A set of analyses of transport and logistic functions of the Lower and Central Oder as a part of the core network corridor TEN-T

TENTacle WP 2:2

Version: final draft, August 2017

Authors: *dr Michał Wolański, dr Bartosz Mazur, Wiktor Mrozowski, Mateusz Pieróg*

Lead Partner

EUROPEAN UNION

EUROPEAN REGIONAL DEVELOPMENT FUND

Content

List of figures

List of tables

Abbreviations

BSR	Baltic Sea Region
BSRP	Baltic Sea Region Programme 2014-2020
CEF	Connecting Europe Facility
CNC	Core network corridors
CUPT	Centre for EU Transport Projects
EGTC	European Grouping of Territorial Cooperation
EIA	Environmental Impact Assessment
EU	European Union
FMCG	fast-moving consumer goods
GDDKiA	General Directorate for National Roads and Motorways
GUS	Central Statistical Office of Poland
IDI	Individual In-depth Interview
MGMiŻŚ	Polish Maritime and Inland Waterways Ministry
ODW	Odrzańska Droga Wodna, The Oder Waterway
PKP PLK	Polish Railway Lines
POIiŚ	Operational Programme 'Infrastructure and Environment'
PPP	Public-private partnership
SEZ	Special Economic Zone
SPV	Special Purpose Vehicle
TEN-T	Trans-European Transport Networks
TEU	Twenty-foot equvalent unit
UTK	Polish Office of Rail Transport

Abstract

Development of transport and logistic functions of the Central and Lower Oder cannot be limited to the realisation of the governmental authorities' plan to make the Oder waterway navigable – a key to success, understood as maximisation of the social and economic impact, is to implement the concept of making the area along the Oder an attractive location for industrial and logistic activities.

Realisation of the project of making the river navigable itself will render the Lower and Central Oder suitable mostly for transporting bulk cargo, such as coal or stone, which is the domain of inland waterways both in Poland and in Europe. Nevertheless, the production of coal or stone does not have great impac on economic growth and industrial development with high added value. The threat of limiting Oder to bulk cargo transport only is even more important since ultimately, parallel to the Oder waterway there will be a high-quality railway line 237 ("Nadodrzanka") and S3 express road, which in many cases may serve as a basis for much more complex, punctual and reliable service, e.g. thanks to direct connections.

Therefore, it is necessary to create – in place of existing river ports and in new locations – modern intermodal industrial and logistic parks in the areas along the Oder. They have to have good connections of all modes of transport (in particular – road and railway connections), and the unique advantages of the parks will be additional waterway capacity for products of abnormal dimensions to many regions in Europe and throughout the world, and access to relatively inexpensive and qualified labour existing in West Pomeranian, Lubusz and Lower Silesian Voivodeships. In the long term, it creates an opportunity to situate the increasingly popular *Value Added Logistics* services in the parks, that is, adjusting "raw" Asian products to the needs of specific markets and purchasers.

Analyses have indicated potential locations of such parks in the following locations: Szczecin, Kostrzyn nad Odrą, Urad, Cigacice, Nowa Sól, Głogów, Wrocław, Opole and Kędzierzyn Koźle. These locations are on one hand based on the development of the existing river and sea-ports, and on the other – they take into account the changes which have taken place (or will take place in the near future) in the region's transport infrastructure, especially the construction of the S3 express road. Specialisation of individual locations should be based on the existing economic potential of the regions along the Oder, such as steel and chemical industry (Opole Voivodeship), mining (Lower Silesia), or paper industry (Lubusz Voivodeship). In the long term, thanks to providing proper road and rail links, the ports should also develop into intermodal logistic centres on the crossing of the corridor and important communication routes, intended to supply the neighbouring urban centres and service the enterprises which import or export highly processed goods.

One of the factors contributing to construction of modern logistic parks based in the Central and Lower Oder is that there are still few such facilities in Poland compared to other countries. Their concentration is sparse, especially in Lubusz and West Pomeranian Voivodeships. So far, development of such parks was not coordinated, often irrational from the macroeconomic point of view – they were created in isolation from the road and railway transport infrastructure, due to lack of proper regulatory tools and institution, or even uniform strategic vision of development. In the current state of law, the most reasonable way of stimulating the construction of logistic parks in a desired manner is developing infrastructure and accessibility in convenient areas, and then selling plots of land to investors. This model is used in the construction of many economic activity zones and qualifies for EU support.

Following infrastructure elements which will foster the improvement of the intermodal connections in the logistic parks in ports along Oder were identified:

- completion of the express road S3, basic connection allowing freight transport,
- construction (restoration) and modernization of railway sidings to ports (e.g. the port in Kędzierzyn-Koźle)
- upgrade of technical parameters of roads leading to ports (e.g. to ports in Głogów, Cigacice).

Continuation of preparing for making the Oder navigable and necessary intermodal connections should cover the analysis of demand for such services based on the intermodal four-step model, reflecting the flow of freight within the entire transport network. The model should first be constructed on a national level, and then, an analysis on a regional level should be conducted on its basis, including the calculation of economic efficiency indicators.

The Oder Waterway can make the transport offer of the Baltic-Adriatic Corridor much more attractive by providing better landside access to sea ports. It can also bring benefits for Sweden.

Trade between Poland and Sweden is characterised by dynamic growth, thanks to which Sweden is the most important economic partner for Poland among Scandinavian countries. Other countries along the Baltic-Adriatic corridor also have great potential for trade with Sweden. West Pomeranian Voivodeship has much experience in international cooperation and actively exploits the available cooperation models. As a part of the project, the modernisation of ports is possible, which increases their potential. Also the continuation and development of the cooperation in the scope of European Grouping of Territorial Cooperation and clusters will bring benefits to the functioning of the transport corridor.

Making Oder navigable and making it an important part of the international transport network requires cooperation from the managers of different types of infrastructures – both because multi-level management (split between central, regional and two levels of local authorities) and separate management of different transport modes.

Following solutions can be very helpful:

- establishing intermodal transport infrastructure managers – inspired by the national infrastructure management in Sweden (Trafikverket) and the regional one in Lower Silesian Voivodeship (Dolnośląska Służba Dróg i Kolei), working not only on prioritising and improving the realisation of the investment in linear infrastructure, but also on activities related to point infrastructure (e.g. reconstruction of defunct sidings, loading points), improving transport offer (e.g. supporting regular railway intermodal transport), international and cross-border cooperation, cooperation with entrepreneurs using transport system (addressing expectations of the freights' consignors and consignees), scientific centres (stimulating innovation) and influencing labour market (e.g. supporting vocational schools, creating classes with profiles related to water transport and logistics);
- setting up inter-industrial study centres – modelled on the Swedish Transport Research Institute (Trafik Analys) – replacing current analyses conducted usually focusing on one mean of transport.

Making rivers navigable along with constructing logistic parks and intermodal connections is a project complicated also from legal and formal point of view. General regulations of the investment process in Poland are currently so complicated that special acts were created for public investments in roads, railway and airports to simplify the investment process. This has been achieved by integrating a number of legally requires permits – the decision of setting the location, the expropriation and the approval of the construction project – in a single permit. If the general regulations are not simplified until the realisation of the project, it will be necessary to establish a separate "waterways special act", which should take into account the diversity of products, and, consequently – similarly to the special act prepared before Euro 2012 – should not be limited to one mode of transport and should allow maximum diversity in investors.

Finding sources of funding is an important challenge – for both making rivers navigable and building intermodal infrastructure. If Oder is included in the TEN-T network, it will be possible to finance the river regulation from the CEF (Connecting Europe Facility), however the percentage of funds for such investments is low and most of the financing has to come from other sources. Complimentary investments will most likely be financed with national funds, and the availability and amount of financing will probably grow if they are directly feeding the TEN-T network. As an alternative source of financing, public-private partnership is considered, especially with Chinese investors, however, such investments have to be viable for the private investor and then bring profit, which lowers the possibility of their realisation and requires detailed efficiency analysis, which should be presented by the public investor.

The fact that a significant part of the terrains of potential investment is covered by Natura 2000 areas poses a threat to the project of making the Oder navigable and building intermodal infrastructure. Although it does not make the realisation of the investment impossible, it significantly lengthens the investment process and narrows the list of potential locations of new ports in favour of extending the currently functioning ones because of the existing degradation of the terrain.

If analyses show that the waterway project is economically efficient, it will without a doubt have broad positive economic impact, because it would be carried out in a region with relatively high poverty and unemployment, which was not so far subject to intensive public intervention like, for example, Eastern Poland with its special operational programmes.

Introduction

The purpose of this paper is developing transport and logistic functions of Central and Lower Oder by formulating recommendations for the construction and reinforcement of intermodal connections and direct connections with freight consignors and consignees located in ports, as well as integrated management of transport corridors, with special reference to good practice developed in cooperation with Sweden, among others within the TENTacle project.

This paper is thus a part of mainstream research and formulated strategies (cf. chapter 1 Analysis of the challenges). Recommendations and analyses contained in these documents are treated as input for the present paper. However, the dynamic development of water transport planning in Poland is an obvious obstacle, due to which, at the moment of preparing this document, multiple other key analyses were in the phase of preparations as well.

Investments strictly connected to water transport, such as regulation and dredging of rivers, elevating bridges etc., are excluded from the scope of the present research, because these matters are discussed in other papers, including those quoted in chapter Analysis of Challenges, which will be the basis for formulating strategies by respective administrative bodies.

The present paper consists of four analyses:

1. Analysis of the challenges to the transport sector on the basis of the development of trade and overseas transport and analysis of technological developments. Proposal of measures and their implementation.
2. Analysis of types of connections between logistic centres in the Duchy of Pomerania which serve the Polish-German infrastructure of Baltic-Adriatic Corridor.
3. Analysis of benefits of the TEN-T network implementation in regard to the cooperation between West Pomeranian Voivodeship and Skåne County.
4. Analysis of challenges and possible measures taken to reduce the negative impact of transport on the environment. Innovative measures and ways of their implementation.

Analyses discussed in the paper have been preceded with the spatial delimitation of the area. According to some sources[1] the Central and Lower Oder passes through the area of four Voivodeships – West Pomeranian, Lubusz, Lower Silesian and Opole Voivodeships – and begins near the mouth of Kłodnica River, near Gliwice Canal in Kędzierzyn-Koźle. On the other hand, according to other authors[2], the Central Oder begins in Brzeg Dolny,

In the paper, a broader spatial coverage of the Central and Lower Oder region has been adopted due to a large number of traffic generators of cargo unloaded in Szczecin – Świnoujście located in Lower Silesian and Opole Voivodeships.

Important TEN-T network transport corridors pass through the aforementioned voivodeships: the Baltic-Adriatic corridor and the North Sea – Baltic corridor. The most important connections include:

[1] *Koncepcja przystani rzecznych na Odrze, Biuro Projektów Dróg i Mostów PRODiM, Nowa Sól 2012, s. 8.*

[2] *M. Pluciński (red.), Możliwości wykorzystania transportu wodnego śródlądowego w obsłudze zespołu portowego Szczecin-Świnoujście, Polskie Towarzystwo Ekonomiczne, Szczecin, 2016 r.*

- in the core TEN-T network:
    - the S3 express road,
    - Szczecin – Poznań – (Wrocław – Upper Siesia) 351 railway line;
- in the comprehensive TEN-T network:
    - 273 railway line, “Nadodrzanka”.

Odrzańska Droga Wodna (The Oder Waterway; hereinafter ODW) is currently only partially included in the TEN-T network – as a connection between Berlin and Szczecin through Oder-Havel Canal (within Polish borders the section from the vicinity of Cedynia to Szczecin). Nevertheless, the whole ODW – from Gliwice through Gliwice Canal to Szczecin, and ultimately also with planned extension from Gliwice through Danube-Oder-Elbe Canal – is a key transport connection and a foundation for the development potential of the region, which should be included in the TEN-T network. The accurate delimitation of the area was based on the following criteria:

- catchment area of Central and Lower Oder (from the outh to Kędzierzyn-Koźle);
- catchment area of TEN-T transport network parallel to ODW;
- area in 10 km radius from ODW and TEN-T network treated as the infrastructure of the corridor

The 10 km radius from ODW routing is justified considering general usage of such distance in researching socio-economic outcomes of carried out transport investments.

The area of in-depth analysis covered 41 powiats and 219 gminas. The existing infrastructure in the area is illustrated on Figure 1.

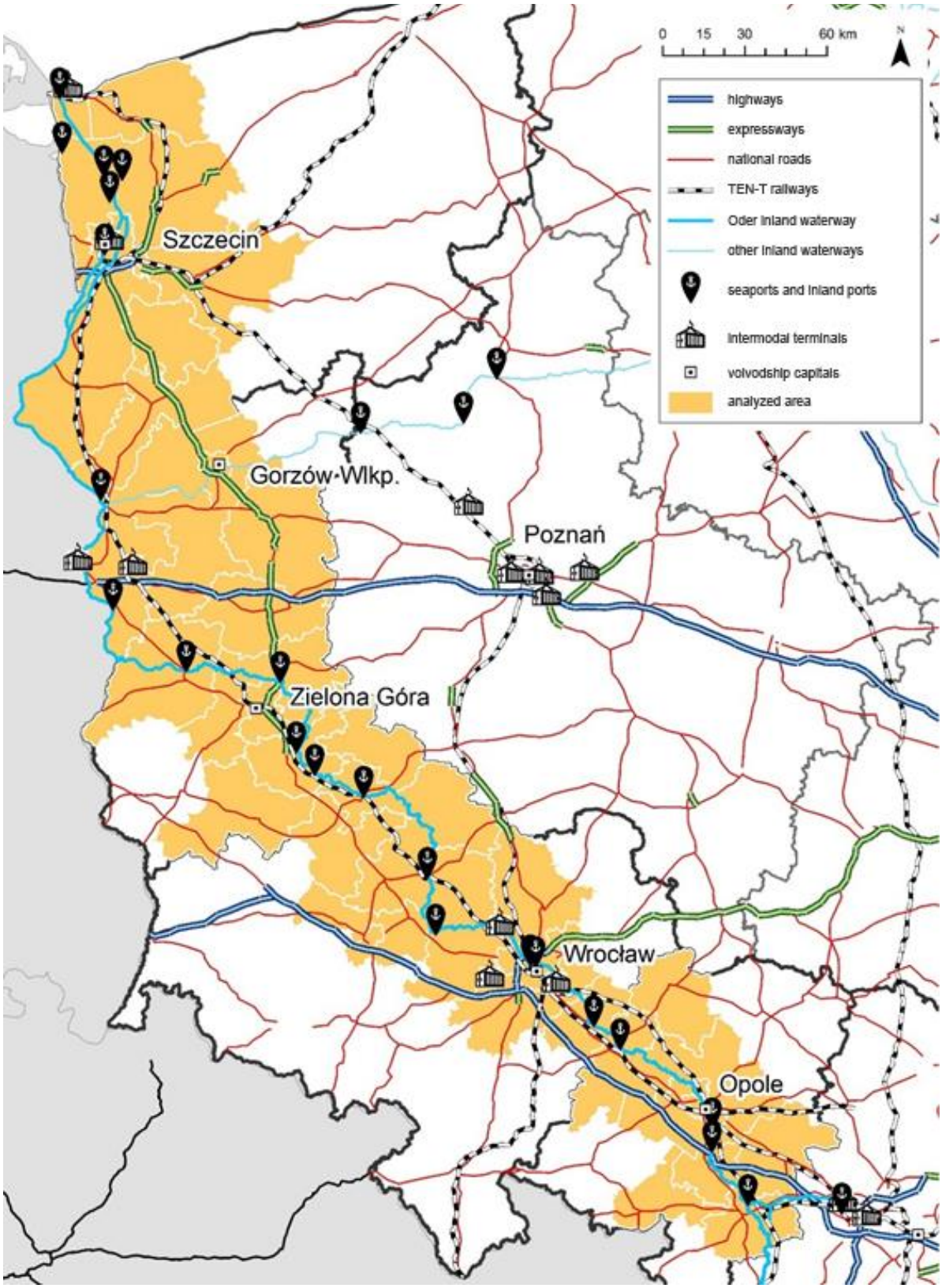

Figure 1. Map of the transport infrastructure in the Central and Lower Oder's catchment area

Source: Own study based on data of GDDKiA, PKP PLK and OpenStreetMap.org

1. Analysis of the challenges to the transport sector on the basis of the development of trade and overseas transport and analysis of technological developments. Proposal of measures and their implementation

1.1 Analysis of challenges

According to the Eurostat data, road transport dominates in modal split of cargo transport both in Poland and in other countries of the European Union (cf.

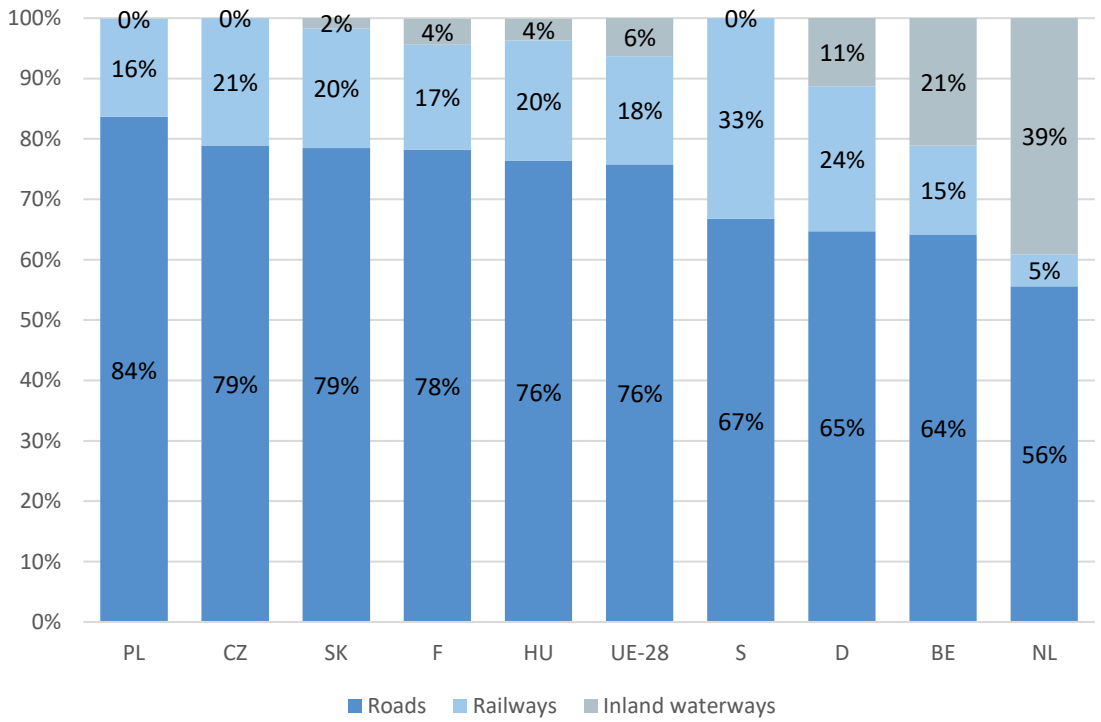

Figure 2). In 2015, in 28 countries of the European Union, an average of 76% of cargo was transported by trucks, 18% by railway and 6% by inland waterways. In Poland, the share of road transport is greater than average (about 84%), while this of railway and inland waterway transport is smaller – respectively 16% and much less than 1%. According to long-term prognoses of the European Commission, the share of road transport will ultimately stabilise at 75%, while this of railway transport – 25% (with hardly noticeable role of inland waterway transport). In the analysed

comparison of countries, the lowest share of road transport in cargo transport (below 70%) was observed in member of states in which inland waterway transport is exploited much more intensively than in other member states – in Germany, Belgium and the Netherlands (whereas the latter two are small coastal states, with ports in Antwerp and Rotterdam being of pan-European importance). Railway transport makes up the biggest share (over 20%) of cargo transport in the Czech Republic, Slovakia, Hungary, Germany and Sweden (as much as 33%).

Ecologically unsustainable division between cargo transport modes in Poland can be explained by domination of bulk cargo in the structure of railway-transported cargo (incompatible with European trends) and simultaneous alignment of structure of road-transported cargo with the European average. It means that even though our economy is similar to other European economies in terms of structure of circulation of goods, our consignors of cargo other than coal and aggregate more often prefer road transport. The railway does not gain acceptance of cargo consignors due to scarce and outdated infrastructure (lack of intermodal terminals and sidings in logistic parks), unpunctuality and unreliability (which is vital in modern *just in time* supply chains), low speeds of trains and lack of satisfactory transport offer for wagonload freight.

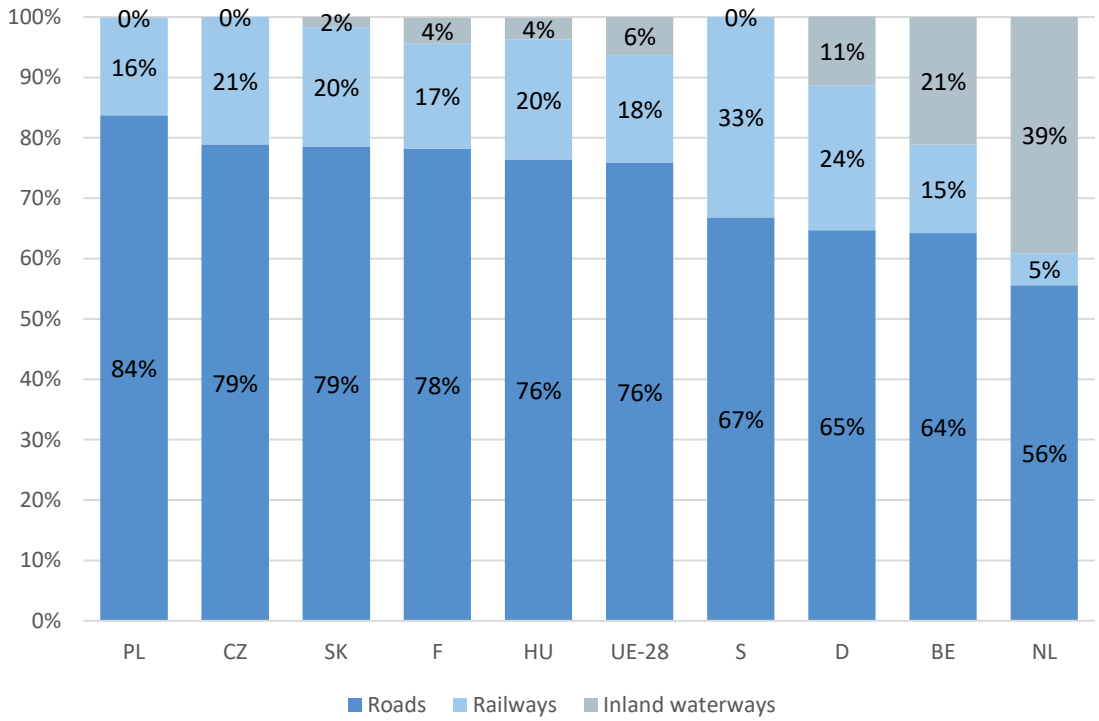

Figure 2. Modal split of freight transport in selected EU countries in 2015

Source: Eurostat

According to plans formulated in *White Paper on Transport,* until 2030, 30%, and until 2050, half of long-distance freight transport should be transferred from roads to other transport modes (railway and inland waterway transport), while trucks will form the basis of short- and medium-distance

transport (up to 300 km)[3]. It is a very ambitious plan, which requires planning and implementation of extensive measures to promote transport modes alternative to road transport.

Apart from the postulated reinforcement of the role of the railway, attention was paid to the great potential of the inland waterways. Currently, the European leader in waterway transport is the Netherlands, in which in 2015 approximately 39% of cargo was transported by waterways. Inland waterways are also intensively exploited in freight transport in Belgium (approx. 21%) and Germany (11%). Waterway transport makes up a lower than the European average (6%) but noticeable share in the transport system in, France, Hungary and Slovakia, among others. According to the Eurostat, the share of inland waterway transport in cargo transport in Poland is close to 0%, and Sweden was not included among countries in which inland waterway transport is realised, although waterways exist there and attempts to use them in modern logistic chains are being made.

Available national data of GUS (Central Statistical Office of Poland) concern cargo transport using shipping fleet on inland waterways and maritime roads in domestic and international carriage. Data on carriage of cargo in international communication concern cargo brought into the country (imported) and shipped out of the country (exported) directly by the means of inland waterway shipping fleet and transit cargo carriage. However, they also include carriage of cargo between foreign ports. It is worth noting, because domestic shipowners are on the lookout for growth opportunities by competing more and more actively on foreign markets.

Also according to data of GUS, total inland waterway transport in Poland (domestic and international) retains the share in total transport performance at the level much lower than 1%. In 2010-2013, a total of approx. 5 million t cargo was shipped by inland waterways annually (in domestic and international transport). In the following years, the transport has increased – up to 7,6 million t in 2014 and almost 12 million t in 2015. To compare, in the peak moment of inland waterway transport development in PRL in 1980, a total of 22,2 million t cargo was shipped, and in 2000 only 10,4 million t[4]. More accurate analyses call for division into domestic and international transport. Progressive degradation of domestic infrastructure has since led to the increase in the share of international transport in carriage of cargo performed by Polish shipowners. Since the eighties, regardless of general decrease in total freight volumes, a period of growth of the share of international transport in total inland waterway transport, which has stayed before at 10%. In the years 2010-2015, most (from 60% to 70%) carriages were performed by international transport. An exception to this is the year 2014, in which there was an over two-fold surge in domestic transport – it was an effect of the transport of materials for the jobs performed to modernize Wrocławski Węzeł Wodny (Wrocław Water System). On the other hand, in 2015 there was a significant increase in international transport to over 8 million tonnes, most of which (over 7 million tonnes) was transport between foreign ports.

In Poland, the structure of transported cargo is dominated by bulk cargo or high-volume cargo from the Metal ores and other mining and quarrying products group (in 2014 – 65,6%), and of the Hard coal, lignite, crude oil and natural gas group (in 2014 0 14,9%). These tendencies were also present in the past years and are relatively permanent. Data from the

[3] *White Paper on Transport: Roadmap to a Single European Transport Area — Towards a Competitive and Resource-Efficient Transport System, Brussels 2011.*
[4] *NIK, Żegluga śródlądowa, Warszawa 2013.*

year 2015 shows significant increase in carriage of cargo from the category of Products of agriculture, hunting, forestry, fishing and fishery – over 5 million tonnes, which makes up approx. 40% of cargo transported this year (In 2014 – only 4%). Regarding the tendencies to date, it should, however, be considered an anomaly caused by the activity of Polish shipowners on the foreign markets. Water transport is also used to transport freight from the Secondary raw materials and municipal waste group (5%), and Chemicals, chemical products, man-made fibres, rubber and plastic products, nuclear fuel group (2%). The other cargo from different groups is transported in smaller amounts and do not make up a significant share of total transport.

