Transformation in Poland*. Review of Economic Perspectives, 11.4, pp. 237-270.

Streszczenie

CZYNNIKI ROZWOJU TRANSPORTU INTERMODALNEGO W WIELKOPOLSCE. W POSZUKIWANIU OPTYMALNEJ POLITYKI PUBLICZNEJ

Transport intermodalny w Polsce odgrywa coraz większą rolę. Rozwój następuje to mimo licznych trudności, jakie napotyka. Artykuł prezentuje wyniki badań nad transportem intermodalnym w województwie wielkopolskim, w którym funkcjonuje najwięcej terminali spośród polskich regionów. Większość terminali nie zostałaby otwarta, gdyby nie wsparcie finansowe ze środków Unii Europejskiej. Transport intermodalny jest postrzegany jako inwestycja mało rentowna i obciążona ryzykiem. Ryzyko wynika nie tylko z barier infrastrukturalnych czy niewielkiej przewadze kosztowej nad transportem drogowym, ale również z niewielkiej świadomości ekologicznej przedsiębiorców zlecających usługi transportowe. W rezultacie na polskim rynku dominują mali i średni przewoźnicy drogowi, a w Polsce jest największa w UE flota ciągników siodłowych. Transport intermodalny świadomie wybierają tylko przedsiębiorcy kładący nacisk na CSR. Można zidentyfikować cztery zasadnicze modele funkcjonowania terminali intermodalnych w Wielkopolsce. Choć wszystkie modele znajdują miejsce na rynku usług logistycznych, koniecznością jest wypracowanie polityki regionalnej i państwowej oraz modelu wsparcia terminali intermodalnych środkami unijnymi.

słowa kluczowe: transport intermodalny, regionalna polityka transportowa, rozwój regionalny, łańcuchy dostaw, fundusze unijne