DEVELOPMENT PROSPECTS OF INLAND WATERWAYS IN THE SCOPE OF FREIGHT TRANSPORT IN POLAND

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Abstract

Inland waterway transport is an important element of the freight transport throughout Europe. Waterways connect the most important points of transport infrastructure with each other, which provides direct access to the sea for countries that do not have it. Inland waterways are classified due to the width and depth of the pass. Currently, in Poland, many transport routes are not adapted to the requirements of companies dealing in water transport. Few sections have received the European Class IV, which allows the flow of cargo. By improving the conditions of navigation in Poland, there is a chance of direct connection between the Baltic and the Adriatic, which would be beneficial for international transport. The aim of this article is to present perspectives for 2020-2030, assuming changes enabling the development of inland waterway transport in Poland.

Keywords: Inland waterways, development prospects, freight transport

1. INTRODUCTION

The basic component of the economy of each country is the transport system. Transport subsystems can be distinguished on: road, rail, sea, pipeline, air and inland. Each of them has its advantages and disadvantages. Modern logistics requires simultaneous and harmonious cooperation of all subsystems in order to improve the flow of goods. Unfortunately, inland transport is currently of marginal importance in Poland despite favorable geographical conditions. In 2000, the share of inland waterway transport in total freight transport was only 0.8 %, and in 2016 it decreased to 0.3 % [1]. The downward trend in this area is caused by the deteriorating condition of waterways and the increasing importance and use of road freight transport. In many countries around the world, i.e. Canada, Russia, the inland freight transport subsystem is of equal importance compared to other modes of transport. This is due to the numerous advantages of inland waterway transport, among others [2] low noise emission, low energy consumption, high load capacity of means of transport and the use of mostly natural transport routes.

Inland transport is considered to be environmentally friendly. It is also worth emphasizing that it can be used to transport large-size loads, which usually causes serious organizational problems in road traffic, may cause accidents and necessitate reconstruction of the point infrastructure on the cargo route. Inland transport allows the transit of very different sizes goods in a safe and non-obstructing manner.

2. CURRENT STATE OF INLAND WATERWAY IN POLAND

There are two main water transport routes in Poland - Vistula and Odra River. They are part of the European communication networks E30 and E40, but in reality their use is minimal, mainly due to natural conditions, including variable weather conditions that determine the height and condition of the water. [3]. Despite the unfavourable state of water resources and insufficient reservoir retention, the total length of transport waterways in Poland in 2014 amounted to 3655 km. Unfortunately, the vast majority are regional roads, whose classifications assigned to them do not correspond to the actual state. Only 6 % are waterways of international importance and international standards class. The poor condition of Polish waterways is the result of many

years of investment negligence, which led to the fact that 90 % of all transport of goods constituted domestic transport at a distance of no more than 50 km, which in the world gives a very unfavourable result.

On the E-30 transport waterway, only the section of the Odra river is currently channelled, amounting to only 183.5 km and combines the degree of water in Koźle with the Gliwicki Canal. This is currently the only section of class III where the transport depth is guaranteed. It consists of 23 water stages, thanks to which the cost of adapting this part of the Odra to the Va class will be much lower than in the case of other sections. The central part of the Odra River is a freely flowing river measuring 336 km, from Brzeg Dolny to Kostrzyn requiring a full sewage system to obtain the desired class. For this purpose, it is necessary to create 15 water levels [4].