In all the countries of the European Union altogether, the most popular cargo transported by inland waterway transport are, just as in Poland, freight from the Metal ores and other mining and quarrying group (approx. 30%). There is also transported cargo from the Coke, briquettes, refined crude oil products, manufactured gas (almost 16%, while in Poland only 0,4%) and the Coal, crude oil and natural gas group (8,9% and in Poland approx. 15%). Additionally, in relatively big amounts, chemical products (approx. 8%), agricultural products (7,2%), metal, food and secondary raw materials (approx. 4% each) are transported. Products transported in smaller amounts are clothing products, furniture, wood and paper, machines and devices, sports equipment and empty freight packaging (in total representing approx. 20% of the transport). In the countries where inland waterway transport is intensively used (Belgium, Netherlands, Germany), relatively much cargo is transported in containers – in Belgium in the years 2012-2014 it was even over 16%, but in 2015 there was a decline to 12%, In the Netherlands and Germany container carriage stays stable at respectively 11-12% and 9% (cf. Figure 3). It is mainly freight carriage from sea ports, especially in Antwerp, Rotterdam or Hamburg, in which there is no sufficient space or human resources for the subsequent handling and packing of cargoes imported from Asia. Long term tendencies in the economy indicate that there is a possibility of an increase in the importance of such transport, because of so-called Value Added Logistics, that is adjusting the 'vanilla' products from Asia to the needs of specific markets and purchasers, gains importance in the modern supply chains.

Therefore, European statistics show the usefulness of inland waterway transport especially in the carriage of raw, bulk and oversized cargo, including, among others, steel structures, which is in accordance with the statistics on domestic transport.

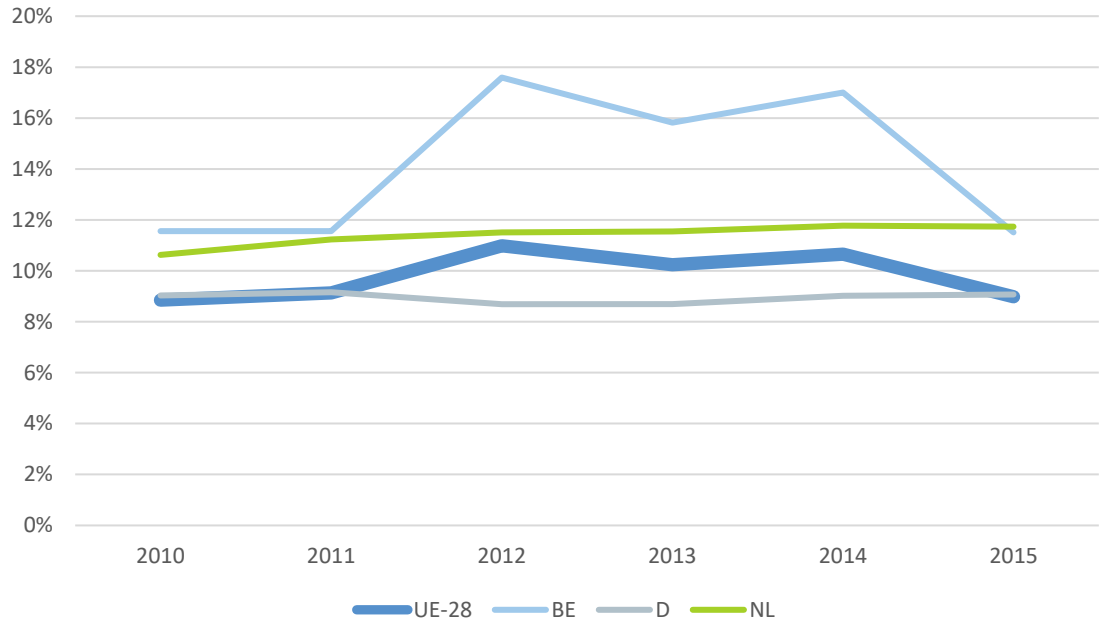

Figure 3. Share of containerised cargo in the total cargo transported by inland waterways in selected EU countries

Source: Eurostat

! Both in Poland and in the whole European Union approx. ¾ of the cargo is transported using road transport. In Poland its share is as much as 84%, which is due to the fact that railway failed to win purchasers of freight other than bulk – because of the lack of infrastructure (intermodal terminals) and offer for such freight consignors (among others unpunctuality, unreliability of the system of single wagon loads).
This puts inland waterway transport in a difficult position, because it will either be focused also on bulk cargo carriage (which is somehow a "natural" market – also in West European countries), or find a right niche on the market, connected with stimulating long-term changes in manufacturing and logistic activities. The niche can be oversize freight (if its production is Poland, along Oder, grows) or containerised freight, especially for making them later undergo logistic services of added value in river ports (if they are not performed in the sea port).

In Poland, inland waterway transport, in spite of its small share in total cargo carriage, can play an important role in selected market segments, especially in port services in Szczecin and Świnoujście, in international transport from and to Germany and in the transport of sand and aggregate dredged from the river. The condition is, however, improvement of the navigating conditions, which requires investments.

The particular importance of inland waterway transport is visible for oversize and especially high volume cargo, including primarily steel structures. In case of road transport, it is necessary to receive a permit for oversize cargo carriage, in which the dimensions, the real total mass and the permissible mass transmitted by a single drive axle are determined, which significantly restricts transport possibilities. The situation is similar for railway transport, in which the limits to the oversize (exceptional) cargo transport, resulting from exciding the loading gauge of freight wagons or permissible load per axle or running meter of rail. Inland waterway transport does not have such restrictions, and it is therefore predestined for oversize freight transport. Also, carriage of such cargo

does not cause obstacles in the traffic for other users of the waterway, which is important in case of road and railway transport.

In the perspective of dynamic growth in the number of containerised cargo in the global logistic chains, the need to adapt the transport infrastructure to the requirements of serving them becomes a challenge. The key elements for intermodal transport are junctions at which the change of the means of transport of the transported cargo happens. For the transport corridors which pass through the area of the Central and Lower Oder, the most important link of such type is the Szczecin-Świnoujście port complex. Currently, it has a limited container unit service capacity, that is why its share in handling significantly differs from other Polish ports: Gdańsk and Gdynia. However, the strategy papers which define the development policy of the ports assume that until 2027, the handling of containers in Szczecin-Świnoujście port complex will be determined by the following factors:

- global growth in container handling in sea ports
- increase in the parameters of container ships
- increase in the number of operated ocean lines in Polish sea ports

The strategy diagnoses low competitiveness of containerized cargo services in Szczecin-Świnoujście port complex. It is caused by location factors, especially the proximity of Hamburg, which is one of the biggest ports in Europe regarding the number of transhipped cargo. Also, the tariff policy of shipping services makes the cost of freight e.g. to the ports in Gdynia or Gdańsk lower.

The main barrier for the increase in the number of containerised cargo transhipped in the complex are insufficient technical parameters of the terminal in Szczecin, lack of regular intermodal connections inland or limitations resulting from the depth of the waterway. These conditions should be improved due to the construction of the deep-sea container terminal in Świnoujście, which will allow the entrance of the biggest vessels currently served. I. a., such measures aim to facilitate the realisation of the vision formulated in the strategy, in which Szczecin and Świnoujście should become the leading ports in the Southern Baltic. One of the goals indicated in the document is a better integration of the port complex in the north-south sea-land transport corridor, the realisation of which includes infrastructure investment plans on a domestic level, and a policy supporting logistic functions formulated by local governments.

In order to achieve the goals in a satisfactory way, not only improving the infrastructure of the ports themselves is necessary, but also a range of actions has to be put forward by the infrastructure managers on land.

For the land transport of cargo between a seaport and origin or destination, the most important is improvement of the railway infrastructure (chapter Railway connections in the Central and Lower Oder corridor), which currently does not meet the expectations of the cargo traffic generators, which, in the present situation of the dynamic development of roads of every category, puts railway transport in a lower competitive position regarding the duration and cost of carriage.

Using the existing potential of the railway infrastructure for the development of intermodal transport and growth in the competitiveness of Szczecin-Świnoujście ports has to be combined with proper spatial planning of the distribution of logistic and industrial functions in the transport corridor. Increase in the location attractiveness of logistic activities along with the minimisation of the negative impact of the development of the industry on the environment and the quality of living

requires coherent planning actions by municipal authorities. Local authorities face challenges of proposing the directions for spatial development in the areas of convenient transport accessibility from the logistic point of view: transport junctions, terminals, river ports etc. Cooperation of the public and private partners is necessary in this part and it may serve i.a innovation development, especially in the scope of the desired implementation of low-carbon solutions in freight transport. Reinforcement of the areas attractive for logistic industry contributes also to the development of other industries in their proximity.

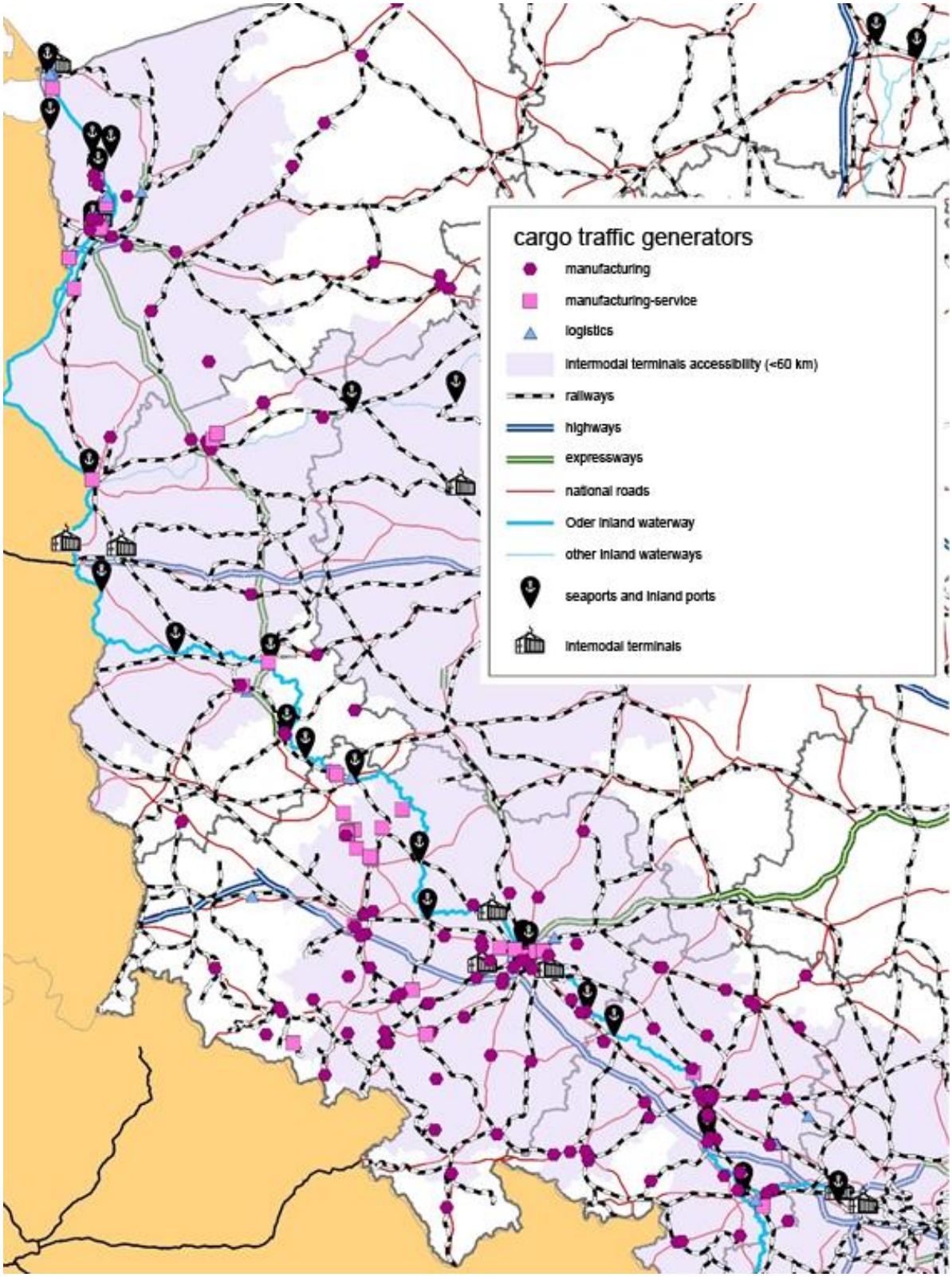

Figure 4. Location of the main freight generators in the area of Central and Lower Oder

Source: Own study

A separate challenge is a skilful promotion of the possible ways of using the potential of the corridor created on the basis of high-quality infrastructure and spatial planning among logistic operators. The

objective of such actions should be cooperation between stakeholders of the existing traffic generators in a manner that allows them to use the economies of scale linked to e.g. aggregation of wagonload freight. It can be assumed that joint ventures and achieving a shared vision of the development of logistic and industrial functions in the corridor will result in the growth in the interest of investors who value positive investment climate and want to use e.g. locations with lower transport costs.

! **Adding inland waterway to the transport offer along the corridor will increase the potential of the surrounding area. Although the most obvious way of using the Oder waterway transport is the transport of coal from mines to power plants and seaports of Szczecin-Świnoujście and also transporting selected freight form the seaports upstream, the key factor to the success of the reconstruction of the waterway transport is gaining other freight besides bulk.**
It can be achieved through creating good connections between the waterways and other means of transport, and also through the development of industry and logistics of added value directly in river ports. Ports should therefore be zones of economic activity – characterised by good intermodal connections, oriented towards oversize goods production and distribution (e.g. turbines for power plants, means of industrial transport, production equipment), and customisation of the freight imported from Asia to the needs of local markets – not only Polish, but also European.
Such activity requires relatively cheap but high-quality labour, proximity of European outlets and possibility of export to global markets, so areas along Oder can achieve great and long-lasting success in this scope – not only in the competition with West European regions, but also with the East.

The White Paper on Transport, which is a part of the Europe 2020 strategy, determines the directions of the development of the transport system for the next decades. Effective transport is a condition necessary to maintain well-being of the European Union, and the realisation of the objectives of the plan will lead to the reduction of congestion, reduction of emission, creation of a bigger number of work place and acceleration of economic growth. Among ten goals for creating a competitive and resource-efficient transport system i.a. the following were indicated: achieving a generally CO_2 free logistics in large urban centres until 2030, transferring road freight transport on distances longer than 300 km to railway or water transport (30% until 2030 and 50% until 2050), creating, until 2030, a fully functional European Union-wide multimodal TEN-T core network, and until 2050 achieving high quality and transport capacity of the network and also providing until 2050 a good connection between all sea ports and railway freight transport, and, as long as it is possible, inland waterway transport.

Strategies at macroregional level also aim to reinforce the efficiency and reduce the negative impact of transport on the environment, including the **European Union Strategy for the Baltic Sea Region**[5], which promotes the integration of the transport system across national borders and between different means of transport, including enhancing the efficiency of the holistic solutions in the scope of freight transport and logistics in the Baltic Sea (elimination of bottlenecks not linked to infrastructure, promoting intermodal connections, developing a concept of a green corridor through the implementation of specific projects, extension of the infrastructure, supporting logistic services providers, establishing harmonised electronic administrative procedures, harmonising control

[5] *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Commitee and the Commitee of the Regions concerning the European Union Strategy for the Baltic Sea Region, Commision of the European Communities, Brussels, 2009*

procedures etc.), enhancing the importance of the Baltic Sea in the transport systems of the region (i.a. development of ports and proper connections between them and the inland territory, especially railway connections and inland waterways, and promotion of sustainable passenger and freight transport, and facilitation of the transferring to intermodality). Strategy for the Baltic Sea Region indicates directions, in which other initiatives of international cooperation in the macroregion are going – like the cross-border **South Baltic Programme 2014-2020**[6], which pays special attention to the domination of mobility based on cars and the widening gap between the levels of exploitation of railway, the position of which is strong in Denmark and Sweden, but is declining in Lithuania and Poland, which poses a serious challenge to the objectives promoted by the European Commission in the White Paper for Transport. Inhibition of the negative trend connected to the railway transport in the area of the South Baltic requires providing adequate and high-quality multimodal public and freight transport services, harmonised on the cross-border level. Any methods for exploiting the potential of centres and transport connections more ecologically should be taken into account, their logistic efficiency should be increased and their impact on the environment – decreased.

The complex European transport system, besides the perspective of macroregions, is recognised also in the context of transport corridors, from which the most important for the European Union were included in the TEN-T network. Two corridors of the TEN-T network pass through the territory of Poland – longitudinal Baltic – Adriatic corridor and latitudinal North Sea – Baltic corridor. The Baltic – Adriatic corridor as one of only a few corridors, besides its connection with the core TEN-T inland waterways network in different sections, does not cover inland waterways. The main goals of **the Baltic-Adriatic Corridor Work Plan**[7] include coherence, efficiency, sustainability and maximisation of the benefits for users. Among the priority challenges, the coordinator Kurt Bodewig mentioned i.a. Railway and road cross-border connections, finalisation of the construction of tunnels in Austria, land connections with port infrastructure, development of urban nodes and implementation of ERTMS. Special attention was paid to the decrease in the importance of railway transport, which is impossible to stop without making significant investments. Investments in the railway and road infrastructure planned to be realised in order to develop the corridor, apart from improving the stability and cost-efficiency in all types of transport, are supposed to have positive, though limited, impact on compensating for the downward trend and are supposed to establish the share of railway on a slightly higher level than the current one.

On the national level, directions in which the transport system develops are determined by the **Transport Development Strategy**[8], according to which the first challenge for Poland is the elimination of the backlog in the development, modernisation and revitalisation of the transport infrastructure, and infrastructure connection between the most important growth centres and the areas of lover development dynamics and including them in the European transport network (TEN-T), and in the long run increasing the level of saturation with infrastructure and creating an integrated transport system. The transport sector was classified to the areas of great importance for achieving the goals of the **Responsible Development Strategy**[9] which is a strategic instrument for the governance of the development policy pursued by national institutions. The strategy seeks to reinforce the national economics i.a. through increasing the importance of knowledge and

[6] *Interreg South Baltic Programme 2014–2020*

[7] *Baltic Adriatic. Second Work Plan of the European Coordinator Kurt Bodewig, Brussels 2016*

[8] *Strategia Rozwoju Transportu do 2020 roku (z perspektywą do 2030 roku), Ministerstwo Transportu, Budownictwa i Gospodarki Morskiej, Warszawa, 2013 r.*

[9] *Strategia na rzecz Odpowiedzialnego Rozwoju do roku 2020 (z perspektywą do 2030 r.), Ministry of Development, Warsaw, 2017 r.*

technology produced in the country, and development and further expansion of the national economic operators.

Reindustrialisation based on innovation and high added value industries will be very important. Development of transport supporting the economy and, at the same time, reduction of its impact on the environment is a challenge. What is especially important is the planned increase in the importance of railway transport (freight as well as passenger), development of intermodal transport, exploitation of the alternative power transmission systems and development of the collective transport offer. Barriers to use railway for transporting freight are the organisation of the transport of freight, time, place of transhipment and security of freight. On the other hand, the railway freight transport segment has a growth potential due to the modernization of the linear infrastructure and development of the intermodality of the system. In Strategy, inland waterway transport was included, although it was underlined that the inland waterway transport development programme in Poland has to include a thorough assessment of the impact on the environment (including the Natura 2000 areas) in accordance with the national and European Union legislations.

Accepted as a law, **Assumptions to the plans of the development of the inland waterways in Poland for the years 2016-2020 with the perspective to 2030** (Założenia do planów rozwoju śródlądowych dróg wodnych w Polsce na lata 2016-2020 z perspektywą do roku 2030)[10] include the revitalisation of the Oder Waterway, as well as restoration of navigability of the Vistula from Warsaw to Gdańsk, connection of Oder, Noteć, Vistula and Bug, and construction of the Silesian Canal connecting Vistula and Oder. The main challenges concern creation of conditions for the realisation of extensive investments, including the ratification of the AGN Agreement, which will allow for the inclusion of waterways into the European System of Inland Water Transport (already achieved) and inclusion of the Oder and the Vistula into the TEN-T network, which will allow access to the EU funding.

Due to the advantageous location along important transport routes and access to sea transport, the transport sector significantly encourages the development of smart local specialisations. **Regional Smart Specialisation Strategy of West Pomerania 2020+** (Regionalna Strategia Rozwoju Inteligentnych Specjalizacji Województwa Zachodniopomorskiego 2020+)[11]**,** presenting the goals and the way of implementation of West Pomeranian innovation policy, indicates that the potential of the voivodeship is not fully exploited, i.a. due to its peripheral location and weak transport accessibility from other regions of Poland (including the capital), lower-than-average road density, which matches the peculiar settlement grid, insufficient maximum permitted speed on important railway lines to Szczecin, as well as decreasing inland waterway transport, due to a large investment backlog which limits the number of days in which the parameters of respective navigability classes are complied with. A chance for reinforcing the growth potential of the West Pomeranian Voivodeship would be the realisation of a number of infrastructure investments, including those under the Central European Transport Corridor Limited Liability European Grouping of Territorial Cooperation. Some of the local specialisations may develop more favourably thanks to economic cooperation with other regions, especially in the area of the Central European Transport Corridor. In view of the West Pomeranian Voivodeship, key areas of cooperation include mechanical industry,

[10] *Założenia do planów rozwoju śródlądowych dróg wodnych w Polsce na lata 2016-2020 z perspektywą do roku 2030, Ministry of maritime economy and inland navigation, Warsaw, 2016 r.*

[11] *Regionalna Strategia Rozwoju Inteligentnych Specjalizacji Województwa Zachodniopomorskiego 2020+, Wydział Zarządzania Strategicznego, Urząd Marszałkowski Województwa Zachodniopomorskiego, Szczecin, 2016 r.*

automotive industry and industrial technologies and processes, as well as biotechnology including food production and processing. The logistics sector additionally has supporting character in regard to other branches, as a leading specialisation in the regions of Berlin, Brandenburg and Lubusz Voivodeship. It is also worth noting that the analysis of local and national specialisations indicates that, despite the location of respective regions in the Central European Transport Corridor or its vicinity, only a small number of regions (Berlin, Brandenburg, West Pomeranian and Lubusz Voivodeships, Burgenland, Vas County, Zala County, Győr-Moson-Sopron County, Coastal–Karst Statistical Region) and countries (Italy) emphasise logistics as a leading specialisation. It should not represent a barrier to the growth of the Corridor, but may undoubtedly restrict the potential of new projects facilitating the usage of its potential. Such a situation calls for encouragement of efforts to include logistics into local specialisations (in locations in which decisions in this regard have not yet been made, e.g. Croatia), or efforts to include tasks related to logistics as a part of already defined specialisations (e.g. logistics in bioeconomy – new technologies, but also technical and organisational solutions of transport and distribution of resources, food products, wood or furniture).

! **The most important strategic documents show the necessity of reindustrialisation of Poland and Europe (especially the creation of high added value industry in Poland) with simultaneous respect to the natural environment. For the port in Szczecin, the call for CO_2-free logistics in large urban centres is the most important, since it may lower its competitiveness against other ports, especially foreign ones.**

1.2 Measure and ways of implementation

1.2.1 Integrated planning process of the development of transport infrastructure

The cost-benefit analysis based on the so-called intermodal four-step traffic model is the foundation of strategic planning of transport infrastructure in most high-developed countries. Currently in Poland, the attempts to implement such a model at national level are in progress. In this part of the study the following shall be described: the functionality of the four-step model, an example of its use in strategic planning of network development, its current use and future plans in Poland at national level, and recommendations for regions on creating intermodal connections of Central and Lower Oder, with particular focus on construction of Oder waterway intermodal connections at regional level.

1.2.1.1 Principles of functioning of the Four-Step Model

The four-step model consists in mathematical modelling for the given area (e.g. country) divided into cells (e.g. gminas) each of the following[12]:

- formation and attraction of traffic for each of the cells based on i.a. demographic data and projections, indicators concerning spatial planning etc.,

[12] *D. Lohse, Grudnlagen der Strassenverkehrstechnik und der Verkehrsplanung. Band 2. Verkehrsplanung, Verlag fuer Bauwesen, Berlin 1997, s. 137-328.*

- so-called origin-destination matrix, estimating the amount of traffic between each pair of cells in the model, based on the amount of traffic generated and attracted by these cells and distance (or rather, the quality of infrastructural connections) between them;
- intermodal distribution, meaning the choice of transport modes, based on their indicators of competitiveness (price, time, punctuality, frequency etc.)
- specific routes within the means of transport utilised by passengers and cargo carriers.

It should be noted that modelling in practice is an iterative process – respective stages of modelling are performed many times. Modelling is performed for both past flows – for calibration purposes, meaning to make the model accurate – and future – for predictive purposes.

Four-step models are designed in an integrated manner for passenger transport and freight. Such models may be characterised by different accuracy depending on the area for which they are calibrated and quality of input data. Therefore, this means that a model optimised for railway transport may not retain full credibility for air transport or inland waterway transport due to a different scale of variability of some parameters. Nonetheless, many elements of the railway model may be utilised in formation of a model for inland waterway transport.

Four-step models especially allow for simulation of mutual influence of investments (including complementarity of investments in different modes of transport) and influence of parameters of the investment on its attractiveness (e.g. comparing an option which guarantees lower costs with an option which guarantees shorter travel duration).

1.2.1.2 The utilisation of the four-step model in Western Europe

In Western European countries, four-step models are designed for the entirety of national transport system and form the basis for integrated investment planning. Such models are made widely accessible for authors of studies and regional and local authorities, in order to make them more precise. Based on the models, beneficiaries commission feasibility studies along with the prognosis of infrastructure utilisation and cost-benefit analysis. Then, baseline indicators of feasibility studies are a key factor in prioritisation of transport investments.

An example of a document in which the four-step model and cost-benefit analysis form a methodical foundation is Bundesverkehrswegeplan[13], a document prioritising the federal investments in transport infrastructure in Germany. For the purpose of this document, a prognosis of traffic density based on socioeconomic and demographic data has been drafted and a four-step model has been designed – taking into account the passenger transport and freight, and all modes of transport[14].

The model included both the national level and smaller areas. Prognoses are being made for the year 2030, while the period of planning begins in year 2015 (therefore, the analyses are conducted for a 15-year period, unlike in Poland, where the analyses are conducted for a 30-year period).

Based on movement data, a cost-benefit analysis is conducted (cf. Figure 5), which basically means a comparison of the costs of construction and the costs of maintenance of the investment with

[13] *Bundesverkehrswegeplan 2030. Bundesministerium fur Verkehr und digitale Infrastruktur. Berlin, 2016.*

[14] *Szerzej na ten temat: Methodenhandbuch zum Entwurf des Bundesverkehrswegeplans 2030. Entwurfsfassung. PTV Group, TCI Roehling, Hans-Urlich Mann, Karlsruhe, Berlin, Waldkirch, München, 2016.*

benefits, including non-financial ones (e.g. time-saving, reduction of the number of accidents, reduction of emission).

In an obvious way, the quantity Time-saving is dependent on the number of users of the infrastructure – prognosed by the means of the four-step model.