The E-40 waterway includes in Poland mainly the lower section of the Vistula. Already in 1912, Eng. T. Tillinger proposed the construction of water stages that would improve the flow of goods. A few years later, there were several new concepts in this field, differing in the parameters and number of water stages. The first element of the Lower Vistula cascade was to be the water level near Włocławek, the construction of which was completed in 1970. It was also assumed that at each of the stages a water power plant would be located, unfortunately, subsequent changes in the projects meant that the construction could not be continued [5]. The planned course of the cascade and the supposed location of its water stages is presented in **Figure 1**. Although there is only the lower section of the Vistula in Poland, it should be remembered that in combination with its central and upper part it is a natural connection of the Tri-city Seaport with other EU countries European Union. The first concept from 1999 assumed supplementing the existing Włocławek grade with seven more. The plans focused primarily on the use of the Vistula's energy potential and its transport functions. Investments, however, have not been realized and in 2014, due to the large degradation of the river bed, other options were planned that assumed the construction of ten rather than eight water levels so far, which would enable the Gdańsk-Warsaw section to obtain the Va-class navigable class. The Lower Vistula Cascade project includes the creation of new and reconstruction of old water infrastructure facilities, among others flow tank with a length of 25-33 km around the Włocławek barrage.

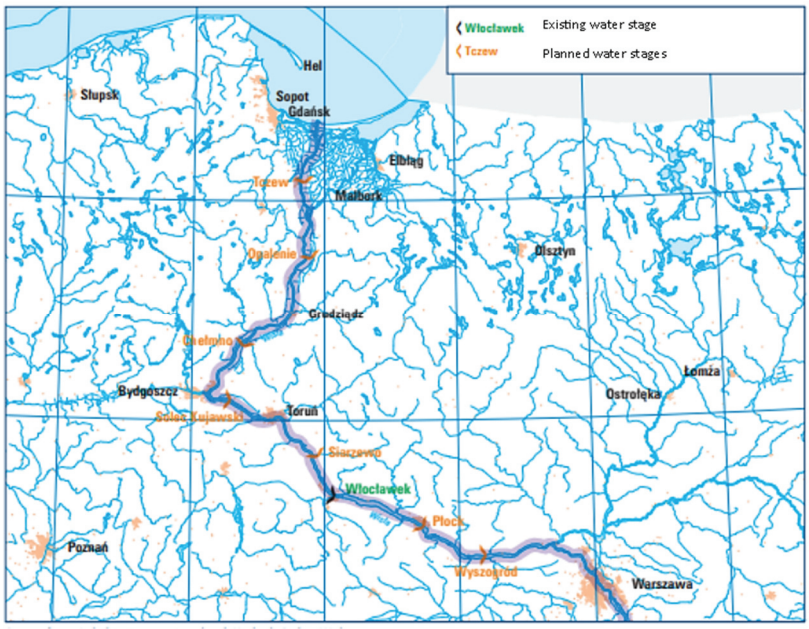

Figure 1 Location of water stages of the Lower Vistula River Cascade [6]

The E-70 waterway on the section from Odra to Vistula was rebuilt at the beginning of the 20th century and adapted to ships with a load capacity up to 500 tons, not exceeding a draft of 1.4 m. All stages on this part of the road are hydrotechnological monuments, only one sluice in the whole section is fully automatic and quite

modern, which could be qualified for class IV. Unfortunately, the remaining objects of water infrastructure along the route, require most renovation, thus not reaching the level of class II [7]. Incorrect with the requirements of class II on the section from Odra to Vistula are: depth and width of transit, vertical clearances of bridges and radii of arches. Modernization of this section is an important element of the connection of the two main inland waterways routes in Poland.

3. DEVELOPMENT PROSPECTS FOR INLAND WATERWAY

3.1. Baltic - Adriatic corridor

In accordance with the guidelines of the Baltic-Adriatic transport corridor plan, it runs through six Member States: Poland, the Czech Republic, Slovakia, Austria, Italy, and Slovenia, and connects the North and South of Europe. The course and infrastructure of the corridor were strictly defined in the regulations of the European Union [8,9]. Thanks to the combination of various transport systems, the Baltic-Adriatic corridor allows efficient, safe and high-quality flow of goods using multimodal supply chains. The 1800 km long corridor comprising 13 urban nodes and airports, 10 ports and 24 road and rail terminals unfortunately currently does not include inland waterways passing through Poland, despite the fact that it connects to the basement TEN-T waterway network at its different sections. The North-South corridor starts in the ports of Świnoujście and Szczecin, or in Gdańsk and Gdynia, and runs directly to the south of Europe to Italy. In Poland, it runs through the largest cities, including Warsaw, Poznań, Łódź and Katowice. The entire route of the Baltic-Adriatic corridor is shown in **Figure 2**.