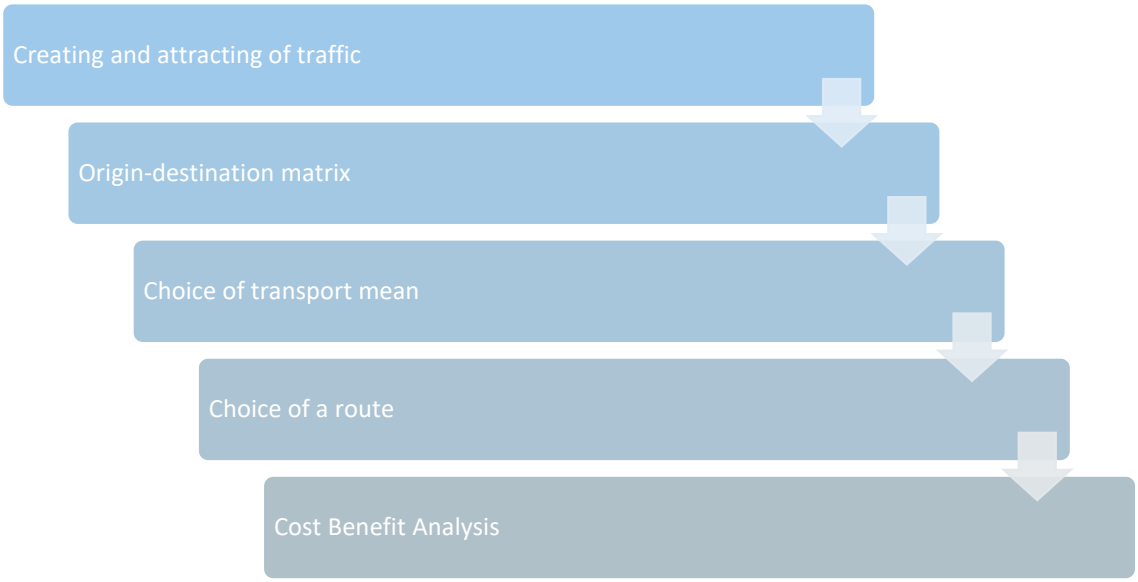

Figure 5. Traffic modelling in order to carry out a costs-benefit analysis

Source: Own study

In the discussed case, the method for cost-benefit analysis is based on thoroughly described, specifically devised for this purpose method including investment costs and twelve impacts, which are the result of the modelling. Attention is drawn to a wide range of mandatory analyses which take interactions with other modes of transport into account, and also – sometimes relevant – the influence of projects on facilitating (or hindering!) pedestrian traffic, particularly in lateral directions. Of course, such a wide range of analyses requires the preparation of very extensive feasibility studies in accordance with equally accurate methodology, the degree of refinement of which is much higher e.g. than in case of national Blue Papers. What is vital, however, is the aforementioned formulation of a unified reference model of traffic along with a prognosis.

The cost-benefit analysis resulting from the modelling is complemented with additional modules of analysis, which later translate into additional criteria of project selection. These are – depending on the scale and type of the project – analyses of environmental impact, consistency with spatial planning, inter- and intramodal dependencies, sensitivity analysis, analysis of alternatives (including e.g. analysis of the extension of the road network by bypasses instead of motorways) and analysis of bottlenecks.

A unified national four-step model allows for easier simulation of influence of new investments on the transport system, especially – preparing a forecast of traffic and including the interaction between investments (including intermodal connections), and in consequence, a plausible calculation of efficiency of the investment.

1.2.1.3 The utilisation of the four-step model in Poland

In Poland, four-step models are utilised, along with cost-benefit analysis, especially in the feasibility study stage of single projects, which is a result of i.a. guidelines of JASPERS Blue Papers[15] for respective transport modes. However, i.a. in the stage of Implementation Document of Transport Development Strategy[16] projections of traffic are not devised and economic efficiency indicators are not calculated, which is criticised i.a. by OECD.

Simultaneously, however, steps are being undertaken to change the current state of affairs. Although currently there is no unified and widely accessible four-step model for the whole country, during the course of the study it has been revealed that:

- General Directorate for National Roads and Motorways (GDDKiA) is in possession of its own four-step model for some years now. The model has been optimised for the development of road network, and is currently in the process of expanding its functionality in cooperation with two leading scientific centres in this regard – the Faculties of Civil Engineering at Cracow University of Technology and Warsaw University of Technology;
- PKP Polskie Linie Kolejowe (Polish Railway Lines) has devised a four-step model optimised for railway transport on its own accord – it is currently at the stage of internal authorisation;
- Centrum Unijnych Projektów Transportowych (Centre for EU Transport Projects, CUPT) has made the decision to construct an intermodal traffic model for the general coordination of the national transport policy, it will probably be based on the elements of GDDKiA and PKP PLK models, though its preparation is in early phase;
- The Ministry of Maritime Economy and Inland Navigation (MGMiŻŚ) is planning to announce the proceedings for a public service contract (preceded by a technical dialogue) for the analysis of inland waterway transport sector in the scope resulting from the modernisation of the Oder Waterway and the Vistula Waterway – its methodology will most probably be based on the four-step model, however, the methodological requirements announced as a part of the request of proposal are of general nature. This model, in conjunction with subsequent expert evaluations planned by the MGMiŻŚ, will serve as a basis of a comprehensive traffic prognosis and an economic evaluation of inland waterway development plans – its results will be available in mid-2018.

It should be noted that within the MGMiŻŚ analysis for the Oder, incorporation of three investment variants is required, including the following:

- classification of the waterway into Class III until 2020 excluding the Koźle – Ostrava connection and the Silesian Canal
- classification of the waterway into Class III until 2030 including the Koźle – Ostrava connection and the Silesian Canal
- classification of the waterway into Class IV until 2030 including the Koźle – Ostrava connection, the Silesian Canal and the Niepołomice barrage.

[15] *Por. np. Niebieska Księga. Infrastruktura drogowa. Jaspers, Warszawa 2015.*

[16] *Dokument Implementacyjny do Strategii Rozwoju Transportu do 2020 roku (z perspektywą do 2030 roku). Ministerstwo Infrastruktury i Rozwoju, Warszawa 2014.*

1.2.1.4 Perspectives of utilisation of the four-step model of intermodal connections for the Central and Upper Oder

In accordance with the prepared national models – especially by CUPT – it will be possible to implement a system of selection of investments in Poland based on economic indicators calculated in an efficient and comparable way, complemented by non-economic criteria (e.g. cohesion with priorities in development policy).

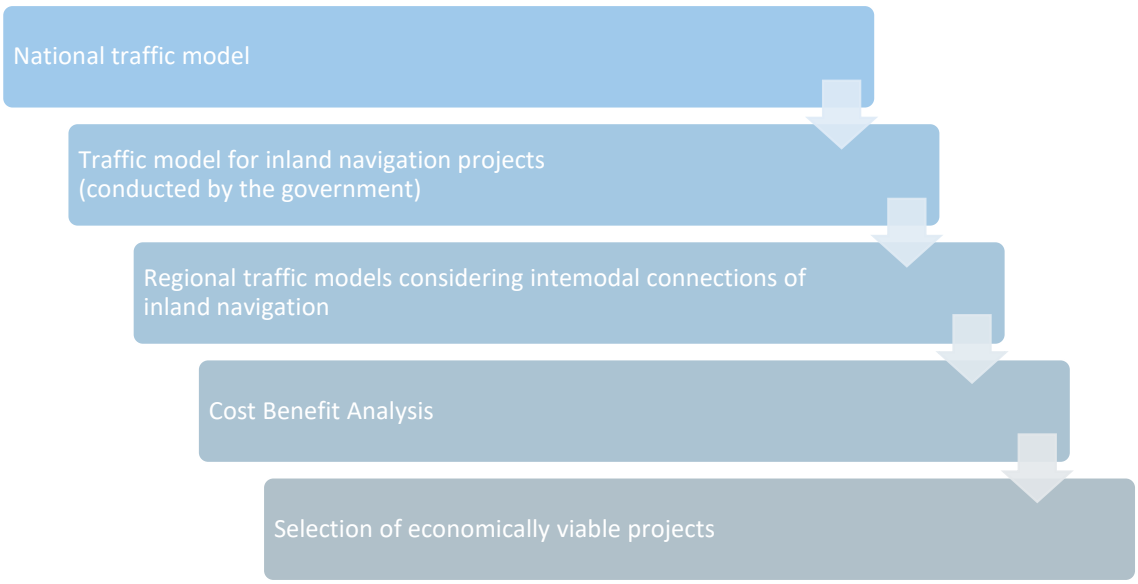

Figure 6. Utilisation of the traffic model for the analysis of the Oder project

Source: own study

Modelling offers also good possibilities in regard to a comprehensive formation of a transport system on a regional and interregional challenges, including in regard to formation of intermodal connections. The future model prepared for MGMiŻŚ should be the key input element here, on the basis of which, a method of intermodal connection building could be prioritised and specified in regard to the possibilities identified in this study. Naturally, it is also appropriate in this case to apply the complementary criteria, e.g. higher priority for investments in the areas with higher unemployment.

After devising that model it will be possible to continue further modelling in order to evaluate and optimise solutions proposed in the following study.

! **After the creation of the national traffic model and adapting it to the issues of inland waterway transport, prognoses of traffic will have to be made for respective elements of intermodal connections of Central and Lower Oder, cost-benefit analyses will have to be carried out, and then decisions about the scope and shape of the investment will have to be made.**

1.2.2 Intermodal manager of infrastructure

Integrated, multimodal programming of transport infrastructure development often find difficulties in the subsequent necessity of investment implementation by managers of different modes of transport. However, while it is not an insurmountable obstacle and modal managers are successful in

various European countries, one of the solutions for simplifying the interconnection of transport modes is the appointment of integrated managers of transport infrastructure. Such a model has been implemented i.a. in Sweden and in Lower Silesian Voivodeship. On the basis of analysis of these cases, a proposal for the regions along the Oder will be prepared, in case of which an additional challenge will be the cooperation between respective regional or local authorities.

It should also be noted that connection of port infrastructure to road and railway network is in interest of regional and local authorities, due to the fact that it fosters the maximalisation of influence of national investments on regional development. An example of this is the self-government of Gdynia, which as an investor – with the help of Union funds – has made large investments in terms of availability of the sea port in order to reduce road traffic and to create additional workplaces for its inhabitants.

1.2.2.1 Integrated transport development structures in Sweden

One of the best examples in the world of an integrated structure managing the entirety of transport infrastructure is Trafikverket, the entire operation scope of which has been described in the analysis of good practice in Sweden (cf. Chapter 3 - Analysis of benefits of the TEN-T network implementation in regard to the cooperation between West Pomeranian Voivodeship and Skåne County).

Planning of the infrastructure development is performed in accordance with the established methodology, in which so called Four-Step Principle (frystegsprincipen, cf. Figure 7), is very important. The Principle includes 4 subsequent actions which refer to different aspects and levels of advancement of the transport development and infrastructure extention. The first step ("think over") concerns analysing the existing transport needs in connection with the available means of transport. The second step (optimise) focuses on the possibilities of the optimising the exploitation of the existing infrastructure (e.g. changing railway infrastructure access rates, parking fees). The third step ("rebuild") concerns slight modernisation of the existing infrastructure, and if the preceding steps do not satisfy the existing needs, performing the fourth step ("build new infrastructure"), which implies major reconstruction of the existing infrastructure or constructing a new one. Sustainable development of the transport infrastructure places emphasis on the first two steps. Such an approach provides a chance for achieving the intended effects more effectively than while conducting an analysis on the basis of an arbitrarily-made decision concerning a given action variant. Thanks to that, an efficient verification of submitted postulates concerning infrastructural changes comes into motion, preventing e.g. implementation of costly investments, the effects of which might be accomplished through simple changes in the traffic organisation and minor reconstructions, or excessive extension of roads without a link to their use or the role of railway and collective transport.

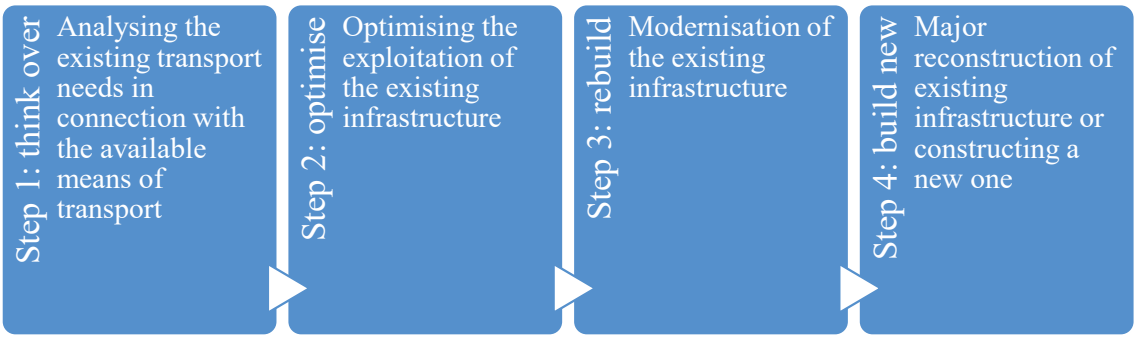

Figure 7. The Four Steps Rule maximising the efficiency of actions undertaken by the Infrastructure Manager

Source: Trafikverket – Fyrstegsprincipen, http://www.trafikverket.se/for-dig-i-branschen/Planera-och-utreda/planera-person--och-godstransporter/Planera-persontransporter/Hallbart-resande/Fyrstegsprincipen/

The planning process is always based on properly prepared data and consultations with the partners expected to be involved in the realisation of the project, including the regional authorities. This ensures taking informed decisions based on full knowledge with the involvement of all partners. The time horizon of prepared plans usually covers a period of 10 years, which allows for planning of sufficiently specific and feasible actions. Plans prepared for longer-term perspective require too many updates not to significantly differ from the actual challenges.

The effects of the analytical and planning work of the specialists from Trafikverket cover a remarkable set of generally available statistical and thematic reports concerning transport system and closely related fields, including spatial planning, environmental protection or security, from the point of view of different stakeholders – direct users (drivers, passengers, cyclists, cargo consignors), carriers, entrepreneurs, city inhabitants. Materials are published in an approachable form on an extensive website containing graphic elements and maps. The knowledge of transport system is gathered and made available also in a form of transport library or online base of good practice examples, which was created in cooperation with representatives of Trafikverket. Also the source data, which is used by specialists for further processing, is widely shared.

One of the interesting examples of studies carried out by Trafikverket is a report concerning the functionally prioritised road network. The project consisted in identification, in cooperation with local entities, of a network covering roads which are most important to the national and regional availability, taking the needs of inhabitants and entrepreneurs into account, and regarding different functions – freight transport, long-distance car travels, daily car travels and public transport, the priority and importance of which have to be properly balanced among one another. Taking supraregional perspective allows more efficient identification of bottlenecks. This results in more efficient prioritisation of investments and increased efficiency. The chosen approach prevents investments overly promoting one of the functions, e.g. travelling by passenger cars.

1.2.2.2 Integrated transport development structures in the Lower Silesian voivodeship

Although the full implementation of the Trafikverket solution in Polish context would require a decision at central level, some of the elements are possible to implement at lower levels, an example of which is Dolnośląska Służba Dróg I Kolei (Lower Silesian Road and Railway Service).

Dolnośląska Służba Dróg I Kolei as a local-government budgetary unit financed by the local authorities of Lower Silesian Voivodeship, carries out tasks of Lower Silesian Voivodeship Executive Board in the scope of rights and obligations of the road manager specified in under the Act of 21 march 2003 in respect of railway transport. The origin of extending the competences of the manager of voivodeship roads with railway infrastructure management is the voivodeship taking action to take over and rebuild the railway lines of regional relevance which are out of use or threatened with liquidation. In 2007, local authorities took over from the national manager the threatened with liquidation railway line no. 326 from Wrocław to Trzebnica, and a year later also an out-of-use national segment of the 311 railway line from Harrachov to Jakuszyce. As a result, it has become necessary to create and administrative apparatus not only for road, but also railway infrastructure.

Initially, DSDiK outsourced the function of manager, and after obtaining authorisation and approval for safety management system it became a full-fledged railway infrastructure manager. The tasks of DSDiK as the railway infrastructure manager cover:

1. construction and maintenance of railway infrastructure,
2. railway traffic management,
3. maintaining the railway infrastructure in a condition which provides the safety of railway traffic,
4. making the train routes available for the movement of trains on railway lines and providing services related to that,
5. management of properties which are a part of the railway infrastructure.

The active attitude of local authorities in Lower Silesian Voivodeship protected local railway lines from liquidation, and thanks to the investments undertaken (including also the ones cofinanced from the resources of RPO (Regional Operational Programme)), and also commitment to the development of local government operator (Koleje Dolnośląskie), it was possible to improve the quality of railway passenger transport and increase the popularity of offered connections. The adopted model works well enough for the local government to express interest in taking over almost 370 km of railway lines within the territory of the voivodeship, which were scheduled for liquidation by the manager.

! **Both Dolnośląska Służba Dróg I Kolei and Swedish local authorities manage not only road, but also railway infrastructure of regional relevance.**
Constructing Central and Lower Oder intermodal connections with railway and road transport network might also require the commitment of regional, or even powiat (county) governments. This will foster the impact of national investments on regional development, thus it will be a real benefit for local economies. Also, international cooperation along the corridor will be more effective.

1.2.2.3 Potential possibilities

While the development of inland waterways is the duty of government administration, the adequate construction of intermodal connections (inland ports, voivodeship and powiat roads leading to them, railway sidings) rests with the regional and local authorities.

The construction can be pursued by special, multifunctional infrastructure managers that can at the same time become the managers of the ports of local authorities and railway sidings in the ports – the commitment of local authorities to port activity, also in sea ports.

In the case of voivodeships which are smaller or less engaged in activities related to waterway transport, it is possible to cede the function of port manager and other infrastructure to other voivodeships through proper agreements.

! **One of the possible optimisations of the benefits resulting from the functioning of intermodal connections is establishing integrated road, railway and chosen parts of port infrastructure management parties – a similar structure already functions in the Lower Silesian Voivodeship. It should be noted that it is not necessary to establish analogous structures in every voivodeship – regions may cede competences to one another on the basis of proper agreements.**

1.2.3 Local corridor structures

Maximisation of the socio-economic impact generated by the transport corridor requires efficient cooperation of private parties, local authorities and infrastructure managers.

The objective of such cooperation should be to lower the costs of transport and accelerate the flow of goods. Basically the best results are brought by modernisation and construction of the infrastructure, for which parties such as PKP PLK, GDDKiA or local road managers are responsible. The investment actions taken by them should meet the needs of the parties functioning in the corridor infrastructure which conduct economic activity, so that their competitiveness is increased. It concerns both the cost of transport or its expected duration, and adequate infrastructure standards and its capacity.

For properly diagnosing and articulating their needs, it is appropriate to initiate the cooperation of stakeholders organisations, which already successfully function around transport junctions, such as e.g. Oder Shipping Team (Zespół ds. Żeglugi na Odrze) or Szczecin Port Stakeholders' Council (Rada Interesantów Portu Szczecin).

A foreign example of a more complex organisation of similar nature is the Logistics in Wallonia cluster, which supports infrastructure actions from the "soft" side. It occupies itself with networking and integration projects, international promotion, but most importantly innovation stimulation. It possesses and distributes the resources for innovations provided by national authorities and takes part in project financed under external programmes. Thanks to them it develops innovative products and logistic services, and also conducts promotional activities in the region.

One of the new projects in which the cluster takes part are scheduled freight trains which at night use the TGV infrastructure. They will allow for better transport of freight from Wallonia to France and England.

It is a part of the policy of the development of Wallonia, which is based on the exploitation of the transhipment of containers, which arrive at sea ports, especially in Asia, to inland vessels and their cheap transport to Wallonia, where they can be subject to value added logistics. This is a great solution for creating work places in a region with unemployment levels at over-a-dozen percent

level, which in some provinces reaches the level of 20%. Logistics allows to create work places which actually engages the unemployed because it does not require high qualifications.

An organisation which brings together entrepreneurs should be a partner to public authorities in the realisation of clear, supraregional development policy, indicating the opportunities to boost the development and actions necessary to seize them – very often of cooperational nature.

1.2.4 The corridor act

1.2.4.1 Standard way of obtaining the investment construction permit

Issues connected to the investment process and concerning the location and construction of facilities in all sectors are subject to regulations primarily of the following acts:

- Act of 27 March 2003 on spatial planning and development (i.e. Dz.U. z 2012 r. Poz. 647, hereinafter referred to as: act on spatial planning);
- Act of 3 October 2008 on the provision of information on the environmant and its protection, public participation in environmental protection and environmental impact assessment (i.e. Dz.U. z 2013 r. Poz. 1235, hereinafter referred to as: OEP);
- Act of 7 July 1994, Construction Law (i.e. Dz.U. z 2013 r. Poz. 1409, hereinafter referred to as: Construction Law);
- Act of 18 July 2001, Water Law (i.e. Dz.U. z 2012 r. Poz. 145, dalej: Water Law).

In simple terms, the process requires obtaining:

- environmental decision – based on the environmental impact assessment (EIA) required i.a. for inland waterways and inland ports which can take vessels of over 1350 tonnes;
- decision concerning the location of a public purpose investment,
- construction permit,
- geological work project approval,
- water permit,
- expropriation decision.

A separate problem is the temporary land take for the purposes of an investment (e.g. access, construction backup facilities) and agreeing on the points of contact with other infrastructure managers.

Works on new legislation for the investment process are currently in progress, but over the years they have been time-consuming and lengthy.

1.2.4.2 Special way of regulating the investment processes

Moreover, the investment process in transport sectors is regulated by the following acts:

- Act of 10 April 2003 on detailed principles of preparing and executing public roads construction investment projects (i.e. Dz.U. z 2013 r. Poz. 687 ze zm., hereinafter referred to as: act on road investment or road special act);
- Act of 28 March 2003 on railway transport (i.e. Dz. U. z 2003r, Poz. 1594 ze zm., hereinafter referred to as: railway act);

- Act of 7 September 2007 on preparation of the final tournament of the UEFA European Football Championships 2012 (i.e. Dz.U. z 2010 r. Nr 26, poz. 133 ze zm., hereinafter referred to as: EURO special act);
- Act of 12 February 2009 on the specific rules of preparation and implementation of investment process concerning public use airports (Dz.U. z 2009 r. Nr 42, poz. 340 ze zm., hereinafter referred to as: act on airport investments).

This situation was caused by the fact that the standard investment procedure was causing obstruction of the investments and risks in the utilisation of the European Union funds, that is why before the end of 2003 special rules of investment realisation were implemented exclusively for the investments of GDDKiA on the national roads. The key change consisted in replacing the decision concerning the location of a public purpose investment, construction permit and expropriation decision with one decision called "realisation of road investment permit" (RRIP).

The specificity of RRIP consists in its effects in:

- the sphere of spatial planning (location of the road);
- the sphere of the ownership right or perpetual usufruct (it is a basis for acquiring by the State Treasury or local government unit the ownership right to real estate designed for construction);
- the sphere of construction law (construction project approval).

Over time, the scope of investments and investors entitled to act to obtain special permits for investment realisation was extended – modal regulations were implemented for the investments concerning airports and railways, and not only national infrastructure managers but also local authorities may become beneficiaries of the regulations.

Investments of local authorities – especially in the scope of urban public transport and stadium infrastructure – could also be realised on the basis of the EURO 2012 special act. Attempts have even been made to use the act for investments which have started after the tournament, which was stopped by a verdict of the Constitutional Tribunal. Notably, for separate modes of transport, separate legal regulations were made in each case, which differ only due to nuances. This solution impedes amending individual acts, but most importantly it is criticised because of replacing the general law with special law ("hole patching" instead of system solutions) and favouring chosen public investors, which indirectly shows how unreal the regulations for all investors are. Moreover, some controversies regarding the mandatory RRIP arise among the investors – in some cases it would be beneficial to e.g. obtain the expropriation decisions earlier, which under the current state of law raises serious questions.

! **Investment processes in the scope of transport infrastructure are possible thanks to special law regulations – for roads, railways and airports. The standard investment path takes too long compared to the time available for preparation, realisation and settlement of the European Union investments. On the other hand, special laws impede expropriations before comprehensively preparing the investment**.

1.2.4.3 Intermodal way of obtaining investment realisation permit

Regarding the lack of special regulations for inland waterway investments and government investment announcements, it will without a doubt be necessary to implement special legal rules for

waterway investments. Although waters are the property of the State Treasury, in many cases it will be necessary to take additional lands.

There are the following formal procedures:

- implementation of new regulations urban-construction code which simplify investment process;
- unification of special acts into one special act – so called corridor special act;
- creation of a separate waterway special act.

The first solution is certainly an optimal solution, but its feasibility is currently difficult to estimate and depends on many external factors. In the other cases, the complexity of future investments should be remembered about – they can have intermodal character and cover constructing various infrastructures, including roads and sidings. They can be realised by different companies, including the ones with public participation. In each of the cases a possibility (not necessarily requirement) of using the integrated permit formula would be desired.

Here, not only a "broad" waterway special act, but also a universal corridor special act can be the solution, and, regarding the intermodality and diversity of beneficiaries, the right prototype is Euro 2012 special act.

! **If there is no complex change in the regulations concerning investment process, the success of waterway investments depends on the implementation of a proper special act. It should include the intermodality of waterway investments (so roads, railway, but also warehouses and factory buildings construction) and diversity of beneficiaries (including commercial law companies).**

1.3 Recommendations

- In Poland, the share of road transport in cargo transport is larger than the EU average and is constantly increasing. It is necessary to undertake actions supporting the development of other branches, which have less negative impact on the environment, including the railway (especially in terms of acquiring other cargo than bulk cargo, modernisation of line infrastructure and development of point infrastructure) and inland waterway transport (in terms of restoring the infrastructure and finding a market niche such as e.g. oversize cargo).
- The cost-benefit analysis should serve as a basis for strategic planning of transport infrastructure. In order to achieve that, the usage of so-called four-step model is recommended. An unified national four-step model allows to easily simulate the impact of new investments on the transport systems, especially – preparing the traffic prognosis and considering the interactions between investments (including intermodal connections), and consequently – plausible estimations of efficiency of the investment.
- Sustainable development of transport infrastructure is impeded by fragmentation of managers of different modes of transport. It is recommended to integrate management functions similar to Lower Silesian Road and Railway Service (Dolnośląska Służba Dróg i Kolei) or Swedish local authorities, which are not only road infrastructure managers, but also regional railway infrastructure managers. It should be noted that it is not necessary to create analogous structures in each voivodeship – regions may cede responsibilities on the basis of proper agreements.

- Construction of intermodal connections of the Central and Lower Oder with the railway and road transport network may require involvement of regional or even powiat governments. This will facilitate the influence of national investments on the regional development, which means genuine benefits for local economies. This will also make international cooperation along the corridor will also more effective.
- An organisation of entrepreneurs should act as a partner of public authorities in the realisation of a clear, supra-regional development policy, which will allow for faster development and the measures needed to exploit them – often of cooperational nature.
- Investment processes in transport infrastructure are facilitated thanks to regulations of road, railway and airline special acts. Standard investment path takes too long compared to time available for preparing, realisation and settlement of the investment. In case of lack of comprehensive regulatory amendments in terms of the investment process, the success of the investment depends on the implementation of a proper special act. It should take into account the intermodality inland waterway investments (namely the construction of roads, railway lines, even warehouse and factory halls) and diversity of beneficiaries (including commercial law companies).

2. Analysis of types of connections between logistic centres in the duchy of Pomerania which serve the Polish-German infrastructure of Baltic-Adriatic corridor

2.1 Intermodal transport in the national transport system

Intermodal transport is defined as the entirety of transport performed using more than one mode of transport, i.e. road transport, railway, air, maritime, and inland waterway transport. A majority of them, however, are trimodal – maritime-railway-road, which stems from the need to simplify handling in ports and the need to transport the cargo inland as fast as possible using the railway, and also lack of adjustment of inland waterway infrastructure to the capacity of cargo redistribution.

The groups of cargo which are transported by the means of intermodal transport are:

- machines, appliances, electrical and electronic equipment,
- transport equipment
- finished goods, e.g. Furniture,
- food products, including beverages and manufactured tobacco,
- other valuable products, for which the duration of transport is an important factor

2.1.1 Modern logistic infrastructure

In Poland, a cohesive logistic system has still not been formed. The work of researchers, who have voiced the need for and formulated the solutions for creating a national logistic network since the mid-90s, has not been reflected in the actions of authorities at national level. As a result, the demand for warehouse space was managed in an uncoordinated way by private developers and logistics operators, who have built logistic centres in areas being the result of infrastructure development in vicinity and the availability of cheap land. There is a clear trend of passing costs of construction of lacking infrastructure from private investors to local infrastructure managers. Also the methodology of designating Special Economic Zones is questionable – they are often dispersed and lacking good access to road and railway network. Insufficient supply of modern transshipping space allowing for service of cargo shipped in intermodal form is also an issue. According to UTK (The Polish Office of Rail Regulation) data, there is a total of 31 container terminals in Poland, the capacity of which amounts to (excluding port terminals) from 10,000 TEU (Erontrans Radomsko) to 385 400 TEU (Polzug Gądki). The density of terminal infrastructure is thus four times lower than in e.g. Germany. The state of affairs is systematically improving due to investments co-financed from Union funds. In the 2007-2013 financial perspective, a total of 26 projects have been carried out as part of the

Measure 7.4 of POIiŚ (Operational Programme 'Infrastructure and Environment') The Development of Intermodal Transport (involving both infrastructural and rolling-stock projects).

The terminal infrastructure excluding sea ports has been supported with a total sum of almost 300 million złoty and the total value of these investments amounted to more than 850 million złoty.

Underdeveloped and inconsistent intermodal terminal network results in reinforcing the domination of road transport in cargo transport, which is inconsistent with e.g. guidelines of the White Paper on Transport, which intends to gradually decrease the share of road transport in favour of railway and inland waterway transport. Furthermore, the attention is more and more often turned to negative impact of trucks on the urban environment (congestion, noise, pollution), which – as Western European experiences show – will lead to the necessity of formulating cargo mobility management policies in a manner that will decrease transit traffic of heavy goods vehicles in cities and increase the efficiency of vehicles used for cargo operations. Thus, it should be expected that in the coming years, investments in the development of a national network of intermodal logistic centres will be necessary, which is encouraged i.a. funds for intermodal transport investments provided by the EU.

The factors of choosing locations of terminals are varied depending on the nature of an investment. Commercial projects are characterised by domination of economic criteria, the participation of a public party also takes into account social and environmental affairs (e.g. decreasing the nuisance of road transport). Usually, the following are mentioned among the criteria of location choice:

- state of economic development of the region;
- structure of the economy;the volume of trade with other regions in export and import;
- structure of cargo;type, condition and availability of transport infrastructure;
- the availability of land, its legal status and price for its acquisition;
- size of the market and its potential;
- level of competition[17].

The realisation of the investment assuming the construction of an intermodal terminal may be conducted according to scenarios dependent on the institutional nature of the investor and organisation of project financing, as well as the expected option of object management in the later operation phase.

In the case of construction of the terminal, the following scenarios of investment are possible:

1. Terminal as a public investment

A public body or one dependent on State Treasury, with desirable competences and understanding of the demand on the logistics market (in this case, the manager of railway infrastructure PKP PLK) undertakes investments in consultation with the local authority (in responsibility of which lies the planning governance) and other entities (e.g. Special Economic Zone).

After the realisation of the investment, it handles the management of the terminal (e.g. in a similar form to that of Euroterminal Sławków, where PKP LHS is a shareholder) or selects a manager (operator) by public tender.

[17] *I. Fechner, Centra logistyczne. Cel-Realizacja-Przyszłość, Biblioteka Logistyka, Poznań 2004, s. 131.*

2. Terminal as a private investment

The potential of a proposed location may prove so attractive to investors (operators) operating on the Polish intermodal market that there will be no need to engage public funding. The key issue in the realisation of such scenario is the intensification of activities in the planning sphere and real estate economics (in the supposed cooperation of the local authority and SEZ). Also important is the role of PKP PLK, which manages the railway infrastructure. Increasing the transport capacity of the line is in its interest, and the construction of the terminal allows for such. In the current legal status, the most sensible course of action when stimulating the construction of logistic centres would be the development of infrastructure and transport routes of a designated convenient area by the public body and subsequent sale of plots of land to the investors. Such a model is utilised in the construction of a large number of Economic Activity Zones, which allows for access to Union funding.

The common element for all the scenarios is the call for the incorporation of available areas in the vicinity of the terminal into the Special Economic Zone. In the future they would be utilised by the investors, for whom the functioning of the terminal in the vicinity would be an asset while choosing the location of their industrial or logistic activity.

In each of the presented options, the time of realisation of the investment is mainly dependent on the possibility of obtaining the land as well as preparing changes in the planning process and conducting necessary environmental procedures. Estimated time of carrying out the preparatory work is approx. two to three years.

The construction of a terminal is a relatively complex undertaking, since it calls for ensuring the possibility of railway access (sidings) and appropriate bearing capacity of the storage space and potential warehouse facilities. In case of construction of elements significantly increasing the capacity (like e.g. cranes), the time needed to complete the construction process could take from 1 to 2 years.

One of the potential financing sources are Union funds as part of Measure 3.2 POIiŚ – Development of maritime transport, inland waterways and multimodal connections, type C: Intermodal transport, which provide co-financing of up to 50% of qualified expenses, such as:

- seaport authorities;
- enterpreneurs from member states of the EU, who are engaged or plan to be engaged in economic activity on the territory of the Republic of Poland in the field of intermodal transport, including intermodal terminal operators;
- parties engaging in renting rolling stock intended for intermodal transport;
- parties managing railway infrastructure providing direct access to intermodal terminals.

So far in Poland the dominant model of terminal functioning is one in which the managers of infrastructure are commercial ventures, mostly logistic operators. They offer comprehensive logistic services, the scope of which, on the example of one of the intermodal operators, covers such services:

- intermodal – intermodal connections based on a timetable adapted to entries and exits of ships as an alternative to road transport, the possibility of creating dedicated railway connections;

- terminal – depots for shipowners, storage, transshipment, weighing, repair, service and sealing of containers;
- railway freight forwarding – organisation of transport by rail routes along the section port – container terminal;
- road transport – from/to port or between terminals, trucking[18].

Therefore, a modern intermodal terminal is not only a place for handling, but rather a centre gathering entrepreneurships offering a wide scale of services – carriers, freight forwarders, companies providing storage as well as further processing of cargo (e.g. repackaging, bulk breaking), customs and control authorities etc. A well-equipped intermodal terminal besides mobile handling equipment (reach stackers) also has gantries, a properly adapted manoeuvring yard for trucks and railway sidings, the length of which is equivalent to that of a train (about 600 m), thanks to which, reforming of train composition into shorter car groups is not necessary.

An intermodal terminal has positive impact on the economic growth of the region. It provides new workplaces of varied required qualifications, not only associated directly with logistic and transport activity, but also others – thanks to attracting production activity making use of the possibility of shortening the chain of supply. So, reserving areas for the expansion of the terminal or production activity is not without significance.

! **In Poland, the network of intermodal terminals is still underdeveloped and incoherent, which results in strengthening the domination of road transport in cargo transport. Many of newly-created logistic parks only have road connections;**
it has been caused by the passive policy of the State concerning these terminals, including lack of end-result vision and tools of its implementation.

2.1.2 The role of railway in intermodal transport

Considering the strong and still increasing position of road transport in cargo transport and services of transportation of intermodal cargo to maritime handling in Poland, it is necessary to reinforce the role of railway transport. Intermodal rail-road transport still accounts for a small, yet improving share of 5,77% in regard to the mass, and of 8,77% of the total performance in railway transport.

This discrepancy results from i.a. relatively low mass of intermodal trains, in which containers are the basic unit of transport. In other words, almost 10% of traffic (in terms of operation work, meaning the overall distance covered by freight trains in kilometres) on Polish railway network is connected with intermodal cargo transport. It should also be noted that as compared to 2015, in 2016 the total mass of intermodal cargo transported by railway has increased by as much as 25%, while e.g. hard coal transport in regard to transported mass have decreased in 2015, compared to 2014, by almost 4% (from 93,4 million t to 89,9 million t).

Poland differs in this regard from other member states of the EU. In Switzerland, Ireland and Norway, intermodal transport accounts for almost half of performance. In most countries, the tendency is upward (cf. Figure 8).

[18] *Website of an intermodal operator Loconi: http://loconi.pl/79/uslugi [access: 26.07.2017]*

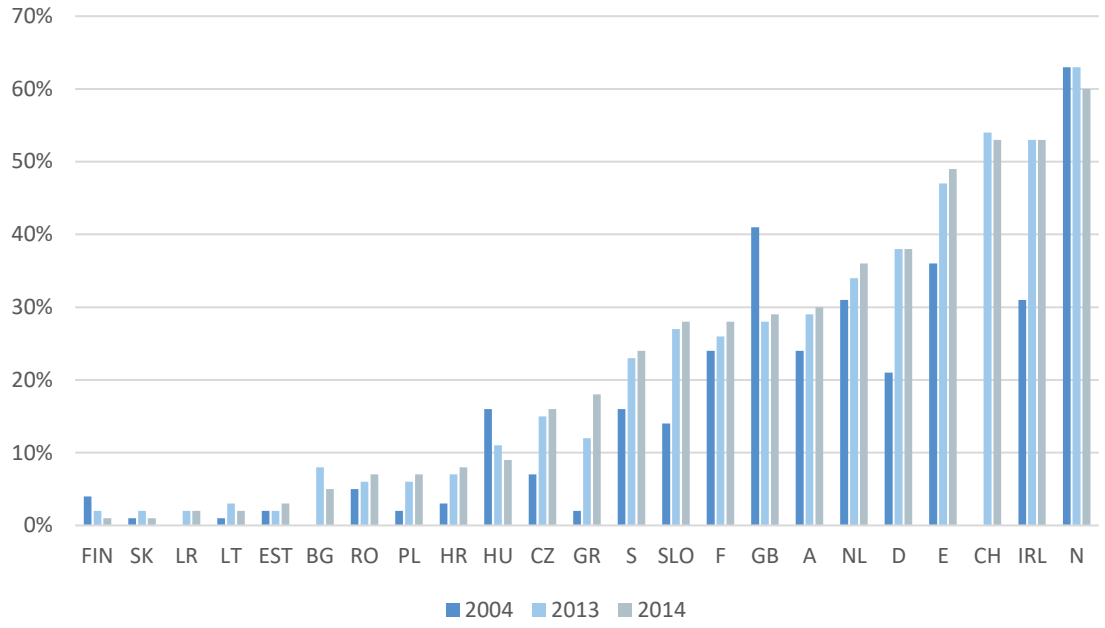

Figure 8. The share of intermodal transport in total performance.

Source: own study based on Eurostat data.

It shows that in the coming years, the relevance of railway infrastructure will increase, in regard to both transport and handling of intermodal cargo, especially in the context of the increase in handling in Polish seaports and development of trans-European railway connections from China to Europe assocated with the idea of the New Silk Road.

It should be noted that the specific nature of intermodal railway transport differs from bulk cargo and is in many terms analogous to passenger transport – contrary to bulk cargo, the mass of cargo is irrelevant, while transit duration and reliability and regularity of shuttling is of consequence, due to the fact that it encourages the consignors to use the connection, similar to passengers. That is why a high frequency of container train transport is a prerequisite for competitiveness, which requires maintaining the connection for a time despite the lack of profitability. One of larger intermodal railway transport operators has decided to increase the frequency of shuttling in the first phase of the project, which was previously characterised by insufficient capacity usage, which resulted in making it profitable. The reason is that a train shuttling two times a week is not a real alternative to road transport. A similar phenomenon usually happens in passenger transport. It is why the introduction of intermodal transport may at first require financial support of e.g. local authorities.

! **Polish railway still remains focused on bulk cargo transport, which deviates from European trends. Intermodal transport, though increasing, is generally lower than in Western European and Scandinavian countries.**
The development of intermodal transport has to be supported not only by infrastructure activities, but also creating frequent and reliable connections for single containers.

2.2 Road connections in the corridor of Central and Lower Oder

As part of IDI (Individual In-Depth Interviews) with entrepreneurs operating in the area covered by the study, the expectations concerning infrastructure development have been diagnosed, particularly domestic and international road infrastructure. To ensure good connection of logistic centres along the Central and Lower Oder, it is vital to finalise the construction of S3 Expressway from Świnoujście to Lubawka in the dual carriageway standard, which is scheduled to be realised until 2024.

Among local connections, respondents have also stressed the necessity to construct the west ring road of Szczecin along with a tunnel under the Oder, which would connect Police with Święta in gmina Goleniów. The investment would allow for connecting Zakłady Chemiczne Police and affiliated ports as well as the polypropylene plant under construction with the network of national roads and motorways by the means of interchange of the A6 motorway in the vicinity of Goleniów.

In turn, for the operation of ports in Szczecin and Świnoujście, there is a need of i.a. reconstructing the road layout in the Międzyodrze region in Szczecin, and reconstructing and extending of the road layout in Świnoujście.

Interlocutors also noted the necessity of further modernisation of the national road network, which would allow for the increase of maximum axle load.

Due to the advanced state of work on the construction project of the S3 Expressway, the lack of more specific expectations towards road infrastructure voiced by respondents and the generally strong position of road transport in cargo carriage, it should be recognised that the development of road network is moving in the right direction and the finalisation of planned investments will ensure sufficient connections of local logistic centres.

! **The finalisation of the S3 Expressway is the key project for the whole area of the Central and Lower Oder. After its realisation, road accessibility of local logistic centres will be improved significantly.**

2.3 Railway connections in the Central and Lower Oder corridor

According to the respondents of IDI interviews, the popularity of railway cargo transport has significantly decreased over the last years, and despite the access to loading infrastructure, in most of the cases the railway is not competitive against cheaper and faster road transport. Further analyses indicated issues with insufficient capacity and inadequate technical standard of the existing railway network in the area of the Central and Lower Oder. In the West Pomeranian Voivodeship it mostly concerns i.a. 401/E59 Railway Line located in the base TEN-T network of the Baltic-Adriatic Corridor. The lack of overhead wire on one of the tracks on the Świnoujście Przytór – Świnoujście Port section results in severe capacity constraints. It is especially important for cargo transport in the

holiday season, when this section experiences higher traffic volumes of long-distance passenger trains[19].

In the Lubusz Voivodeship, infrastructure issues are mostly concerned with the capacity of Rzepin station and the border crossing with Germany on No 3 Rail Line. In Rzepin, only one platform is available for passenger trains, which also hinders the traffic of freight trains – which is signalled by freight carriers using the E20 Railway Line[20].

In the Lower Silesian Voivodeship, railway infrastructure issues are mostly concerned with the 277 Opole – Wrocław line on the Biskupice Oławskie – Jelcz Miłoszyce section, which is located in the core TEN-T network, within the C-E30 line. There are restrictions in maximum train speed on one of the tracks, which is especially detrimental for freight trains, the large number of which is the result of avoiding the No 132 Railway Route, where intensive passenger transport between Opole and Wrocław is conducted.

On the other hand, freight operators on the No 276 Wrocław – Międzylesie Line (which is part of the TEN-T comprehensive network), on the Strzelin – Kamieniec Ząbkowicki – Kłodzko Miasto section, signal that their requests for allocation of train paths are rejected, and that there are insufficient tracks on Kłodzko and Kamieniec Ząbkowicki stations. Low capacity of infrastructure results from maximum speed limits to 30-50km/h on the line and lack of relevant block posts[21].

An important route in terms of freight transport to countries located south of Poland is the No 139 Railway Line, which is single-track on the Żywiec – Zwardoń section, and the line speed there amounts to only 50 km/h, which, in conjunction with the insufficient number of passing loops, forces prolonged standstill of trains, which in turn causes the decrease of capacity. The line to Zwardoń is located in the base TEN-T network. Difficulties connected with the fact that the line is single-track are also reported along the No 61 and 144 Railway Lines on the Lubliniec – Fosowskie – Opole sections. Increasing utilisation of the route associated with routing of EIP trains connecting Warsaw and Wrocław and other long-distance passenger trains (e.g. bypasses of Kraków – Wrocław connections) results in lower capacity, especially for freight trains utilising the No 61 and 144 Railway Lines in case of difficulties in the area of Gliwice and Kędzierzyn-Koźle[22].

Some of the respondents of IDI interviews also noted the insufficient development of the track layout in the vicinity of Szczecin port. Currently, the railway access to a large area of the port is based upon the spur of the siding running across the bridge over the Gdańska street, which is characterised by insufficient parameters. The construction of an additional bridge would allow for increasing the capacity of the connection and would create an alternative ensuring the handling capability in case of renovation or malfunction.

Suprisingly, IDI respondents have not listed the poor condition of line infrastructure among the reasons for lack of competitiveness of the railway, rather pointing at insufficient density of unloading sidings which would allow for shipping the product to the geographically dispersed market, and the necessity of forming block trains which is not in accordance with the implemented business strategy. It means that to encourage railway transport, there is a need for both projects

[19] *Piotrkowski J., Analiza odcinków sieci kolejowej o ograniczonej przepustowości, UTK, Warszawa 2014, s. 25.*
[20] *Piotrkowski J., Analiza odcinków sieci kolejowej o ograniczonej przepustowości, UTK, Warszawa 2014, s. 20-23.*
[21] *Piotrkowski J., Analiza odcinków sieci kolejowej o ograniczonej przepustowości, UTK, Warszawa 2014, s.19.*
[22] *Ibidem*

improving the parameters of railway lines and investments in increasing density of unloading points (including restoration of former sidings, cf. Figure 9) and changes in the transport offer of the operators. Local authority may thus function as a mediator facilitating cooperation between cargo consignors and operators and infrastructure managers, supporting establishment of e.g. scheduled intermodal connections most important logistic centres in the country or creation of new sidings.

Figure 9. Once very extensive, the railway infrastructure in the port in Kędzierzyn-Koźle now needs full restoration

Source: Own study

! In order to increase popularity of railway transport, it is vital not only to invest in improving the parameters of railway lines, but also to rebuild sidings, invest in increasing the density of unloading points and changes in transport offers of the operators, which may require the support of local authorities.

2.4 The potential of inland waterway transport

Accessibility of the Oder Waterway is a significant competitive advantage of Szczecin-Świnoujście seaports over other Baltic ports, fed only by road and railway transport, and it is also important for the development of the whole region. Regulating the Oder Waterway will make the transport offer along the Baltic-Adriatic corridor significantly more attractive, though it requires undertaking additional actions to recreate and modernise the port infrastructure with focus on intermodal functions (cf. Figure 10).

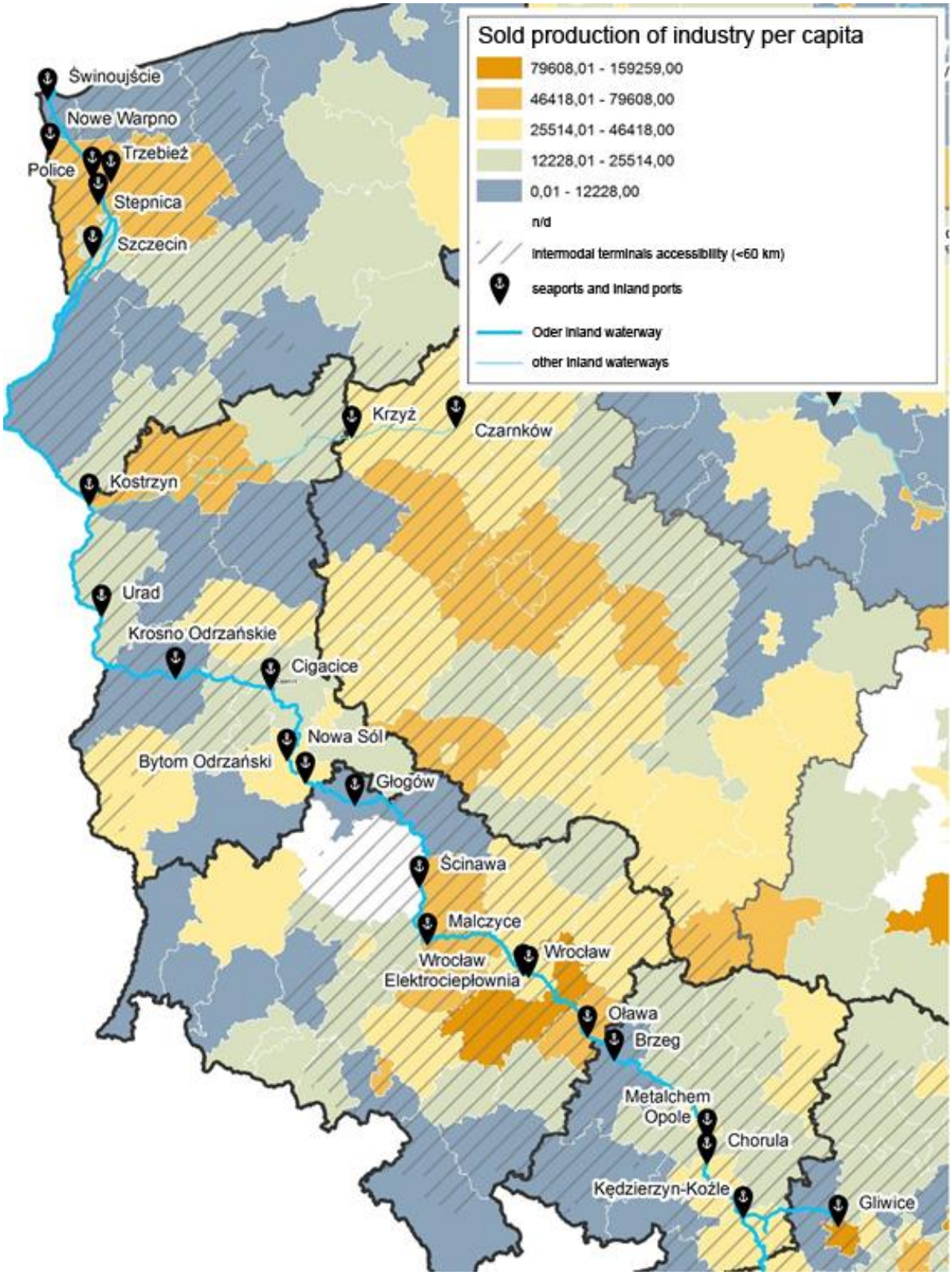

Figure 10. River ports and access to intermodal terminals and the sold production of industry per inhabitant in the area of Central and Lower Oder

Source: Own study based on the data of UTK, GDDKiA and PKP PLK.

The current state of the Oder made basically all the port locations lose their character. None of the river ports are continuously exploited, and the decapitalisation of assets impedes or even precludes undertaking any actions directly connected to water transport and using the Oder as default transport connection (e.g. power equipment industry). Historically, the Oder generated the emergence of production facilities of specific profiles in cities located along its stream, so a short-term improvement of the navigability can contribute primarily to the prosperity of the existing ports, renovation and expansion of production base of the businesses operating in a traditional cooperation with the Oder water transport, and only in the long-term – gaining new investors which exploit the neighbour effect. Having in mind the low level of the investment in the majority of the port areas, there is a big potential of attracting new parties and extending the existing ones.

It is thus reasonable to properly shape the development policy in the areas leaning towards the rivers, and most importantly – in port areas. Currently, the locations mainly have the character of brownfields (investments based on the existing degraded infrastructure), which forces additional efforts to make the investment activities in a given area more attractive. The cost of the restoration of the area itself, not to mention the social tissue, will be much higher than in the case of investments of the greenfield type (investments realised from scratch in a new place), that is why investors need incentives, which will turn their attention specifically to the areas on the basis of which it is possible to achieve the highest synergy of positive business effects and realize the goals of the socio-economic policy. Guiding the attention of investors towards areas along the Oder supports achieving the following goals of public policies character:

- development of degraded areas – it contributes to the revitalisation of problematic areas, revitalisation of city quarters, which are currently forgotten and are islands of poverty, which is also a kind of "recovering" the areas difficult to exploit in an alternative way along with keeping other free areas for alternative use;
- environmental protection – a holistic approach to transport services allows such a way of shaping the supply chain which exploits the means of transport, which in given conditions are the least of a nuisance to the environment;
- labour market – investments in the port districts revitalise the local labour markets, including the labour markets for the unqualified labourers, and they also generate workplaces in the vicinity;
- sustainable development of transport – it reflects in the higher safety and reliability of supplies thanks to including different modes of transport in the transport system;
- rationalisation of spatial planning – in cities and regions the whole space is used, fragmentation of cohesive areas is reduced, "white spaces", which are often large areas of former ports, are eliminated;
- sustainable development – long-term nature of the investments in inland waterway transport makes the capital expenditures contribute to launching the process of long-term development based on solid foundations.

Due to the historically well-developed railway network in western Poland, the majority of ports had good access to such infrastructure, which was in turn well connected with the most important railway lines in the area. Suspending the regular handling has, however, contributed to the reduction of maintenance works and gradual degradation or complete physical liquidation of sidings and

railway line sections, so that is why the resumption of the activity of ports will have to entail restoration of the track layouts.

! **The resumption of waterway transport on the Oder Waterway and including it in the Baltic-Adriatic Corridor might be an additional asset boosting the potential of the macro-region and creating its competitive advantages.**

2.4.1 The potential of inland ports in the West Pomeranian Voivodeship

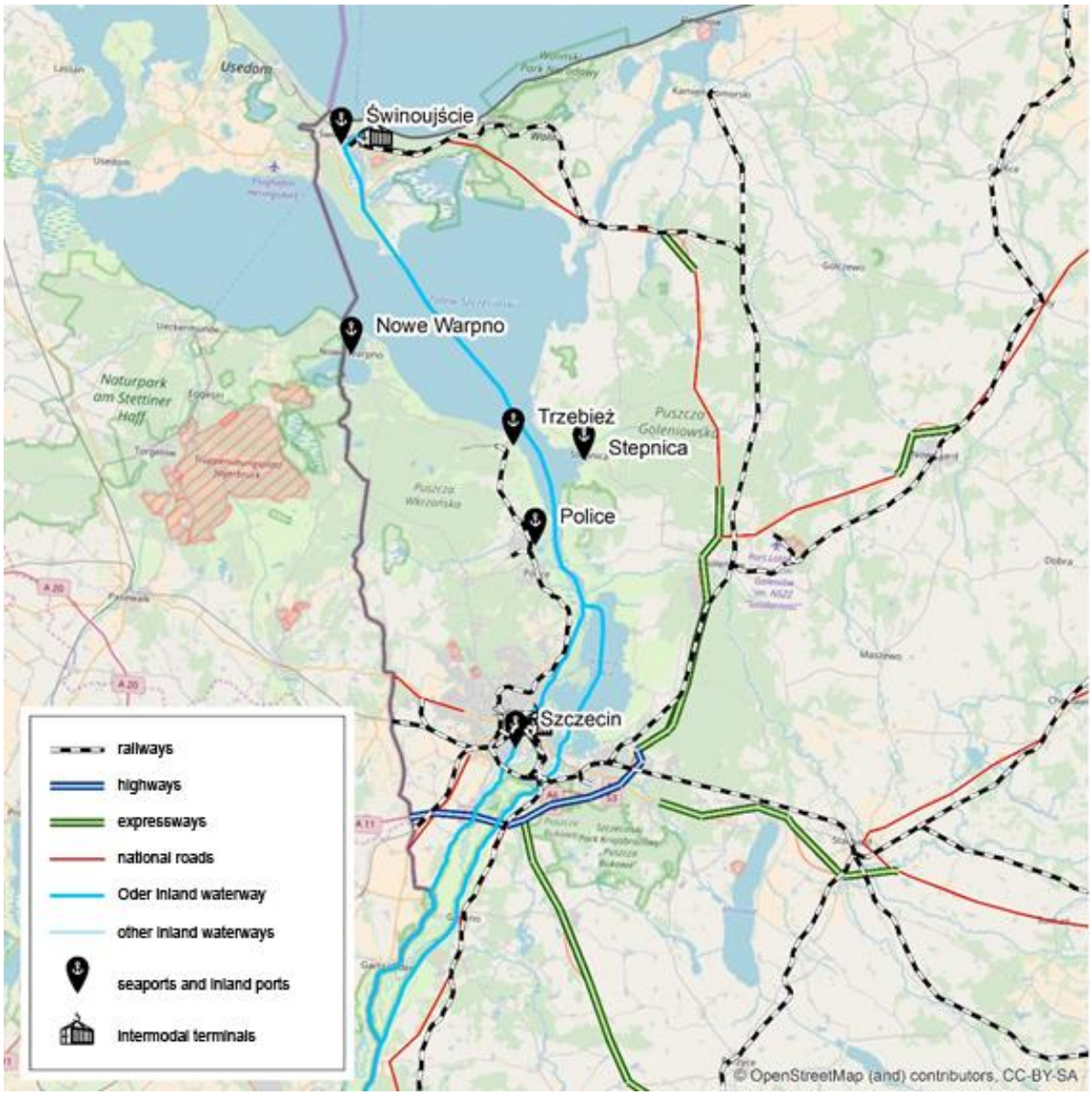

Figure 11. Location and transport infrastructure in the vicinity of river ports in West Pomeranian Voivodeship

Source: own study based on data of OpenStreetMap.org.

In the West Pomeranian Voivodeship, sea ports are the most relevant pieces of infrastructre also for inland wayerway transport (cf. Figure 11, Table 1), as the points of contact with maritime shipping.

Ports in Szczecin and Świnoujście **do not have a separate area intended for mooring and service of inland waterway vessels.** Those vessels are served at the same quays as sea ships. Both the

quayside infrastructure and its suprastructure which exist in the ports have not yet been a bottleneck for the efficient service of the handling from/on barges. Inland barges are not required to pay any tonnage fee in Szczecin or Świnoujście.

A strong advantage of the Szczecin-Świnoujście port complex in comparison to other Baltic ports is the availability of areas for further development. However, the following issues remain unaddressed:

- moorages for the barges,
- system solution for the reception of ship-generated waste from inland waterway transport units,
- creation of modern information platform for cargo senders and inland shipowners.

Besides regular transport (mainly of coal in export relation to Germany), inland waterway transport is used also for internatl transport between the quays of Szczecin-Świnoujście port complex or other ports located at the mouth of Oder.

The port in Szczecin can serve as the most important logistic centre for Oder waterway transport, and also a mounting and dismounting point of large-scale structures (equipment for offshore wind energy purposes, mining machinery, steel structures). It can be also used a destination point of municipal waste transport to the planned incinerator, located within the port areas.

Also the port in Police, which covers 4 handling terminals, is very relevant for the region. Initially the port served mainly as the internal harbour of the "Police" Chemical Plant – it provided supplies of imported raw materials (bulk) and export of products, and also supplies of other materials necessary for operation (aggregates for plant construction, coal). Because of the capacity reserve, the port in Police also performs handling for external clients, which puts it in the fifth place in respect of handling turnover among national sea ports.[23] The port in Police is characterised by advantageous location and availability of areas for development. 117 ha of land directly next to the sea port, also next to the barge port and Jasienica, convenient for port, logistic and industry development, were designated to investors. It is worth mentioning that the port in Police is especially predisposed to developing the activities connected to production and export of oversize elements – from the port in Police towards Baltic there are no headroom limitations.

Nearby, in Szczecin Lagoon, there are also smaller mixed-sea-inland ports – in Trzebież, Stepnica and Nowe Warpno. The ports of Trzebież and Nowe Warpno are currently used for fishery and tourism, regular handling is only done in the port of Stepnica. The port of Stepnica can ultimately develop handling functions, both in sea vessel service (including especially short sea shipping) and for the purposes of inland waterway transport – in bulk cargo and timber transport.

Table 1 - Potential of inland ports in the West Pomeranian Voivodeship

Source: Own study

WEST POMERANIAN VOIVODESHIP

[23] *Transport – wyniki działalności 2016 r., GUS, Warszawa 2017 r.*

WEST POMERANIAN VOIVODESHIP

Figure 12. Road-rail terminal in the Port of Szczecin

Source: Own study

Szczecin (based on the sea port)	Access to the transport infrastructure: • direct access to an extensive system of sidings and a railway line (E59 and CE59), • direct access to the No. 10 National Road which is connected to the A6 motorway and the S3 Expressway. Possibility of development: • extensive existing infrastructure, • areas available for development. Possible designation: • logistic centre, • handling of high-volume structures, • destination point the transportation of municipal waste to the planned waste incineration facilities.
Świnoujście (based on the sea port)	Access to the transport infrastructure: • direct access to sidings and railway line (E59 and CE59 in most of the port (Wolin), lack of access to railway in the part of the port located on the island of Usedom (i.a. a fuel base is located there), • direct access to the No. 3 National Road (ultimately S3). Possibility of development: • extensive existing infrastructure, • areas available for development. Possible designation: • logistic centre,

WEST POMERANIAN VOIVODESHIP	
Stepnica	• intermodal, • agro terminal, • liquid fuels. Access to the transport infrastructure: • lack of access to railway, • approx. 15 km away from S3 road. Possibility of development: • areas available for development. Possible designation: • bulk cargo, • timber.

2.4.2 The potential of inland ports in the Lubusz Voivodeship

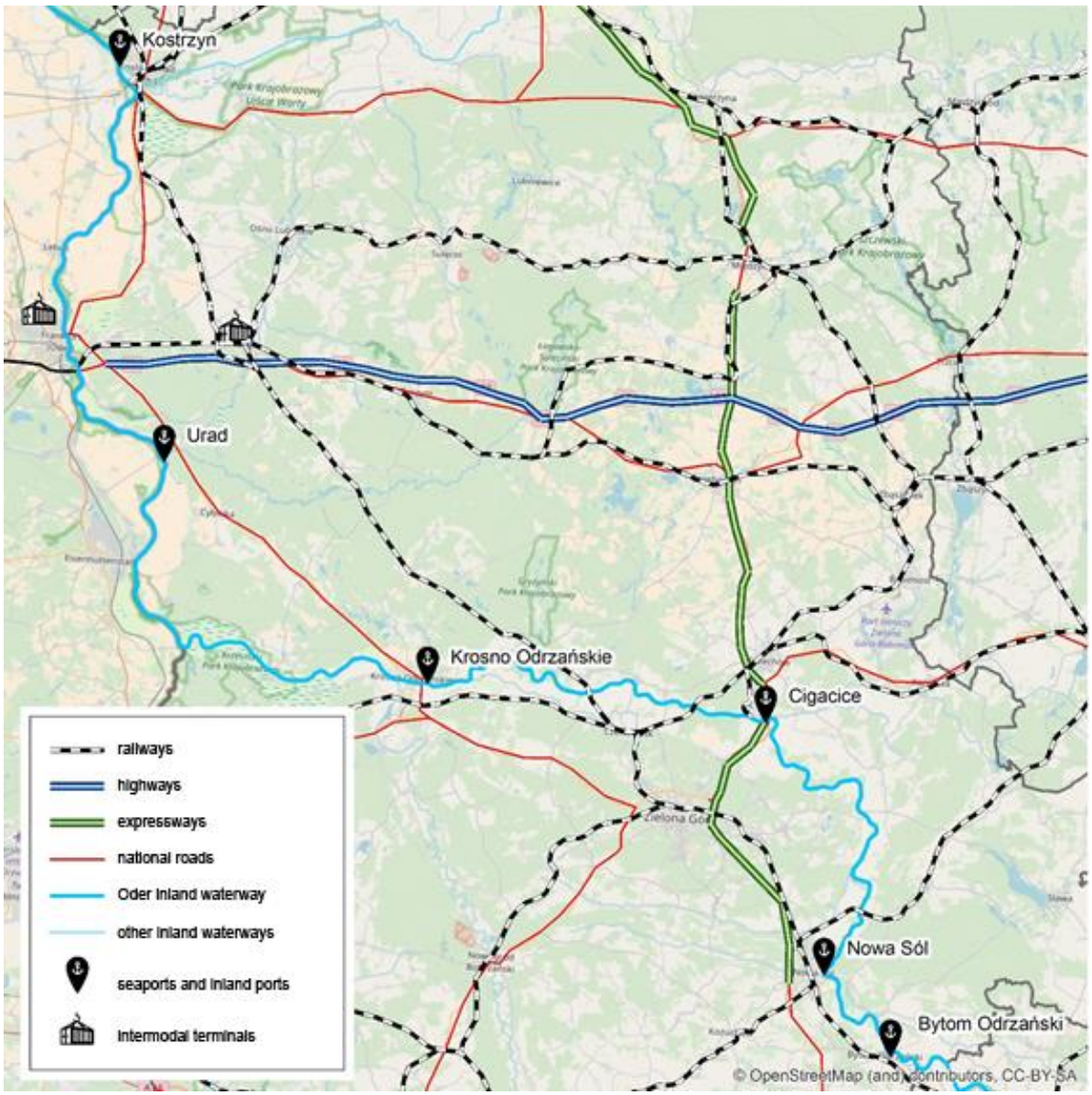

Figure 13. Location and transport infrastructure in the vicinity of river ports in Lubusz Voivodeship

Source: Own study based on data of OpenStreetMap.org.

In the Lubusz Voivodeship (cf. Figure 13) the promising locations for industry development on the basis of the existing inland ports are: Kostrzyn nad Odrą (paper industry), Cigacice (very convenient acces to the road network, good access to railway – logistic junction) and Nowa Sól (well connected with the road system).

Moreover, a place of potential for connecting road, railway and inland waterway transport is the crossroads of the western branch of the Baltic - Adriatic Corridor with th North Sea - Baltic Corridor (A2 motorway and 3/E20 railway line). The situated neraby city of Słubice is approx. 180 km far from Poznań, around which function well-organised national intermodal container terminals. In the vicinity, there are also road handling terminals along with warehouses and the intermodal terminal

of Rzepin (approx. 20 km from Słubice). The extended transport and logistic infrastructure functions also on the German side. Over the last years approximately 1,5 billion euros was invested in the region around Frankfurt (Oder) and Eisenhüttenstadt, and i.a. Freight Village Frankfurt (Oder).

In Słubice there is a river port, but it is located in the vicinity of the city centre and green areas and, while currently serving as a marina for touristic purposes, it is not suitable for development for logistic purposes. Approx. 15 km to the South of Słubice there is a river port in Urad, on the basis of which a construction of a complex modern intermodal logistic centre is possible, targeted at value added logistics and further transport of cargo by the A2 East-West motorway. The port has convenient location in relation to transport network. In 2013, a Dutch investor was interested in transforming the port in Urad into a container terminal. Currently a company called Urad Logistic encourages cargo consignors to include waterway transport in the logistic chain in the Amsterdam – Poland relation. However, the full exploitation of the potential resulting from the location on the crossroads of transport corridors requires large-scale investments – constructing from scratch a modern handling port along with proper infrastructure, modernising access roads leading to the A2 motorway, restoring the demolished 386 railway line along with constructing an over 600 metres long, multiple track siding. Despite the fact that the location is based on the existing port, the scale of investment needed is similar to a construction of a brand new port along with a logistic park.

Table 2 - Potential of inland ports in the Lubusz Voivodeship

Source: Own study

LUBUSZ VOIVODESHIP	
Kostrzyn	Access to the transport infrastructure: • direct access to the siding connected with the 203 railway line Tczew – Kostrzyn, nearby the 273 railway line ("Nadodrzanka"), • nearby (approx. 1 km) the national line no. 31. • approx. 40 km from the A2 motorway, approx. 60 km from S3 road. Possibility of development: • limited (brownfield). Possible designation: • logistic centre, • paper industry.

LUBUSZ VOIVODESHIP

Figure 14. Port in Urad

Source: Own study

Urad	Access to the transport infrastructure: • in the future direct access to the 386 railway line Cybinka – Kumowice demolished in 2013, running throug a road terminal in Świecko to the international railway line E20 and intermodal terminal in Rzepin (approx. 25 km by railway), • approx. 15 km to the A2 motorway being a part of the North Sea – Baltic Corridor, approx. 65 km to the S3 road, • approx. 12 km to the Oder-Spree Canal allowing a connection with the German waterway system. Possibility of development: • areas available for development (greenfield). Possible designation: • logistic centre.

LUBUSZ VOIVODESHIP

Figure 15. Port in Cigacice

Source: Own study

Cigacice	Access to transport infrastructure: • direct access to the 393 railway line – the line requires renovation (according to PLK maximum speed permitted is 0 km/h; the line was taken over by UM Sulechów), • distance to the S3 road approx. 3,5 km, • necessity to increase the technical parameters of road system in the immediate vicinity of the port – i.a. Mickiewicza street which branches off Kwiatowa street leading to the Rockwool industrial plant. Possibility of development: • limited (brownfield, touristic marina) because of the existing in the neighborhood single-family housing – necessity of planning activity reserving land for nonresidential functions. Possible designation: • bulk handling, • logistic centre.

LUBUSZ VOIVODESHIP

Figure 16. Port in Nowa Sól

Source: Own Study

Nowa Sól	Access to transport infrastructure: • nearby a siding connecting the port with the 273 railway line ("Nadodrzanka"), • Approx. 3 km from the S3 road, through runs the 315 regional road (a new bypass of Nowa Sól. Possibility of development: • high availability of land – limitations resulting from using the neighboring areas for recreational purposes. Possible designation: • bulk handling, • logistic centre.

2.4.3 The potential of inland ports in the Lower SIlesian Voivodeship

Figure 17. Location and transport infrastructure in the vicinity of river ports in Lower Silesian and Opole Voivodeships

Source: own study based on data of OpenStreetMap.org.

In the Lower Silesian Voivodeship (cf. Figure 17), development of inland ports for intermodal and industrial purposes is viable in Głogów (metallurgy combine service), Malczyce (shipbuilding industry), Wrocław (huge potential for distribution of customer goods).

Wrocław Agglomeration is already an important logistic centre which has three big intermodal terminals. Complementation of the logistic offer with water transport mightincrease the importance of Wrocław and reinforce the economic connection with the ports in Szczecin and Świnoujście. Wrocław City Port is located too close to the city centre, which results in the limited access for trucks. It is, however, well connected with the railway network, it could be used for a pilot project of FMCG distribution by waterway. Port in Popowice, once connected with the railway infrastructure

and having good access to the road system, was well-suited for the role of a modern logistic centre. However, the area of the port was attractive for residential purposes and was taken over by a developer. Consideration should be given to the construction of a new port, e.g. in the vicinity of the Millenium Bridge.

Table 3 – Potential of inland ports in the Lower Silesian Voivodeship

Source: Own study

LOWER SILESIAN VOIVODESHIP	
Głogów	Access to transport infrastructure: • direct access to the 273 railway line ("Nadodrzanka"), • nearby the national road no. 12, approx. 13 km from the S3 road, • lack of the possibility of reaching the port area by road transport: - restrictions in capacity of objects on the east side, - low technical standard of Krochmalna street and lack of connection with the ring road for Głogów along the No 292 Provincial Road. Possibility of development: • areas available for development (brownfield, greenfield). Possible designation: • bulk handling, • metallurgic combine service, • intermodal.
Malczyce	Access to transport infrastructure: • in the past, direct access to the No 347 railway line connecting the port with the No 275 railway line; the line needs reconstruction and inclusion in the track layout of No 275 railway line. Possibility of development: • areas available for development (brownfield, greenfield). Possible designation: • shipbuilding industry, • bulk handling.

LOWER SILESIAN VOIVODESHIP

Figure 18. Wrocław – City Port

Source: Own study

Wrocław – City Port	Access to transport infrastructure: • a siding with direct access to the No 143 railway line, • limited road availability (city area). Possibility of development: • limited (brownfield). Possible designation: • bulk handling, • retail logistics with distribution in the area of Wrocław Water System.

2.4.4 The potential of inland ports in the Opole Voivodeship

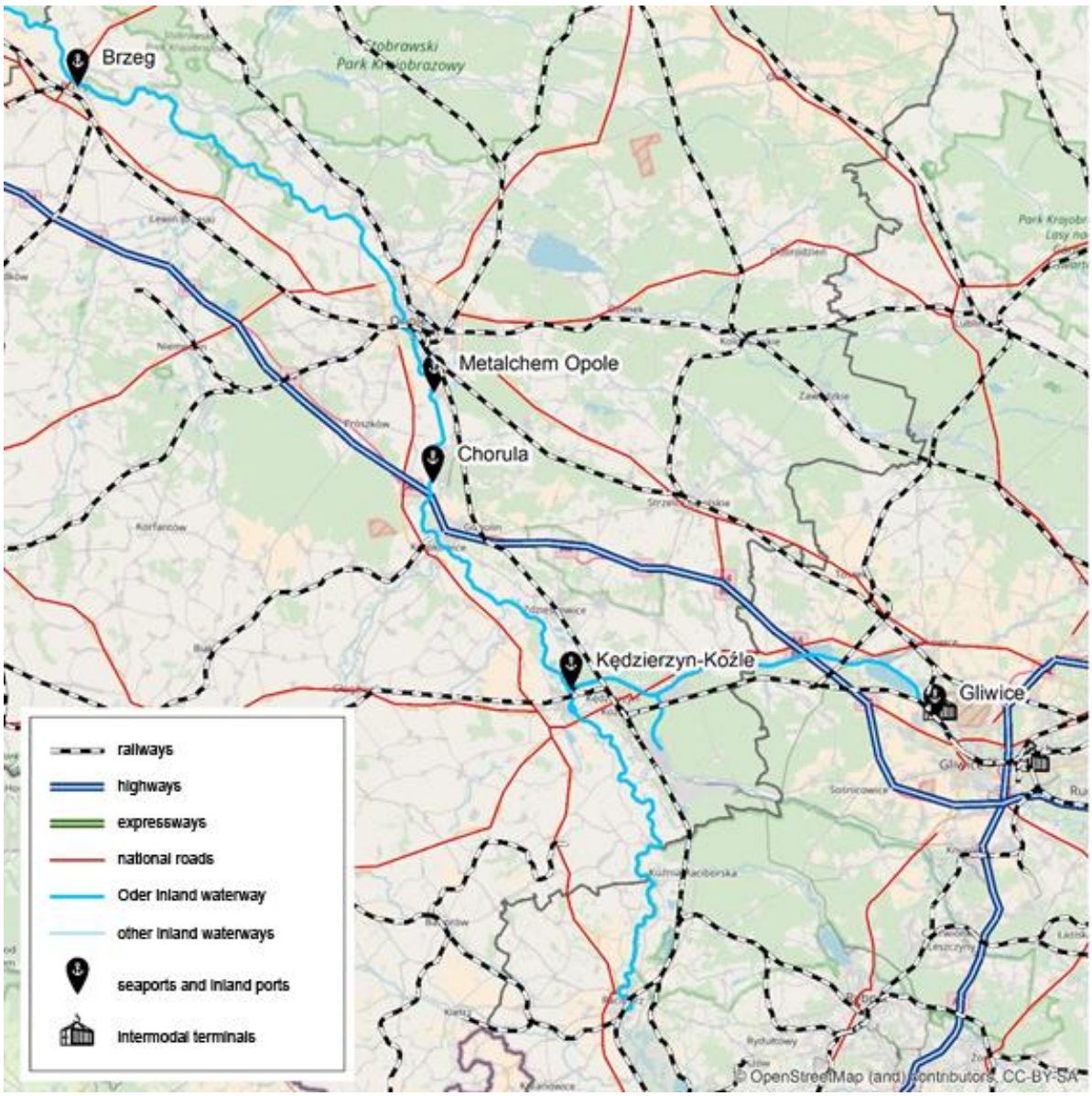

Figure 19. Location and transport infrastructure in the vicinity of river ports in Silesian and Opole Voivodeships

Source: own study based on the data of OpenStreetMap.org.

In Opole Voivodeship (cf. Figure 19), it is recommended to develop the ports in Opole (aggregate, steel industry, development of economic zone, using the Oder for FMCG distribution) and Kędzierzyn-Koźle (petrochemical terminal, multimodal logistic centre).

Table 4 – Potential of inland ports in the Opole Voivodeship

Source: Own study

OPOLE VOIVODESHIP

OPOLE VOIVODESHIP

Figure 20. Opole-Metalchem port

Source: Own study

Opole-Metalchem	Access to transport infrastructure: • direct access to a siding connecting with the No 136 railway line, • approx. 15 km to the A4 Motorway. Possibility of development: • good condition of infrastructure, • areas available for development within the SEZ. Possible designation: • steel industry, oversize cargo, • service of industrial zone, • intermodal.

OPOLE VOIVODESHIP

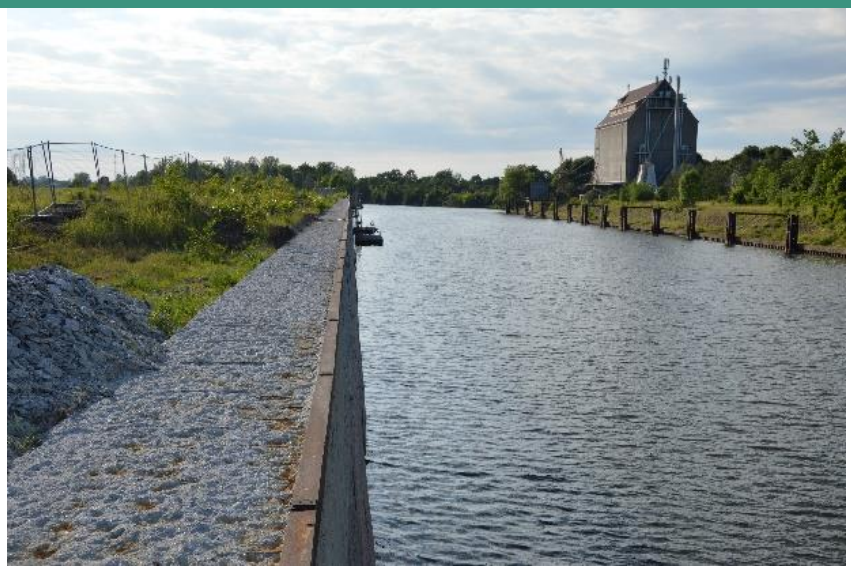

Figure 21. Port in Kędzierzyn-Koźle

Source: Own study

Kędzierzyn-Koźle	Access to transport infrastructure: • in the past, direct access to No 174 electrified railway line connecting the port with No 137 line (needs reconstruction), • approx. 2 km to the No 40 national road, approx. 25 km to the A4 motorway. Possibility of development: • biggest inland port, • large areas available for development (brownfield, greenfield). Possible designation: • terminal for liquid fuels, • intermodal, • agro terminal.

! **Numerous existing inland ports along the Oder may serve as intermodal logistic centres after reconstruction, however, it calls for making a number of investments, i.a. restoration of damaged rail sidings and railway line sections.**
The ports in Cigacice, Nowa Sól and Głogów are of significant potential as a location for creating an intermodal terminal. These ports are located more than 60 km from other intermodal terminals, while having good access to road infrastructure (S3 expressway), and railway infrastructure ("Nadodrzanka", / CE-59).

2.5 SWOT analysis for the logistic sector in the Central and Lower Oder region

Table 5 – SWOT analysis for the logistic sector in the Central and Lower Oder region

Source: Own study

STRENGTHS (S)	WEAKNESSES (W)
• Developing Szczecin-Świnoujście port complex; • location in the Baltic-Adriatic transport corridor, which is the shortest connection between Scandinavia and Southern Europe; • conveniently located, undeveloped investment areas possible to be assigned to port-located, logistic and industrial purposes; access to ODW; • high attractiveness for localization of economic activity requiring the possibility of oversize transport along the ODW; • developed sector of maritime transport; • advanced construction of basic road connections (S3)	• Insufficient capacity of railway infrastructure considering increasing demand; • ODW not being a part of TEN-T network; • degraded ODW infrastructure preventing regular shipping services; • lack of formalized cooperation between stakeholders located in the catchment area of main transport corridor; • lack of high quality container terminal in the Szczecin – Świnoujście port complex; • low quality of road infrastructure in the nearest vicinity of potential locations of logistic and industrial activity, e.g. in river ports • low quality and insufficient number of spatial development plans resulting in allocation of areas naturally inclined for industry and logistics for residential and recreational functions;
OPPORTUNITIES (O)	**WEAKNESSES (W)**
• Development of international cross-border and corridor cooperation; • increasing international trade; • good transport availability of German and Swedish markets; • strengthening the cooperation between Poland and The Visegrád Group and development of cross-border infrastructure; • favorable orientation of national transport policy for investments in maritime and inland waterway transport; • construction and modernization of road and railway infrastructure by PKP PLK and GDDKiA.	• Domination of bulk cargo in railway cargo transport – lack of intermodal connections; • increasing containerization of cargo in international transport chains in regard to lack of possibility of servicing container units in the Szczecin-Świnoujście port complex; • realization of investment projects inadequate to the needs of cargo generators; • already formed logistic chains based on competing sea ports; • restrictions in infrastructure development resulting from conditions of environmental protection.

2.6 Recommendations

- In Poland, the network of intermodal terminals is still insufficiently developed and inconsistent, which results in strengthening the domination of road transport in cargo transport. It is necessary to formulate the target vision of the network of intermodal terminals and logistic chains, as well as the measures of their implementation.
- The finalisation of the construction of the S3 Expressway is the key investment for the whole area of the Central and Lower Oder. After its realisation, the road availability of local logistic centres will significantly improve.
- In order to increase the popularity of railway transport, it is vital not only to invest in improving the parameters of railway lines, but also to rebuild sidings, invest in increasing the density of unloading points and changes in the transport offer, which may require the support of local authorities.
- Numerous inland waterway ports existing along the Oder after redevelopment may serve as intermodal logistic centres (parks) connecting waterway transport with road and railway transport, however, it requires undertaking a number of investments i.a. in reconstruction of degraded sidings and railway line sections.

3. Analysis of benefits of the TEN-T network implementation in regard to the cooperation between West Pomeranian Voivodeship and Skåne County

3.1 Economic and transport connections between Poland and Sweden

Trade between Poland and Sweden increased by 30% since 2010. This dynamic growth makes Sweden the most important economic partner for Poland among all Scandinavian countries. In 2015, freight export to Poland made up 3,1% of total Swedish freight export. The value of import from Poland was in turn 3,5%. Both export and import experience stable growth, which are influenced by periodic changes in the economic trends.

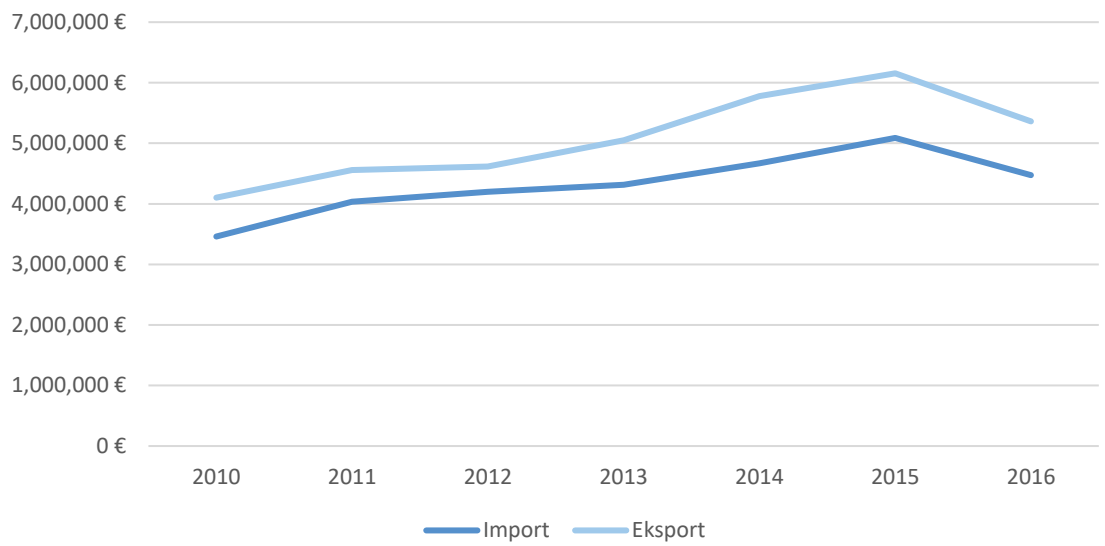

Figure 22. Trade between Poland and Sweden

Source: Own study based on the data of GUS

Main trade partners of Sweden are Germany, Great Britain and Denmark.

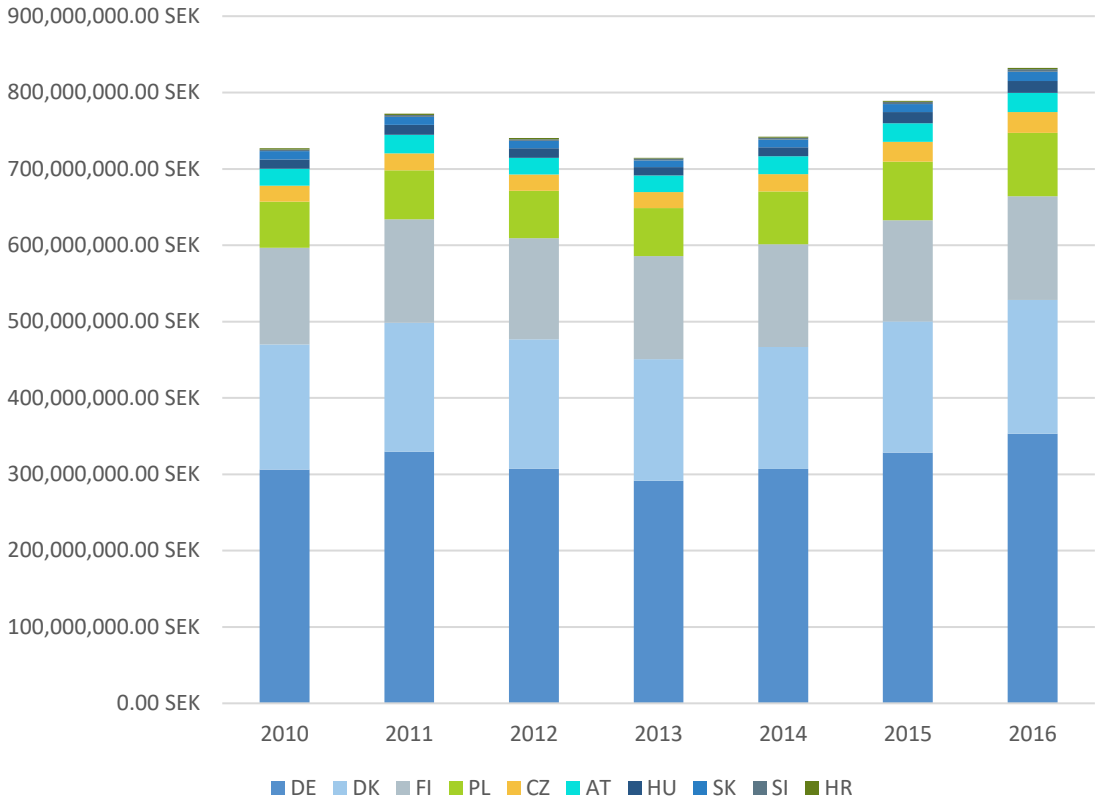

Figure 23. The volume of trade between Sweden and chosen countries in the years 2010-2016.

Source: Own study based on the data of Statistics Sweden

Countries located along the Baltic-Adriatic transport corridor such as Czech Republic, Slovakia, Hungary, Slovenia, Croatia and Austria have nominally much lower trade with Sweden than Poland, however overall they have a slightly higher trade with Sweden than Poland.

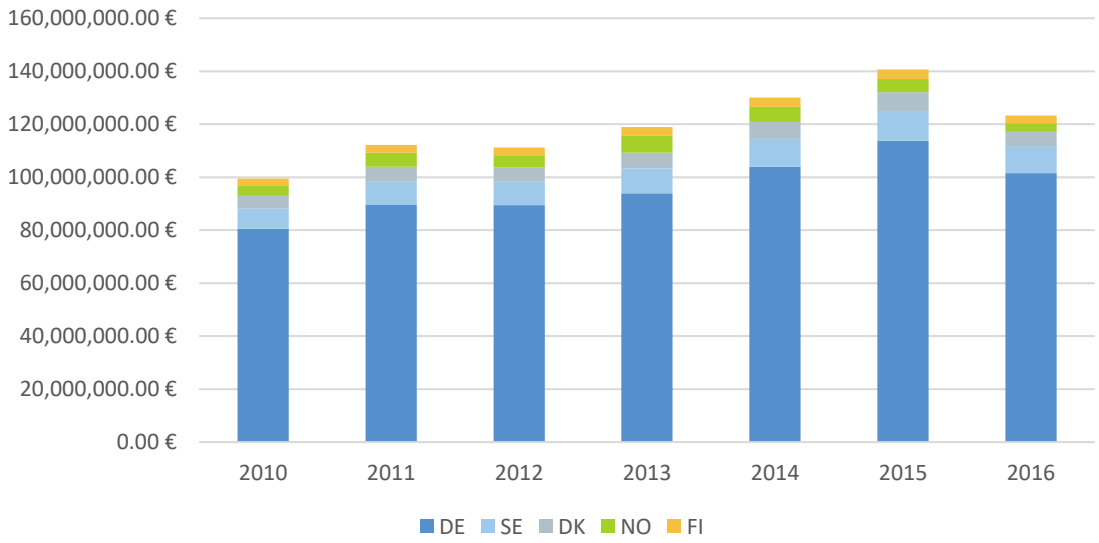

Figure 24. The volume of trade between Poland and chosen countries in the years 2010-2016.

Source: Own study based on the data of GUS

The biggest trading partner of Poland, similarly to Sweden, is Germany. The volume of trade with Scandinavian countries is for Germany relatively low, but the highest in the case of Sweden.

Shipowners serving the trade are TT-Line, Unity Line and Stena Line. The first two companies operate the connections between Świnoujście and Trelleborg. Stena Line offers ferry connections between Tricity ports (Gdańsk, Gdynia) and Karlskrona. Recently, there has been an increase in the importance of the market of ferry connections between Sweden and Poland. It happens mainly thanks to the existence of Świnoujście-Trelleborg connections, at which numbers of transported trucks and semi-trailers, and also passenger cars and passengers, are growing. A challenge in further growth of cargo at this connection is the limited handling capacity of the ferry terminal in Świnoujście, which do not meet the needs of carriers.

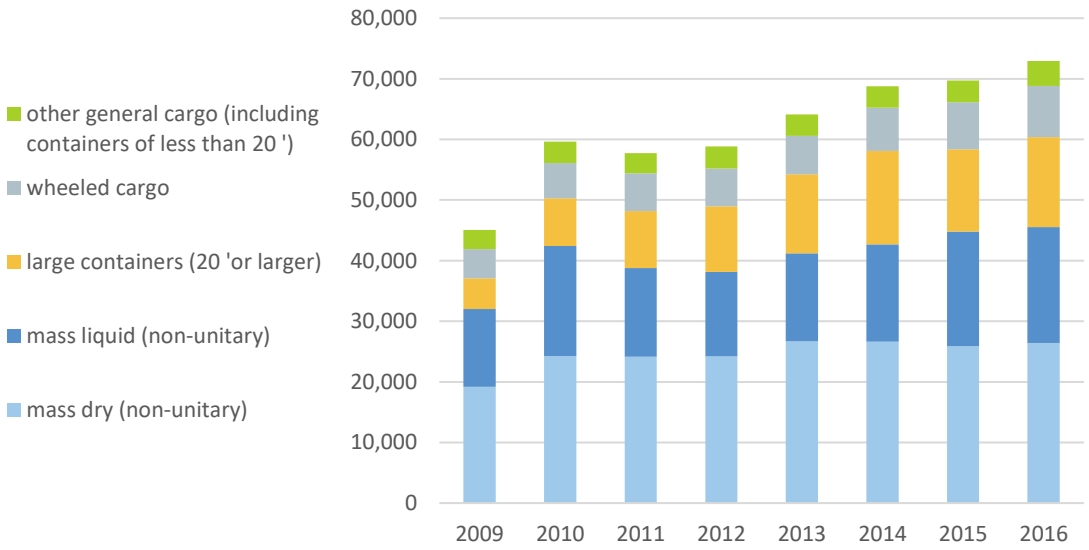

Figure 25. Cargo turnover in Polish sea ports in accordance with cargo categories in the years 2009-2016. [thousands of tons]

Source: own study based on the data of GUS.

In Polish sea ports, the volume of the containerised freight is constantly growing. Since 2009 it almost tripled, which is impressive regarding its moderate increase in other categories (from 1,12 to 1,89). The growths are noted mostly thanks to the ports of Tricity (Gdańsk, Gdynia). In 2016 the turnover of cargo in containers in Szczecin was 498,5 thousand tonnes, which made up slightly more than 3% total container turnover volume in Polish ports. The increase in the number and mass of the transhipped cargo was mainly influenced by the investments realised in the ports of Tricity and in their infrastructure. The construction of a deep-sea terminal, improvement of the handling infrastructure and direct railway access to ports caused the increased interest of shipowners and the inclusion of Tricity in international logistic chains. In this regard, the ports in Szczecin and Świnoujście are currently less competitive, especially because of the limits of depth and access to the intermodal terminal in Szczecin. The technical parameters of railway lines leading to ports and inland are also unsatisfactory.

Trade with Sweden is especially important for the Szczecin-Świnoujście ports, because maritime transport in this relation still maintains its importance. It is estimated that approx. 91% of export and

81% of import from this country is processed through ports, and the biggest share, approx.2/3, passes through the Szczecin-Świnoujście corridor.

Considering the ongoing development of containerisation, which also concerns Sweden and growth of intermodal cargo transport, to increase international trade, limit transport cost and decrease the environmental impact, a challenge should be addressed, which mostly concerns the railway infrastructure in Poland. The key problems of railways include:

- limited number of intermodal terminals,
- terminals are unadjusted to modern logistic systems,
- limited load capacity on railway lines,
- capacity constraints,
- train length limits,
- delays,
- unstable timetable,
- limited number of platforms for semi-trailer transport[24].

! **Trade between Sweden and Poland can be supported by the development of intermodal transport infrastructure and improvement of railway transport. The widespread growth in containerisation in logistic chains results in the decrease in the costs of transport with the simultaneous increase in the efficiency of carriage and positive impact on the environment. An opportunity for the Baltic-Adriatic corridor, and in a wider scope, also for freight connections between Poland and Sweden, is the construction of an intermodal terminal in Świnoujście and modernisation of the inland intermodal structure along with the optimisation of the processes of sending and receiving cargo in cooperation with stakeholders.**

3.2 Motorways of the sea

The program of motorways of the sea was presented in 2001 in the White Paper of the European Commision devoted to transport policy titled "European transport policy for 2010: time to decide". It was designed as a tool for revitalising short-distance maritime transport and for creating European network of short-distance maritime connections. According to the guidelines concerning TEN-T from 2004, projects in relation to which financing from the motorways of the sea programme is requested should concern at least two ports in two different member states, and their goal should be a change of the mode of transport or cohesion. The programme of motorways of the sea can contribute to different types of investments, connected to, i.a.:

- equipment and infrastructure for ports and connections with inland areas;
- full-year access to equipment (dredging equipment and icebreakers);
- investing in information and communication technologies for the purposes of the traffic management systems or electronic recording and reporting systems;
- research determining the market potential of the new services and analysing new and existing freight flows in order to asses the potential new services, as well as evaluating the impact, implementation and financing.

[24] *UTK (Office of Rail Transport), Analiza kolejowych przewozów intermodalnych w Polsce, Warszawa 2016. (Analysis of rail intermodal transport in Poland, Warsaw 2016)*

Motorways of the sea are intended to improve the access to European markets and reduce the use of the road network. To pursue this, the focus should also be given on exploiting the potential of railway and inland waterways as elements of an integrated transport chain. According to recommendations, the motorways of the sea programme should progress into sustainability and management of the supply chains. A scenario based on the pursuit of sustainability should focus on decreasing the environmental impact through the use of alternative fuels, innovative vessel structures, port facilities and using new materials, such as composites. A scenario based on management of supply chains should in turn focus on the entire supply chains, exceeding the connection between ports itself and the handling within the ports[25].

In the 2014-2020 programming period the European Union financing is significant – the Connecting Europe Facility holds ca. 24 billion Euros for co-financing transport investments (in all transport modes) as part of direct management or using financial instruments (entrusted to EIB). Projects in the scope of maritime transport, including investments in port infrastructure and motorways of the sea, qualify for this financing. 900 million Euros were allocated to projects concerning motorways of the sea, while for projects concerning comprehensive network and projects concerning freight transport services, budgets of, respectively, 1 billion and 200 million Euros will be available.

Zarząd Morskich Portów Szczecin i Świnoujście S. A. (Szczecin and Swinoujscie Seaports Authority S.A.) in cooperation with the port in Trelleborg (Trelleborgs Hamn AB) and other partners (Trelleborg commune, Trafikverket, Terminal Promowy Świnoujście Spółka z o. o. (The Ferry Terminal in Świnoujście Ltd.)) have become involved in the creation of a motorway of the sea between Świnoujście and Trelleborg. Financing from the resources of CEF was acquired for realisation of two projects covering studies and infrastructure and suprastructure modernisation in both ports (cf. Table 6). The Świnoujście-Ystad connection also has a status of a motorway of the sea, thanks to which it is possible to seek support in the realisation of further modernisation investments within the port infrastructure, and also placing two new bigger car-passenger ferries into service is planned.

Table 6 - Projects concerning the Świnoujście-Ystad and Świnoujście-Trelleborg motorways of the sea.

Source: own study based on the project identification fiches of projects no. 2013-EU-21004-P, 2014-EU-TM-0640-M and 2014-EU-TM-0641-M available on the webpages of the European Commission and CUPT press information [access: 14.09.2017]

PROJECT NAME	TOTAL INVESTMENT VALUE	ACTIVITIES IN THE PORT IN TRELLEBORG	ACTIVITIES IN THE PORT IN ŚWINOUJŚCIE
Providing sustainable services in the scope of Trelleborg-Świnoujście motorway of the sea thanks to the modernisation of the port structure,	10 933 090 €	Modernisation of intermodal terminal; modernisation of traffic management system.	Works on exploiting LNG to vessel propulsion.

[25] *Buck Consultants International, Udoskonalenie koncepcji autostrad morskich, Parlament Europejski, Dyrekcja Generalna ds. polityki wewnętrznej, Departament Tematyczny B: polityka strukturalna i polityka spójności, Bruksela, 2014 r.*

PROJECT NAME	TOTAL INVESTMENT VALUE	ACTIVITIES IN THE PORT IN TRELLEBORG	ACTIVITIES IN THE PORT IN ŚWINOUJŚCIE
intermodal transport development and integration with inland corridors (2013-EU-21004-P)			
Sustainable sea-land Sweden-Poland services: Sustainable Świnoujście-Trelleborg motorway of the sea based on improving the quality of port infrastructure, intermodal transport development and integration of the corridors of the hinterland (two related projects 2014-EU-TM-0640-M i 2014-EU-TM-0641-M)	29 812 872 € 5 357 500 €	Preparation of the documentation of development of the northeastern part of the port, entrance to the port from the east side, construction of a logistic centre, parking areas, new hinterland and road access; construction of infrastructure for supplying the ferries with the electrical power.	Adjusting the Ferry Terminal to intermodal transport services, including the connecting and restructuring the ferry positions no. 5 and 6; construction of three parking spaces connected with a flyover; restructuring of railway tracks layout and construction of a ramp for the purposes of the terminal; purchasing two reachstackers and four truck tractors.

As a result of the realisation of the projects, on the Polish side there will be a port infrastructure built for service of large ferries (up to 265 meters long) in the Świnoujście ferry terminal, which will allow for offering a new type of handling services with the involvement of the railway transport at the level of 30 thousand TEU in 2020. Investments are a part of actions concerning the improvement and optimisation of logistic chains between Scandinavia and Southern Europe within the Baltic-Adriatic transport corridor.

Ultimately, the motorways of the sea are intended to lead to a growth in the intermodal handling in the port of Świnoujście. For the efficient functioning of the connections it is necessary to undertake complementary activities, which include:

- finalisation of the full-length reconstruction of the S3 express road,
- finalisation of the 273 railway line modernisation,
- providing an offer of regular intermodal railway connections.

! **The motorways of the sea project allows an access to resources for financing port modernisation, which will contribute to the increase of their potential and affect the improvement of the transport conditions along the corridor. It will also contribute to the increase in the flow of cargo along the corridor, that is why it is necessary to realise investments which are complementary to the road and railway infrastructure as well as undertake actions connected to the railway transport offer.**

3.3 The Oder Waterway in the Baltic-Adriatic corridor

The Oder Waterway might make the transport offer of the Baltic-Adriatic corridor much more attractive, which will be reflected in the decrease of the transport costs within the logistic chain or decease in the negative impact of the road transport on the environment through a modal shift. It will also be an impulse to economic development along the Oder.

Conducted interviews and desk research analyses have shown numerous obstacles, because of which, without taking significant steps, it will not be possible for the Oder Waterway to play an important role in the Baltic-Adriatic corridor. According to the respondents, the most important step is implementing real actions in accordance to the plan and guaranteeing the predictability of the project, which will stimulate the interest of investors in undertaking complementary actions. Therefore, it should be a priority to finish the construction of the barrage in Malczyce and restore the existing technical river training to actual Class III, which will, in short-term perspective (until 2020), allow for the realisation of effective navigation for 250 days per year. The emergence of first regular cargo carriages will justify the further development of the waterway to the requirements of class IV. According to the respondents – both representatives of economic entities and shipowners – only providing the possibility of regular navigation will be enough to interest the investors in adjusting the ports and fleet to the demand. Despite that, it has to be taken into account that in the beginning the transport of cargo by the Oder Waterway will require support, both by promoting waterway transport and providing the possibility of acquiring external support for financing the reconstruction of ports. Identification of the obstacles along with the ways of solving are presented in the table (cf. Table 7).

Table 7 – Identified obstacles in the development of inland waterway transport and ways of solving them.

Source: Own study

OBSTACLES	RECOMMENDED SOLUTIONS
Degradation of the ODW infrastructure which impedes regular navigation	• Fastest possible works leading to reaching class III along the Central and Lower Oder (1.8 m of depth), including: construction of the barrage in Malczyce, restoring degraded existing technical river training, regulation of the further course of the river with wing dams and seawalls, restructuring critical bridges (including the drawbridge in Podjuchy (a municipal neighbourhood in the city of Szczecin)).
Degradation of the port infrastructure	• Supporting the port owners in acquiring external funds for the modernisation and development of the port infrastructure and suprastructure, • acquiring investors through local government units, • interesting local government units in taking over the port areas and undertaking investments on their own.
Formed logistic chains, not including inland waterways	• Promoting inland waterway transport among cargo consignors and consignees, • if possible – supporting carriages through decisions concerning supplying state or local facilities with the use of waterway transport (e.g. power plants), • Including the preferred way of supplying construction materials for realising the infrastructural investments in tenders, (e.g. using

OBSTACLES	RECOMMENDED SOLUTIONS
	waterway or railway transport in the supply of aggregate, if the location of investment justifies it, • searching for new uses of navigation (e.g. cooperation between gmina (commune) self-governments along the Oder in transport and waste disposal).
Inland waterways not adjusted to the needs of the cargo consignors	• Researching the expectations of cargo purchasers and supporting actions enabling the realisation of their needs, e.g. learning about the specific needs of the high-volume cargo consignors lobbying for changes in legal regulations, formulating demands concerning further infrastructure development e.g. through guaranteeing the adjustment of railway and road bridges reconstructions to the needs of inland waterway transport.
Fleet inadequate to the needs	• Supporting shipowners in aquiring external financing for supporting the replacement or modernisation of fleet.
Lack of staff	• Supporting and promoting vacational education, which will increase the resources of qualified workers.

The majority of suggested solutions require the cooperation between various the levels of local government and establishing by the public sector (including local governments) administrative structures for example in the form of intermodal transport manager, inspired by the Swedish Trafikverket.

! **The Oder Waterway can make the transport offer of the Baltic-Adriatic corridor much more attractive, but it most importantly requires restoring the infrastructure at least to the level of class III, and supporting the modernisation of port infrastructure and the fleet of shipowners, as well as taking measures to popularise using waterways in cargo transport and ensuring the influx of staff.**

3.4 Description of the benefits resulting from including ODW in the TEN-T network

Including a longer section of the Oder Waterway in the TEN-T network increases the possibilities to acces the European Union financial resources. Although actual availability and rules of the distribution of the Union funds after terminating the 2014-2020 financial perspective (so after 2020) are not yet known, including ODW in TEN-T will certainly improve the availability of financing tools. At the same time, however, while considering the matter of financing the investments it should be remembered that the availability of Union resources decreases and the possibility of national or private funding should be taken into account – on an exclusive basis or as complementary to the Union funds.

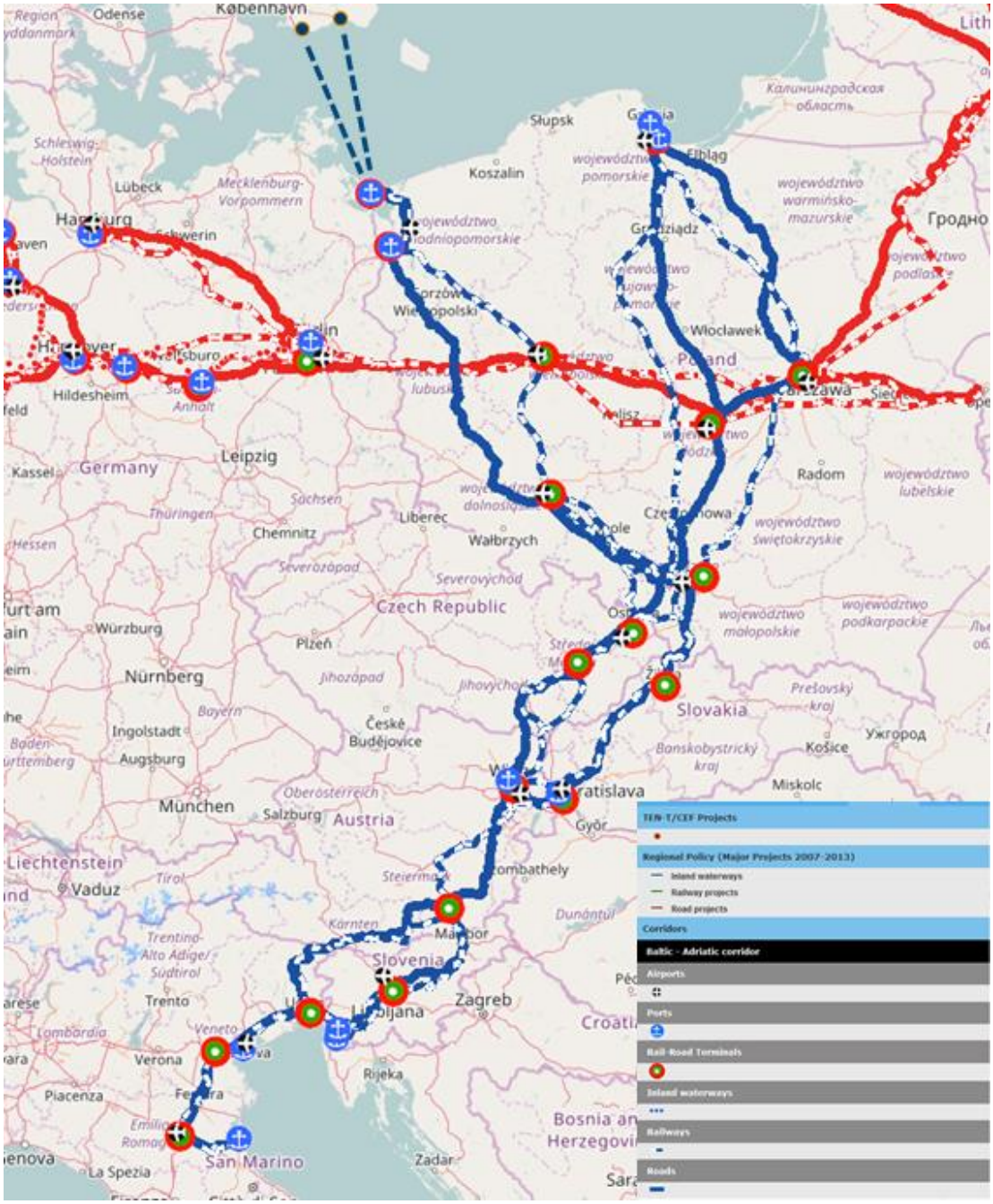

Figure 26. The course of Baltic-Adriatic and North Sea-Baltic transport corridors.

Source: TenTec [http://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/map/maps.html?corridor=1&layer=20,21, access: 28.08.2017 r.]

3.4.1 Options in financing the TEN-T network projects

As the basic sources of financing for inland waterway projects the representatives of MGMiŻŚ (Polish Maritime Ministry) indicated the Connecting Europe Facility (CEF) and public-private partnership, especially with Chinese investors. Funds managed on the national level (POIiŚ 2020+) and national financing are also considered.

3.4.1.1 CEF and other European Union funds

CEF is a relatively new financial instrument of the European Commision, which was designated for the construction of trans-European infrastructure networks (transport, energy and telecommunication) and has replaced the old TEN-T programme and a part of the Cohesion Fund. This means that the first condition of access to CEF is including the Oder Waterway in the TEN-T network.

Currently CEF consists of a so called general envelope and so called national envelopes to which resources of the Cohesion Fund were transferred. In the new financial perspective the share of the general envelope will most probably grow, and the entire management of CEF on the international level may even happen.

In the case of Polish "national envelope" the Union financing is generally high and amounts to 85%. However, in the case of general envelope, which requires taking part in an international competition with beneficiaries from all around Europe, the amount of Union financial support cannot exceed 50% of the eligible cost for studies and 20% for construction works in the scope of inland waterways and 20% "in regard to inland transport, connections with multimodal logistic platforms and their development, including the connections with inland and sea ports and airports, and also development of ports". In the case of actions undertaken on the TEN-T inland waterway network connected to eliminating bottlenecks and connected to cross-border sections the financial aid might increase to 40%[26]. The open question is qualifying Oder as a cross-border section, however, taking into account its location on the border, the chances in this case are high (unlike in the case of Vistula).

This level of financing is on one hand surprisingly low in comparison to the financing to which Polish beneficiaries are "accustomed" by the hitherto Cohesion Policy, but on the other hand – high compared to other means of transport (railway transport can use similar financing, but road transport – 10% of the eligible cost only on cross-border sections, other sections are excluded from co-financing).

Projects concerning inland waterways fit well in the criteria of CEF, because they will directly contribute to the strategic goals of the reduction of the emission of CO_2 by at least 20% in comparison to the level from 1990, and increase in the efficiency of energy use by 20%. What is more, inland waterway projects may contribute to the reindustrialisation of Europe thanks to creating an attractive location for the production of mechanical industry of oversize cargo, from the point of view of sizes permitted in road and railway transport.

Due to that, the following solutions of the presented problem of relatively low financing of CEF projects can be considered:

- lobbying for higher CEF investment co-financing – especially in new member states, case of the means of transport that fit perfectly into the European Union development and transport strategies;
- financing from Union resources disposed by countries (working name: POIiŚ 2020+ - Operational Programme Infrastructure and Environment 2020+) - although the availability of the funds is not known, inland waterway investments can be assigned a higher priority

[26] *Regulation (EU) No 1316/2013 of the European Parliament and of the Council of 11 December 2013 establishing the "Connecting Europe" facility, amending Regulation (EU) No 913/2010 and repealing Regulations (EC) No 680/2007 and (EC) No 67/2010, L 348/129.*

because the country is relatively abundant in road and railway investments, especially in the scope of TEN-T network; this is particularly important since within TEN-T network the European Commission allows for higher project financing, and in regard to the growing debt of the state the availability of resources can become a bottleneck;

- acquiring funds for the national part of the investment as part of public-private partnership;
- acquiring funds for the national part of the investment as part of budget resources.

The last two options will be described in the next part of the study, since they can also be alternative financing sources in case of the lack of Union financing, which also has to be taken into account.

! **Currently, resources disposed at the level of European Union-wide competitions allow for achieving only 20% funding of inland waterway projects, which can increase to 40% in case of bottlenecks and cross-border sections (the Oder can probably be included in this category). This implies the necessity of searching for alternative or complementary funding sources.**

3.4.1.2 Public-Private Partnership and national financing

Public-private partnership (PPP) in accordance with definitions accepted internationally in academic literature means ”arrangements where the public sector contracts to purchase quality services on a long-term basis so as to take advantage of private sector management skills incentivised by having private finance at risk”[27].

In accordance with the Polish act on PPP "The subject of public-private partnership is joint implementation of a project based on division of tasks and risks between the public entity and the private partner"[28].

The characteristic trait of PPP is therefore contracting by the public entity the services based on the infrastructure instead of purchasing the infrastructure. Such services are typically provided by companies established specifically for this purpose (SPV – Special Purpose Vehicle) co-owned usually by construction companies, investment funds, banks and maintenance companies, financed mostly by the debt – loans, bonds or combination of the two.

An advantage of PPP is better timeliness of project realisation, better budget discipline, and strong orientation of the private partner towards optimising technical parameters result in the lower cost of life cycle. Disadvantages of PPP are higher costs of capital costs incurred by the private sector and the necessity of gaining adequate profit by the private partners. A risk connected to the public-private partnership is also the possibility of the bankruptcy of SPV in case of a low performance of the project – it may imply transferring considerable loss (in the projects in which they occur) to the public sector along with simultaneous maintenance of profits by the private sector.

PPP in Europe is especially popular in the United Kingdom, which for every bigger investment requires a so called Value for Money analysis, which is a comparison of the efficiency of the PPP model with the infrastructural investment model. Such analyses are carried out for investments, the validity of which was verified, so, after preparing the feasibility study. There is a variety of PPP models, whereas in the recent years an increase in the commitment of public entities aiming at decreasing the risk and capital costs was visible. This means i.a. taking over the income risk by the

[27] *Public Private Partnerships: The Government Approach, HM Treasury, The Stationery Office, London 2000.*
[28] *Ustawa z dnia 19 grudnia 2008 o partnerstwie publiczno prywatnym, Dz.U. nr 19, poz. 100 z późn. zm.*

public partner through guaranteeing a fixed fee to the public party instead of fees incurred by the users (like it happened e.g. in the case of polish A1 motorway – fees incurred by the users are the income of the public party, which pays the private partner a fixed remuneration) and providing SPV with different guarantees.

The popularity of PPP was lowered after financial crisis in 2008, which resulted i.a. from the loss of trust in insurance companies (so called monoline insurers), which secured the debt of SPV, but also the American "bad mortgages" – and at a critical moment declared their insolvency – and from the increased caution of the investors, including the enhanced rules of managing the liquidity by banks (so called Basel III)[29].

Moreover, for years an advantage of PPP was the possibility of not charging the debt balance of the public party (government or self-government) with the future repayment of the investment – contrary to the classic model of infrastructure construction and acquiring debt financing (credits or bonds) by the public entity. These options, however, are also gradually limited.

Public-private partnership can theoretically be combined with the usage of Union funds, nevertheless in case of "big" infrastructure projects realised in Poland (motorways, rail roads) adequate analyses conducted by the investors with much experience in PPP (especially GDDKiA) have shown its pointlessness. It results from the fact that with high availability of Union funds (up to 85%) the potential financial contribution of the private partner would be relatively low, which would result in him not risking significant capital, which is a foundation of PPP, and without which it automatically becomes ineffective.

The realisation of large projects in pure PPP form have in turn been abandoned in Poland due to the availability of Union funds. The infrastructure built as part of PPP has to “pay itself off” from the funds of users or national budgets, due to which it becomes unattractive compared to the infrastructure financed mostly by Union funds. This can be also explained by the comparison of total costs of construction and maintenance of specific sections of A1, A2 and A4 motorways with other motorways in the country, resulting in much higher user fees.

From the point of view of inland waterway transport:

- in case of the necessity of full PPP funding, there is a large risk of low competitiveness of the infrastructure, the costs of which will have to be paid off eventually, compared to road and railway infrastructure constructed with significant EU co-funding;
- in case of partial Union funding (approx. 40-60%), PPP may prove to be a promising alternative to the traditional investment model due to the following:
    - great difficulty in preparing cost-efficient projects of inland waterway modernisation due to lack of experience of Polish investors – they will not be able to effectively cooperate with designers in order to optimise the costs of construction and maintenance of the investment,
    - large completion risk of the investment on time due to no experience in such investments in Poland;
    - the necessity of raising significant capital.

[29] *More on this matter: E. Yescombe, Public-Private Partnerships, Principles of Policy and Finance, Butterworth-Heinemann, Burlington, Oxford, 2007 and J. Delmon, Public-Private Partnerships, An Essential Guide for Policy Makers, Cambridge University Press 2011.*

Still, there is a lot of doubt concerning the competitiveness of infrastructure co-financed with non-returnable foreign aid at the level of 20%, 40%, or even 60%, with the infrastructure co-financed in 85%.

! **Both the application for CEF funds and the search for an investor in the PPP formula requires thorough preparation of traffic prognoses and economic analyses by the public party in order to ensure the financial stability of the investment to the European Commission / CEF selection board / investor.**
This, in turn, requires adequate prognoses – as described in the chapter 1.2.

The last potential source of financing or co-financing of the project is of course the budget. According to welfare economics, such financing is possible if:

- the benefits from the investment (including non-financial ones, related to creating workplaces, supporting the development of industry, saving on wear and tear of roads and emission of pollutants and greenhouse gases) exceed the costs;
- the cost-benefit ratio is higher than in the case of other, alternative investments.

Of course, the decision is always made from the point of view of a specific entity and looks differently for regional authorities, the government, and the European Commission. Furthermore, the possibility of external cofounding has significant impact on the decision, that is why in case of availability of CEF funds such an investment may be beneficial to the budget, while in case of their unavailability – unfavourable. In practice, political criteria are also of importance.

Moreover, another important aspect is the physical availability of budget funds, because of constitutional restriction of national debt existing in Poland at a much lower level than in e.g. Southern European countries. That is why budgetary financing of the entirety of the investment is hard to imagine at this moment, however in the future, it cannot be completely excluded, especially in the case of drastic changes in the functioning of the EU and lowering the membership due, or in case of the amendment of Polish constitution.

! **The main tool allowing to build the inland waterway infrastructure should be the CEF funds for the 2020+ financial perspective and the finances of the Cohesion Fund (POIŚ 2020+), if available. Currently, the advantage of the Cohesion Fund is the higher level of financing, while of CEF – the possibility of competition with beneficiaries from other EU member states and consequently not reducing the amount of funds in the national pot.**
The public-private partnership - without significant public financing, e.g. from the EU – will involve with the need of the private investor to regain invested funds, which will significantly decrease the competitiveness of inland navigation compared to other modes of transport with publicly funded infrastructure. Thus, it should be used as a supplementary tool - in order to cover own contribution, to reduce the design risk, or construction of supplementary infrastructure (e.g. logistic parks), whereas in the last case, it doesn't have to be PPP in statutory meaning.

3.5 Description of the benefits resulting from including ODW in the TEN-T network

3.5.1 European Grouping of Territorial Cooperation

European Grouping of Territorial Cooperation is a transnational institution created within the territory of the EU, aiming to facilitate and support of cross-border, transnational and interregional

cooperation between member states or their regional and local authorities. Usually, the cooperation includes neighbouring regions, although the e.g. cooperation of cities is also possible. EGTC may be created by partners located in at least two member states. The partners may be member states, regional and local authorities, public law bodies, as well as associations comprising entities from at least one of these categories. EGTC may be charged with the realisation of programmes co-financed by the EU or other cross-border projects, not necessarily involving Union funding.

Among the advantages of EGTC creation, the following are mentioned:

- creation of one legal entity and using a single legislation in order to implement joint initiatives in at least two member states;
- international cooperation within the framework of joint initiatives without the need to conclude international agreements, which would have to be ratified by national parliaments;
- possibility of joint and direct answering to calls for proposals launched by EU territorial programmes and acting as a single managing authority in this regard.

The West Pomeranian Voivodeship has a lot of experience in international and cross-border cooperation. It was a signatory of the Agreement on Establishing the Central European Transport Corridor (CETC-ROUTE65), which has evolved into a Grouping named the Central European Transport Corridor European Grouping of Territorial Cooperation Limited Liability (CETC-EGTC Ltd.) based in Szczecin. It was the first EGTC operating in the field of transport.

CETC-EGTC is supposed to contribute to economic and social cohesion of regions of the EU. According to the agreement, the regional partners are supposed to be joined by universities and economic entities in subsequent stages, and ultimately also by government bodies. The tasks of CETC-EGTC are related to i.a.:

- formation of a common CETC planning area;
- identification of missing transport links under the CETC according to types of transport and location;
- initiation of investment analysis and development of initial feasibility studies;
- attracting investors;
- provision of the free flow of know-how, statistical data, and other information;
- development of the concept of logistics chains and the provision of access to economic information assisting in the operations of the enterprise sector within the operating area of the Grouping;
- inclusion of the R&D sector and higher education institutions into the cooperation;
- promotion of the operating regulations of the “green transport infrastructure”;
- creation of a common tourism zone;
- implementation of other programmes or projects developed under the EGTC following the work of the cross-border specialist working groups;
- recommendation of solutions for regional policies.

An advantage of the EGTC is extensive experience resulting from several-year cooperation as part of CETC-ROUTE65 agreement and numerous experiences of respective partners in realisation of cross-border projects. The operation of EGTC is an appropriate form of partner cooperation within the transport corridor and should be continued and developed in accordance with formulated tasks – especially in regard to involvement of partners other than regional authorities into the cooperation.

! European Grouping of Territorial Cooperation is an advantageous form of cooperation between regions located along the transport corridor. Implementation of tasks and objectives formulated by the members of CETC-EGTC will contribute to the increase in efficiency of functioning of the Baltic-Adriatic corridor.

3.5.2 Clusters

The cooperation of entities based along the transport corridor within clusters may integrate different groups of stakeholders (e.g. within industrial clusters) and stimulate cooperation with other corridors.

The participation of entities involved in the development of the transport corridor (e.g. CETC-EGTC) in existing industrial clusters is an attractive form of cooperation, providing mainly flow of information between different groups of customers and facilitating the formulation of accurate diagnoses and plans concerning further directions of infrastructural and organisational development of transport systems. Each of the industries is characterised by specific expectations regarding infrastructure development (duration of transit, costs, availability of specific services, elimination of restrictions concerning mass or volume of cargo), while the geographical and functional dispersion of stakeholders severely impairs gathering information and consulting further directions of infrastructure development.

In the catchment area of the Central and Lower Oder, a total of 13 clusters have been identified, the partners of which may be potentially interested in cooperating with an entity based around the Baltic-Adriatic (cf. Table 8). Clusters reflect economic specialisation of the regions – e.g. chemical clusters in West Pomeranian and Opole Voivodeships, metal clusters in West Pomeranian, Lubusz and Lower Silesian Voivodeships, or construction and building industry clusters in West Pomeranian and Lower Silesian Voivodeships.

Table 8 – Clusters in the area of the Central and Lower Oder with the potential to cooperate in the scope of the transport corridor.

Source: own study based on G. Buczyńska, D. Frączek, P. Kryjom, Raport z inwentaryzacji klastrów w Polsce 2015, Polska Agencja Rozwoju Przedsiębiorczości, Warszawa, 2016 r.

NO.	NAME OF THE CLUSTER	BRANCH
	WEST POMERANIAN VOIVODSHIP	
1.	Construction Cluster	Construction and architecture
2.	Metal cluster METALIKA	Metal industry
3.	Maritime cluster of West Pomerania	Maritime affairs
4.	West Pomeranian Chemical Cluster "Green Chemistry"	Chemistry, pesticides, plastics
	LUBUSZ VOIVODSHIP	
5.	Lubusz Metal Cluster	Metal industry
6.	Lubusz Cluster of Entrepreneurship and Tourism	Tourism, entertainment, recreation, culture
	LOWER SILESIAN VOIVODSHIP	
7.	Lower Silesian Metal Cluster	Metal industry
8.	Centre for Energy Technologies based Cluster (CETC)	Construction and architecture
9.	Cluster "Wałbrzyskie Surowce" ("Wałbrzych Raw Materials")	Raw materials industry
10.	Polish Quarrying Cluster	Raw materials industry
11.	SIDE CLUSTER	Construction and architecture
12.	Cluster for power generation and energy consumption in mega- to nano-scale	Power engineering, heating, renewable energy sources
	OPOLE VOIVODSHIP	
13.	CHEM-STER Speciality Chemicals Cluster	Chemistry, pesticides, plastics

The cooperation of an entity representing the transport corridor with economic clusters is characterised by a common objective – the improvement of efficiency of cargo transport along the corridor, which provides benefits for all interested parties. In regard to international cooperation, it is vital to cooperate with institutions responsible for transport infrastructure and organisation. In the

case of Sweden, such cooperation is possible thanks to the existence of an integrated manager Trafikverket (cf. Chapter 1.2.2). Unfortunately, in Poland fragmentation of entities responsible for road, railway and inland waterway infrastructure is noticeable and requires creation of new administrative structures, working groups or clusters, which may impede effective cooperation.

Relations between transport corridors may be influenced by a competition between them. Nevertheless, some of the objectives of member organisations may be common, especially at higher levels – e.g. economic and social growth of the Baltic Sea Region, reduction of negative impact of transport on the environment on the Union-wide scale, or increasing the competitiveness of Union economy. The cooperation of transport clusters seems most promising.

An example of such cooperation was the BSR Transport Cluster, established by eight partners representing three countries of the Baltic Sea Region (Finland, Germany and Sweden), undertaking independent projects as part of Programmes for the Baltic Sea and North Sea Regions in 2007-2013. The cluster was established for the period of one year in order to create a platform for discussion, exchange of knowledge, sharing methodology of research and results of implementing green corridors.

Another example is the TENTacle project, which is to be implemented in the years 2016-2019, consisting of 23 partners from 9 countries and more than 60 associated organisations in the catchment rate of three corridors of the base TEN-T network. The objective of the project is to increase the possibilities of stakeholders in regard to increasing the potential of base network corridors to achieve prosperity, sustainable development and territorial cohesion in the Baltic Sea Region.

! **Wider cooperation of an entity representing the Baltic-Adriatic corridor with other entities may be achieved by creating clusters. Participation in industry clusters located in the catchment rate of the Central and Lower Oder will facilitate formulations of accurate diagnoses and plans concerning future directions of infrastructural and organisational development of transport system. International cooperation with entities representing other transport corridors will enable the transfer of knowledge.**

3.6 Swedish standards

Meeting the targets related to the development of the Baltic-Adriatic corridor requires the coordination of financial, infrastructural and organisational activities, occurring on many levels of local and central government units, as well as internationally. Efficient planning and implementation of investments and traffic management, should be supported by creation of proper authorities or implementation of changes in the existing structures. International cooperation delivers inspirations of effective and well-established Swedish standards, such as integrated infrastructure manager or transport research institute.

3.6.1 Trafikverket

In 2010 in Sweden, the Transport Administration (Trafikverket) has been established as a government agency subordinate to the Ministry of Industry. The case of Trafikverket has already been discussed in the part 1.2.2.1 (Analysis of challenges) in the context of integrated infrastructure development planning with the utilisation of the four-step model, however, all activities of this institution are interesting while considering integrated management structures of a transport corridor.

Trafikverket integrated previously independent managers of railway and roads, including some of the competences of maritime navigation, civil aviation and transport research institute, as well as, since 2011, matters related to funding of interregional public transport operations. The decision to integrate infrastructure managers and authorities was preceded by extensive analyses, which also entailed interviews with stakeholders of the transport sector, who – despite rating the previous system quite high – have noted a number of disadvantages.

Above all, it has been noted that there is no integration of planning of infrastructure development between different modes of transport, with a tendency to excessively optimise the mode of transport, that is considered in a given analysis. That is why the main task of Trafikverket is to plan long-term development of road, railway, inland waterway and airport infrastructure, as well as management (construction and maintenance) of national roads and railway lines, with emphasis on completing the objectives of the national transport policy.

In the headquarters in Borlänge and in six regional offices, approximately 6500 people are employed. The duties of Trafikverket include i.a.:

- technical standards of road infrastructure and equipment;
- gathering and transferring the knowledge and information about the availability, traffic flow, environment, health and safety in regard to the managed infrastructure;
- conducting and sharing current transport forecasts;
- carrying out in-depth investigations of all road accident fatalities;
- research and innovation supporting the activities of the unit (including supervision, documentation and funding on behalf of the government);
- development of public transport, e.g. by advising regional public transport authorities and supporting the preparation of transport plans.

In the research of Trafikverket, a lot of attention has been devoted to cargo transport, which is still neglected in the creation of transport policies in Poland. In Sweden, the needs of the cargo segment are taken into consideration not only at each stage of infrastructure development planning, but also in regard to its utilisation. A consignor of cargo is treated as a passenger of collective transport – he may learn about the railway transport offer, including terminals, on the Trafikverket websites (cf. Figure 27). Also rules concerning the reduction of negative impact of transport on the environment are available. Entrepreneurs are included in making the decisions about the directions of infrastructure development by participating in Trafikverket research, and at the regional scale, they may participate in Councils of Cargo Transport, bringing together the representatives of national and regional administration, entrepreneurs, clusters and academics.

The Councils of Cargo Transport allow for the increase of economic potential of the region, ensuring dialogue between infrastructure managers and business end-users, facilitating the transfer of experience (e.g. by visits to headquarters of companies which implement best practices), organising workshops and seminars or providing the possibility of dialogue at early stages of planning of infrastructural changes.

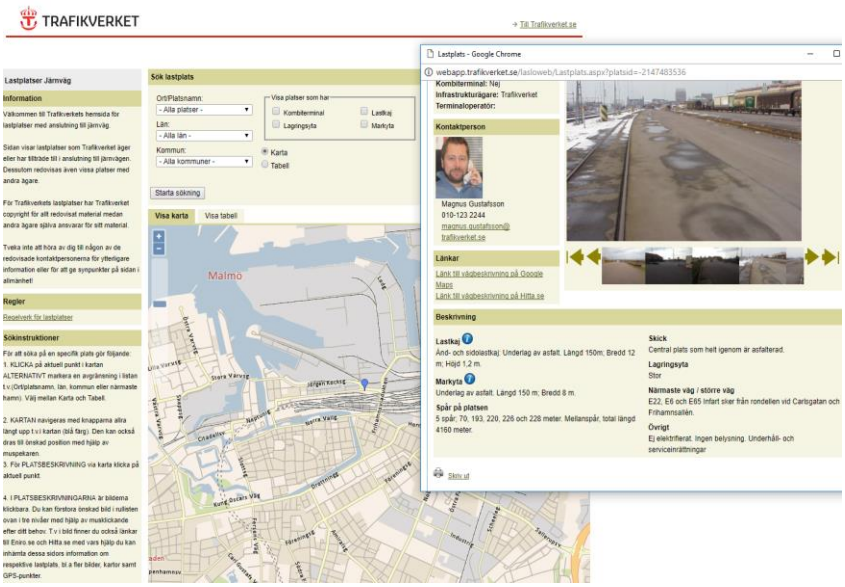

Figure 27. Map, available on the Trafikverket website, showing basic locations and information on railway handling infrastructure .

Source: http://www.trafikverket.se [access: 2.08.2017 r.]

The experiences of Trafikverket prove that the approach integrating the roles of managers of different modes of transport infrastructure facilitates the formation of a cohesive and sustainable transport system, and helps to undertake actions that really meet users' needs. Efficient use of gathered data concerning transport and significant expansion of activities of administration differs Trafikverket from the Polish equivalents. Also soft actions, such as networking, training, consultations, as well as international cooperation are facilitated by the integration of management function into one entity.

3.6.2 Trafik Analys

The Government Agency for Transport Policy Analysis (Trafik Analys) was established by the Swedish government in 2010 as a unit responsible for statistics of transport and communication under the act on official statistics. According to it, the statistical data gathered are intended for open access and use in planning and research. The institute is legally equipped with tools allowing for acquisition of statistical data from other entities, it also carries out marketing research on representative groups of consignees of transport services and users of transport infrastructure. The main task of the institution is to provide the decision-makers with data allowing for making appropriate decisions. Furthermore, the institute participates in the development of the national transport systems by constant monitoring, analysing and commenting on changes within its scope, as well as evaluation of proposed and implemented measures. Similar to Trafikverket, a broader approach is adopted, including the business community and prognoses concerning the future in relation to transport policies.

The unit is divided into three departments:

- The Department of Analysis of Transport Policy is responsible for assesment of actions of decision-makers in the scope of transport policy planning, as well as ex-ante evaluation of solutions planned to be implemented;

- The Department of Evaluation and Statistics, which is responsible for gathering of data describing the current situation in the transport segment, evaluation of impact of implemented solutions, as well as creating and supervising the methodology of research;
- The Department of Operational Support responsible for internal organisational and financial matters.

Apart from constant monitoring of a broad set of indicators related to main activity areas (road traffic, public transport, railways, navigation, mobility of passengers and goods, aviation), the institute is in charge of numerous thematic projects – both self-proposed and at the request of central authorities. Some projects are resulting from the legislation governing the activities of the unit and other are procured different ministries and the government. Some of these responsibilities are constant and entail preparation of annual reports (e.g. monitoring of completing the objectives of transport policies), others provide the *ad hoc* answers to current challenges related to the work of the government (e.g. studies providing the knowledge helpful to develop the form of changes in legislation or evaluation of effects of the implemented changes). The data is published in three forms – a descriptive report, tables with source data in an editable file format (xls) and a methodical report, which allows for convenient use of these without the need to contact the institution.

Extensive data concerning transport are also gathered and utilised by the Trafikverket administration, while making them widely accessible to entities interested – partially without limitations (cf. Figure 28), and partially (source data concerning traffic in real time) after prior registration. Data originate from various sources, including i.a. local authorities, other road and railway managers, government agencies (geodetic and transport) or forest industry. They are utilised in traffic planning and infrastructure development, matters related to safety and protection of the environment, infrastructural maintenance works, information about transport. Data concerning road and railway transport in real time are also gathered, processed and made accessible, both static (the entirety of road and railway network with numerous attributes, including names and locations of stops and stations, names and locations of cities, road numbers, sections with speed limits, cycling paths, etc.) and dynamic (real duration of transit, times of arrivals and departures of collective transport vehicles, information concerning current traffic disruptions, etc.). Besides own data, the information is gathered from devices (cameras, detectors), intelligent transport systems adn partners, such as other managers of railway lines, police, emergency services, taxi drivers, phone calls from road users, etc. Data is processed in real time and updated continuously, which means that if the changes are registered in the system, they are immediately shared – on the Internet, via variable traffic signs located along the roads, smartphone apps, navigation systems and passenger information systems in public transport, as well as the media (mostly in radio information broadcasts). The extensive database gathered by Trafikverket serves both end-users (drivers, passengers), who access them by websites and applications, as well as business-users using the source data for further processing, e.g. creation of own application or preparing maps of the transport system.

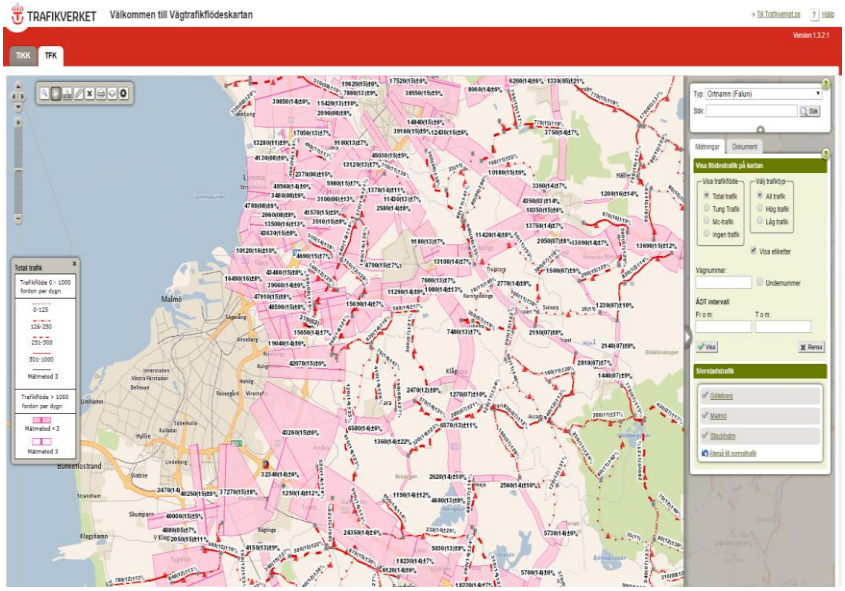

Figure 28. Map, available on the Trafikverket website, showing the traffic congestion

Source: http://www.trafikverket.se [access: 2.08.2017 r.]

Complex and real time updated data gathered in one place are the basis of efficient transport management at all levels. In case of Poland, there is still no integrated data platform gathering data about entire transport system, even in static form. Infrastructure managers, public transport authorities and local authorities prepare own data sets of a varying extent. It is very difficult, and in many cases impossible, to acquire geodata for further processing, which would describe the road network managed by dispersed managers, information concerning collective transport services are scarce and varying (especially outside cities), as well as offers for cargo consignors (widely available handling places). Modern solutions allowing for transferring of traffic information in real time are also not used in full extent, although an increasing number of vehicles is equipped with modern systems e.g. GPS. The creation of a comprehensive and continuously updated database shared to other entities not only supports own planning and development processes of infrastructure managers and operators, but also, by creative exploitation of available data e.g. in mobile applications and websites, increases the efficiency of transport systems, as well creates a data warehouse for valuable analyses in studies providing findings for further improvements of the existing transport system e.g. by evaluation of efficiency of functioning of implemented intelligent transport systems.

Gathering and utilising transport-related data on the basis of intelligent transport systems is currently strongly supported by the EU policy, and by extension, national policy. Passed by the European Parliament and the Council of the European Union, the ITS Directive[30] gives responsibility to the European Commission for producing the specifications (or issuing authorisations for standardisation bodies to adopt standards) in the first instance for priority actions:

- provision of EU-wide multimodal travel information services;
- provision of EU-wide real-time traffic information services;

[30] *Directive 2010/40/EU of the European Parliament and the Council of 7 July 2010 on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport.*

- data and procedures concerning supplying the users, free of charge if possible, with
- data and procedures for the provision, where possible, of road safety-related minimum universal traffic information free of charge to users ;
- the harmonised provision for an interoperable EU-wide eCall;
- the provision of information services for safe and secure parking places for trucks and commercial vehicles;
- the provision of reservation services for safe and secure parking places for trucks and commercial vehicles.

The Polish General Directorate for National Roads and Motorways is working on introducing the National Traffic Management System based on broadly understood telematic infrastructure, including the system of acquiring data about traffic, traffic management and communication. There are also plans to introduce subsystems of traffic interaction (e.g. using the variable speed limits optimising the flow of traffic and road capacity), information about availability and rotation of parking spaces in Passenger Service Facilities, weight preselection of overloaded vehicles, closed-circuit television, meteorological protection. What is vital, however, is the pursuit for gathering comprehensive data in one place, including different modes of transport and concerning all infrastructure managers.

3.7 Recommendations

- Trade between Sweden and Poland may be supported by the development of intermodal transport infrastructure and improvement of railway transport. The general increase in containerisation in logistic chains results in decreasing of transport costs, along with simultaneous increase of efficiency of transport and positive impact on the environment. The construction of an intermodal terminal in Świnoujście and modernisation of inland intermodal infrastructure, along with optimisation of the process of sending and receiving cargo in cooperation with the stakeholders is a chance for the Baltic-Adriatic Corridor, and more broadly, for Polish and Swedish freight connections.
- The project of the motorways of the sea allows for access to financing needed to modernise ports, which will contribute to increasing their potential and will have a positive impact on the improvement of transport conditions along the corridor. It will also contribute to the flow of cargo along the corridor. Therefore, it’s crucial to conduct complementary investments in road and railway infrastructure, as well as improve railway transport offer.
- The Oder Waterway may significantly improve the transport offer in the Baltic-Adriatic corridor, however, it most importantly requires restoring the infrastructure at least to the level of class III, support of modernisation of port infrastructure and shipowners' fleet, as well as measures to popularise using waterways in cargo transport and ensuring the influx of staff.
- The basic financing tool for the construction of waterway infrastructure should be the CEF funds for the 2020+ Financial Perspective and the funds of the Cohesion Fund (POIŚ 2020+), if they are available. The advantage of the Cohesion Fund is the higher level of financing, while of CEF – the possibility of competition with beneficiaries from other EU member states and consequently not reducing the amount of funds available for other Polish projects.
- In some extend, it is also possible to acquire private funding within public-private partnership. Without significant public financing, e.g. from the EU – the private investor

will want to regain invested funds, which will significantly decrease the competitiveness of navigation compared to modes of transport with funded infrastructure. Thus, it should be used as a supplementary tool - in order to cover own contribution, to reduce the design risk, or construction of supplementary infrastructure (e.g. logistic areas), whereas in the last case, it does not have to be PPP in statutory meaning.

- European Grouping of Territorial Cooperation is an advantageous form of cooperation between regions located along the transport corridor. The realisations of objectives and tasks of Central European Transport Corridor European Grouping of Territorial Cooperation formulated by its members will contribute to the increase of efficiency of functioning of the Baltic-Adriatic Corridor.
- Broader cooperation of an entity representing the Baltic-Adriatic Corridor with other entities may happen in the form of clusters. Participation in branch clusters connected with the catchment rate of the Central and Lower Oder will facilitate the formulation of accurate diagnoses and plans concerning future directions of infrastructural and organisational development in regard to transport, while international cooperation with entities representing other transport corridors will enable the transfer of knowledge.

4. Analysis of challenges and possible measures taken to reduce the negative impact of transport on the environment. Innovative measures and ways of their implementation

4.1 Pro-ecological formation of the new infrastructure

Natura 2000 is a European ecological network of special habitat areas, which consists of zones of natural habitats enlisted in attachment 1 to the Council Directive 92/43/EEC of 21st May 1992 on the protection of natural habitats, fauna, flora (OJ 1992 EC L 206 22.07.1992, the Habitat Directive) and habitats of species enlisted in the attachment 2 to the same directive. The main objective of this act, is to maintain natural habitats and habitats of species, in favourable conservation status within their natural range, or if applicable, ensure their restoration. Moreover, Natura 2000 covers the special protection areas for birds by the Member States in accordance with the Directive of the European Parliament and Council 2009/147/EC of 30th of November 2009 on the protection of wild birds (OJ 2010 EU L 20 26.01.2010, the Birds Directive).

In the case of infrastructural investments potentially impacting Natura 2000 sites, their influence must be assessed at the stage of obtaining environmental permits.

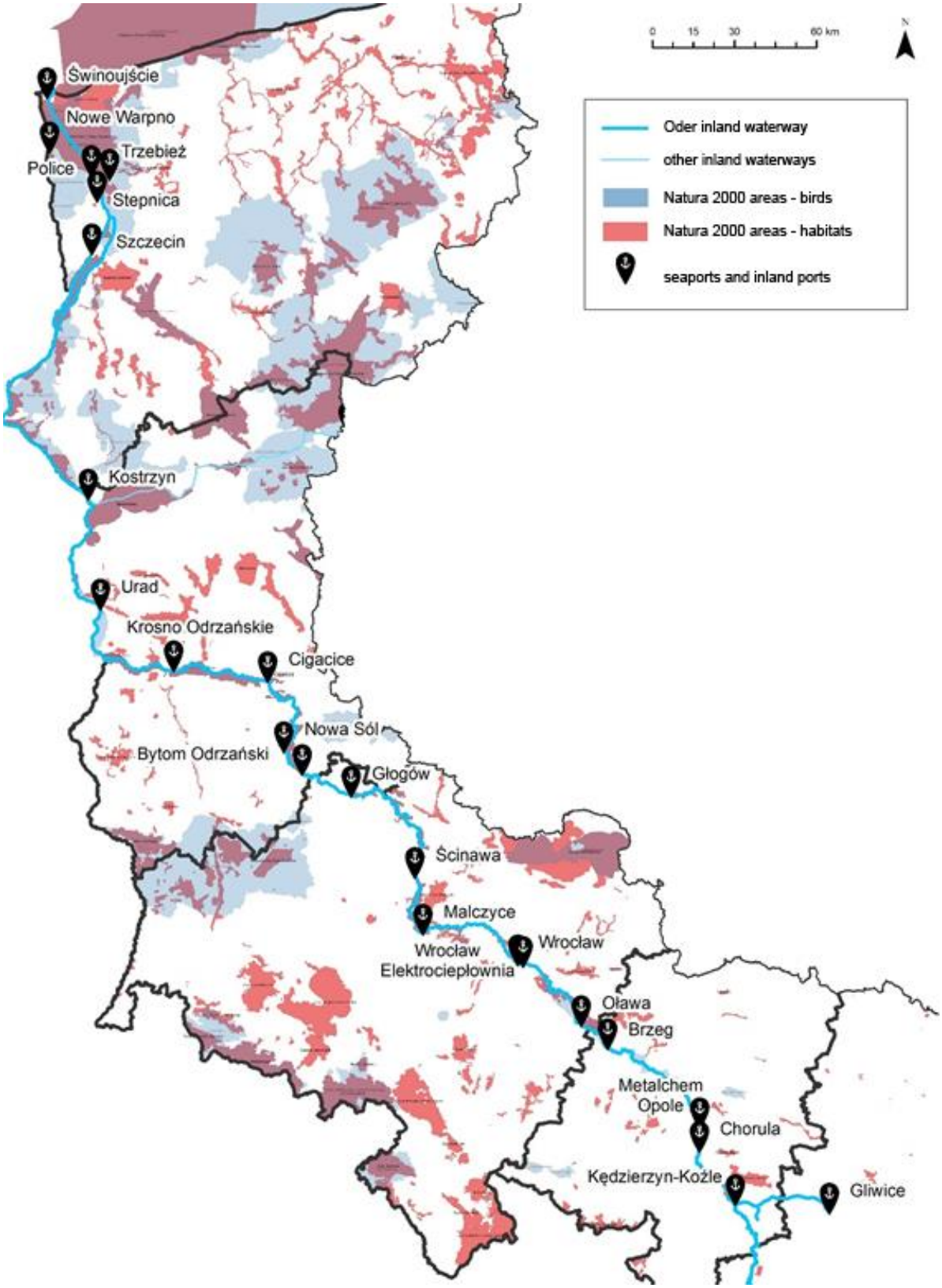

Figure 29. Natura 2000 areas established by the Central and Lower Oder

Source: own study based on the data of GDOŚ.

The Union regulations were implemented in the Act of 16th of April 2004, on the protection of nature (Official Journal of the Republic of Poland of 2013, pos. 627, The Law on the protection of Nature), as well as, in the EIA Directive. According to the art. 33 of the Law on the protection of nature, subject to article 34, it is forbidden to adopt measures that could, alone or in combination with other measures, significantly adversely affect areas under Natura 2000 protection, and in particular:

- deteriorate the condition of natural habitats or habitats of plants and animals, within the Natura 2000 areas;
- negatively affect the species, within the Natura 2000 areas;
- negatively affect the integrity of a Natura 2000 areas or its interactions with other areas.

Art. 34 provides the possibility of granting a permit for the execution of an investment, despite its negative effects on a Natura 2000 area, provided that it is supported by the necessary and overriding needs of public interest, social and economic character of needs included, and when lacking any alternative solutions. In the case when such negative influence involves the, so called, priority habitats and species, the permit mentioned in sec. 1, can be granted only in order to:

- protect human health and lives,
- provide the general safety,
- provide favourable consequences that will be of primary importance to the environment,
- address the overriding needs of public interest, having obtained the opinion of the European Commission.

Although some authors[31] indicate the possibility of using such clauses to the Oder regulation project, it is applicable for flood protection measures only, without exceeding the necessary needs for improving the shipping route's parameters. Intensive river regulation remains ecologically controversial[32], similar discussion may also arise during complex action involving construction and upgrade of inland ports, creating their intermodal connections or acquiring higher class of navigable waterway.

4.2 Good practises in environment protection

The transport sector has a considerable impact on the natural environment, both through the construction and maintenance of its infrastructure, as well as through the traffic of the vehicles. Environmental risks caused by transport mainly include:

- loss or degradation of habitats,
- hindering of the movement of species,
- pollution (of air, soil, water),
- disturbance of the natural habitats of species (emission of noise, vibration, lighting).

The nature and level of such adverse effects depend on the type of infrastructure and means of transport used, hence such dangers and ways of their mitigation are to be addressed separately.

[31] *M. Pluciński (red.), Możliwości wykorzystania transportu wodnego śródlądowego w obsłudze zespołu portowego Szczecin-Świnoujście, Polskie Towarzystwo Ekonomiczne, Szczecin, 2016 r.*

[32] *J. Brański, A. Czajka, A. Kadłubowski, E. Maciążek, M. Mierkiewicz, M. Sasim, B. Szypuła, J. Żelaziński. Analiza uwarunkowań i efektywności ekonomicznej rozwoju odrzańskiej drogi wodnej, WWF Polska, Warszawa 2010 r.*

4.2.1 Road transport

The construction of road infrastructure, can lead to the destruction of natural habitats in the area where it is conducted, as well as in surrounding areas. This is particularly important in case of road infrastructure, which has the highest density and land use intensity from all types of the transport infrastructure. Moreover, a wide range of secondary adverse effects on natural habitats have to be taken into account, when upgrading on constructing infrastructure, e.g. the development of industrial or service and commercial buildings, along the new connection lines, which only widens the range of its devastating impact. With the linear infrastructure comes the barrier effect, which restricts animal movement between areas. In the case of road traffic it is directly connected with the intensity of traffic - roads with the daily traffic intensity of only 1000 vehicles per day restrict animal movement, whereas roads with the intensity of 10 000 vehicles per day create a barrier which is completely impassable for most of the terrestrial animal species[33]. The development of road infrastructure, aiming for the highest quality and safety of journeys, leads to the usage of numerous physical barriers (noise absorbing panels, fences) in order to mitigate collisions with animals, as well as, to reduce noise and lighting during the night. However, such measures affect the migration patterns and flow of animals. When species are prevented from free transfers to other habitats, they become gradually weaker, and may even become extinct due to the limited gene flow.

In case of road transport, the most popular problem is polluting the air with toxic fumes emissions from engine vehicles; nitrogen oxide, suspended particulate matter, carbon monoxide, volatile organic compound (being harmful for human health) and greenhouse gases (causing unwanted climate changes). According to the European Union policy, all countries should aim to reduce greenhouse gasses emissions, what is a part of the EU adopting the Energy-Climate Package before 2020 and the non-ESD (Energy Sharing Decision), which has included transport to the non-ESD sector (as well as, agriculture, construction, wastes). Polish emission quotas established for the 2013-2020 period are 14% larger than in 2005. The European Commission proposal for the upcoming years, states that by 2030 Poland will have to reduce the non-ESD sector emissions by 7%, as compared to 2005 figures. However, the National Center of Emission Balancing and Management provides for a systematic increase in the greenhouse gasses emission trends and increase in the share of transport in the non-ESD sector. The car transport alone constitutes about 97% of carbon dioxide emission of the whole transport sector[34]. It means that decision actions need to be taken to reduce the sector's emission of harmful substances. Meanwhile, simultaneously with the general increase in freight traffic in Poland, the role of road transport in its service also increases – at the expense of railway and inland waterway transport – in 2015, almost 84% of performance accounted for road transport, compared to the Union average of 75%[35]. According to plans formulated in the White Paper on Transport, until 2030, 30%, and until 2050, 50% of freight transport on longer distances should be transferred from roads to other modes of transport (railway and inland waterway transport), while trucks are meant to be the basis of transport on shorter and medium distances (up to approx. 300 km)[36].

[33] *„Wpływ dróg i linii kolejowych na łączność ekologiczną", Stowarzyszenie Pracownia na rzecz Wszystkich Istot (dostęp: 9.12.2016).]*
[34] *Data of KOBIZE.*
[35] *Data of Eurostat.*
[36] *White Paper on Transport: Roadmap to a Single European Transport Area – Towards a Competitive and Resource-Efficient Transport System, Brussels 2011.*

Taking into account the aforementioned types of negative impact of road transport on the environment and the importance of cargo transport for the economy, the actions taken to achieve sustainable cargo mobility should be targeted at the development of proecological solutions in road infrastructure, changes in logistic chains, popularisation of alternative power sources in vehicles and promotion of innovation.

Table 9 - Measures to limit the negative impact of road transport on the environment

Source: Own study

TYPE OF MEASURES	EXAMPLES OF REALISATION
Proecological solutions in road infrastructure	• Construction of different kinds of animal passages – small (culverts), medium (under- and overpasses), large (ecological overpasses – along with reduction of excessive lighting by the means of sufficiently dense plantings along the barriers). • Creation of new habitats and feeding grounds (planting shrubs and trees, water bodies) compensating for the loss of existing ones. • Alternative measures of noise reduction (earthworks, dense screening green strips). • Surfaces made of new mixtures meant for wearing courses characterised by reduced noise emission of vehicle traffic (e.g. rubber-asphalt granulate).
Changes in logistic chains	• Preparation and implementation of urban logistics plans, which determine the rules of goods' supply provided to the city (including e.g. restriction on emission of exhaust gasses, alternative power sources).
Popularisation of alternative power sources	• Provision of adequate density of stations providing supply of alternative fuels along the corridor (CNG and LNG stations, charging facilities for electric vehicles). • Requiring or favouring of vehicles using an alternative power source in public transport orders, e.g. in road maintenance services.
Promotion of innovation	• Commited cooperation between road managers and research and development units leading to development and implementation of innovative solutions (experimental road sections along the existing roads, cf. Table 10). • Engaging researchers and students in realised projects related to e.g. alternative vehicle power sources in order to make them more effective and to recommend further improvements. • International cooperation along the corridor allowing for implementation of solutions on a large scale, which may result in contribution to increase the level of technological innovation.

Table 10 - Example of an innovative solution protecting the environment

Source: Scania Group, https://www.scania.com/group/en/worlds-first-electric-road-opens-in-sweden/ (access: 7.08.2017 r.)

ELECTRIFICATION OF CARGO TRANSPORT

Research on electrification of cargo transport is an impressive example of commitment of a road manager to innovation, resulting in lowering the negative impact on the environment, co-financed by the Swedish Trafikverket administration with involvement of two other government agencies (Energy and Innovation) and other partners (including local authorities, truck manufacturer Scania, electrical drive manufacturer Siemens and the carrier). On 22 July 2016, an experimental, two-kilometre-long section on the E16 motorway was opened, above which, an overhead contact line was placed at the height of 5,4 m, which is utilised by, similar to the principles of trolleybuses, hybrid trucks equipped with pantographs and electric drives. Apart from the electrical equipment, the vehicles are equipped with a regular combustion engine, so after being disconnected from the contact line, they are able to continue to the required destination. The tested solution is one of the answers to the forecasted increase in utilisation of road transport in long-term perspective of cargo transport, it is also an example of a practical support of innovativeness in transport by the infrastructure manager.

Figure 30. A truck on an experimental eHighway section in Sweden

Source: Scania Group, https://www.scania.com/group/en/worlds-first-electric-road-opens-in-sweden/ (access: 7.08.2017 r.)

4.2.2 Railway transport

Compared to road transport, railways have much less impact on the natural environment. Railway infrastructure, similar to that of roads, may result in destruction of natural habitats along its area, it also becomes an obstacle for movement of species, although to a smaller degree due to absence of constant traffic (as in the case of road transport). Railway transport is also characterised by significantly lower land use – the line infrastructure providing similar capacity consumes three times

less land (25m for a two-track line) than road transport (75 m of three-lane road in both directions)[37], also, it is possible to intensify the capacity usage on the basis of modern signalling systems. Additionally, lower energy consumption of railway transport is also of importance – one litre of fuel allows to transport 97 tonnes on the distance of 1 km using the railway, while a vehicle would transport two times less cargo[38], which also means lower greenhouse gas emission.

In case of railway transport, measures taken to ensure sustainable mobility of cargo should be geared to increasing the share of railway in cargo transport and increasing the usage of solutions reducing negative impact of railway on the environment.

Table 11 - Measures to limit the negative impact of railway transport on the environment

Source: Own study

TYPE OF MEASURES	EXAMPLES OF REALISATION
Increasing the share of railway in cargo transport	• Provision of an attractive transport offer to cargo consignors e.g. by creation of intermodal line trains along the corridor • Promotion of freight transport e.g. requiring or favouring of railway transport in public procurement connected with supply of building materials to infrastructure construction
Development of infrastructure	• Modernisation of infrastructure (increasing maximum speed), elimination of bottlenecks leading to increased competitiveness of the railway
Proecological solutions in railway infrastructure	• Usage of animal repelling devices (cf. Table 12) in order to avoid collisions • Anti-vibration ground mats reducing vibration transmitted from the surface to the track bed and the ground • Construction of noise barriers equipped with an octagonal noise reductor, which allows to reduce the height of the barrier without affecting expected acoustic effects • Construction of different kinds of animal passages – small (culverts), medium (under- and overpasses), large (ecological overpasses – along with reduction of excessive lighting by the means of sufficiently dense plantings along the barriers) • Creation of new habitats and feeding grounds (planting shrubs and trees, water bodies) compensating for the loss of existing ones
Increasing the share of railway in cargo transport	• Provision of an attractive transport offer to cargo consignors e.g. by creation of intermodal line trains along the corridor • Promotion of freight transport e.g. Requiring or favouring of railway transport in public transport orders connected with supply of building materials to infrastructure construction

[37] *K. Wojewódzka-Król, Koleje dużych prędkości w europejskiej polityce transportowej, Problemy Kolejnictwa – Zeszyt 153.*
[38] *NIK, Żegluga Śródlądowa, Warszawa 2013.*

Table 12 - Example of an innovative solution protecting the environment

Source: M. Stolarski, J. Żyłkowska, Ochrona Zwierząt jako istotny element procesu inwestycyjnego podczas budowy i modernizacji linii kolejowych, Problemy Kolejnictwa – Zeszyt 153, s. 159-175.

UOZ-1 ANIMAL REPELLING DEVICES

The UOZ-1 device, created by an expert in railway automation, Marek Stolarski, MSc, was implemented by the PKP on multiple railway line sections of high traffic intensity and high train speeds in order to protect the animals from colliding with trains. The functioning of the device is based on emission of an animal-repelling sound sequence, which lasts from 50 to 180 seconds, depending on the speed of an incoming train. The repelling sound sequence was composed by prof. Simona Kossak of the Forest Research Institute in Białowieża based on study. It consists of e.g. alarm sounds of birds, barking of a pack of hounds, and sounds of frightened animals. It has been organised in such a way as to make sure that the choice of sound effects would be recognised by a largest possible number of species as a warning signal, furthermore, thanks to the basis in inborn reflexes, animals are not becoming accustomed to the device, which usually happens with devices emitting artificial and regular sounds. Research carried out by the railway infrastructure manager have confirmed the effectiveness of used devices – animals react with escaping and do not become accustomed to the sounds. What is important is that the system does not result in disperse of animals from the area, but compared with so-called ecological overpasses, facilitates the crossing of animals on the whole distance of the railway line – apart from the time of train passage.

4.2.3 Inland waterway transport

Development of inland waterway infrastructure interferes with the river ecosystem and causes different threats to the environment. Interference in natural river course (straightening or shortening of riverbeds) or preventing the fluctuation of water levels may result in loss, degradation or fragmentation of habitats – due to direct destruction (e.g. construction of facilities, coastal vegetation clearance or clearance of natural islands, fortification of the waterfront, drainage of flood plains, stabilisation of the river bottom etc.), disruptions of natural hydromorphological processes, interference in balance of sediment or circulation of nutrients. Changes in river course influence the flow velocity, which in turn leads to a serious erosion of the riverbed and waterfront, may result in lowering the level of the water surface on surrounding areas, and deposition of sediment and silt in the lower course of the river. Changes disrupting the longitudinal and lateral cohesion of the ecosystem also results in isolation of the river sections in order to control the depth and flow of the river. A separate danger for the environment is the obstruction of migration and biodiversification by creating physical obstacles for migration of fish downstream and upstream (dams, reservoirs).

Despite disrupting the ecosystem some technical river training measures are necessary to protect inhabited areas along rivers from flooding. Present engineering knowledge together with ecology may greatly alleviate potential detrimental effects of human intervention. In case of projects connected with inland waterway development, an integrated approach is recommended, in which the emphasis is placed on the multifunctional nature of rivers by finding a compromise between the requirements of environmental protection and sustainable transport. In such an approach, the work is meant to, as much as it is possible, preserve or restore functions such as:

- preservation of morphological processes (erosion, transfer of sediment and deposition);
- preservation of hydrological equilibrium (e.g. flood waves);

- provision of habitats;
- preservation of biological and chemical processes (circulation of nutrients)[39].

The experiences of countries with substantial river exploitation for transport purposes show that in many cases, the actions taken to achieve expected depth, cleanness, width or water flow velocity can be planned in such a way as to both develop the inland waterway transport and support ecology and natural functions of regulated rivers.

Diesel-powered vessels also affect the environment, but on a much smaller scale than vehicles or railway (1 litre of fuel allows to move 127 tonnes of cargo on a distance of 1 km by river vessel, by railway – 97 tonnes, and by vehicle – 50 tonnes[40]). Considering the insubstantial usage of inland waterway transport in Poland, shipowners do not invest in the fleet utilised, which means that it is dominated by obsolete vessels lacking modern power solutions. The possibility of obtaining steady transport orders will, in longer perspective, the basis of the restoration of the river fleet, including investments in environment-friendly drives.

Taking into account the natural values of the Oder, including numerous habitats protected by Natura 2000, realisation of investments related to development of inland waterways, in accordance with national and European law and with the approval of local experts and environmental NGOs, is a challenge.

The achievement of expected objectives will first and foremost call for exactness in procedure completing and constructive dialogue between interested parties. After completion of the critical investments, it is desirable to popularise the usage of inland waterways, which will contribute to increasing the efficiency and diversity of the transport offer, allowing for reduction of the share of road transport in cargo transport.

Table 13 - Measures to limit the negative impact of inland waterway transport on the environment

Source: Own study

TYPE OF MEASURES	EXAMPLES OF REALISATION
Cooperation with local environmental NGOs	• Creation of a working group to act as a platform of dialogue between delegates of various parties engaged in the development of inland waterways on the Oder (local authorities, entrepreneurs, environmental NGOs, researchers) in order to determine the scope of reconstruction of the waterway and planning of measures to alleviate the negative impact on the environment • Exchange of international experiences with parties engaged in renaturalisation of navigable rivers (Germany, the Netherlands)
Adjustment of infrastructure to the needs of inland waterway transport with respect to the environment	• Realisation only of necessary regulation works (e.g. leaving some sections in the current state, limiting the length of sections requiring fortification of the waterfront, construction on one side only)

[39] *Guidance Document on Inland Waterway Transport and Natura 2000, European Commission*
[40] *NIK, Żegluga Śródlądowa, Warszawa 2013.*

Increasing the share of inland waterways in cargo transport in order to lower the negative impact of road transport on the environment	• Regulation with respect to nature (e.g. resigning from fortification using artificial materials (concrete, asphalt) in favour of natural materials (rocks, fascine), creation of possibility of vegetation growth on the riverbanks, reduction of the angle of inclination of the slopes of riverbanks, preservation of steep slopes, allowing for free shaping of the shoreline)[41] • Strategic decisions concerning supplying local and national facilities (e.g. heat and power plants) using inland waterway transport • Involvement of local authorities in obtaining cargo

4.3 Recommendations

- The transport sector substantially impacts the natural environment, which is why the modernisation and development of the infrastructure should take into account modern solutions alleviating the negative results. High standards in this regard are made necessary by regulations associated with Natura 2000 areas and statutory environmental procedures.
- Support of innovation is vital in this regard for infrastructure managers i.a. by stimulating cooperation between research centres and implementation of pilot programmes on sections of communication lines.

[41] *More detailed description: Analiza sposobów rozwiązywania potencjalnych konfliktów między poprawą parametrów infrastruktury transportowej a wymogami ochrony środowiska naturalnego na przebiegu ODW w: M. Pluciński (red.), Możliwości wykorzystania transportu wodnego śródlądowego w obsłudze zespołu portowego Szczecin-Świnoujście, Polskie Towarzystwo Ekonomiczne, Szczecin, 2016 r.*