Figure 2 The route of the Baltic-Adriatic transport corridor [10]

The Baltic-Adriatic transport corridor undoubtedly allows undisturbed intra-EU flow of goods, improving multimodal transport and contributing to the development of the market. The global role of the corridor is also growing, because it is a gateway to the European market [10].

3.2. Plans for the development of inland waterway transport until 2020 with the perspective of 2030

Renovation of the E-30 waterway, development and implementation of the adopted assumptions regarding the change of navigability class to IV on the Odra River will depend primarily on political decisions and national and international financial conditions. The scope of works at the border section was defined in 2015 in the Polish-German agreement and included, among other things, obtaining a stable depth of the river bed at the level of 1.8 m. According to plans, the modernization was to be completed in 2028. During the design both the winter flood protection and the improvement of the conditions of shipping and transport of goods were taken into account. The plans for the national section of the Odra River have been divided into two stages and include the construction of 15 water stages. By 2020, the Lubiąż and Ścinawa and Malczyce water sluices are to be modernized, which have been under renovation for years. Investment plans on the national section of the Odra River are presented in **Figure 3**.

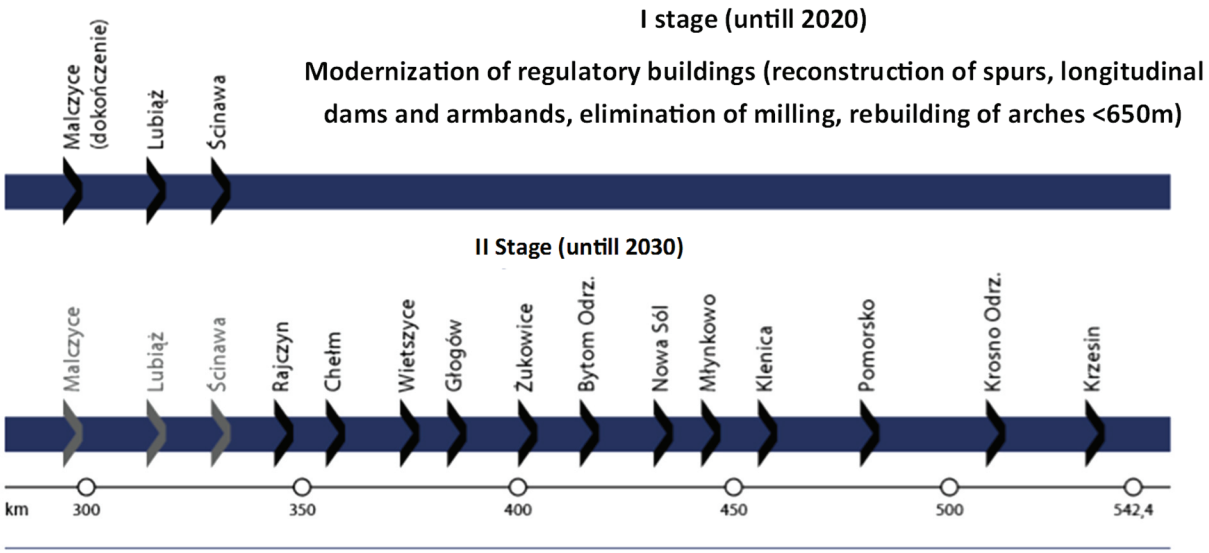

Figure 3 Investment plans on the national section of the Odra River [4]

The entire cascade of water degrees on the Odra River is to comprise 23 objects. The authors of the project also assume gradual drainage and deepening of the river. The whole investment requires, however, approval from the German side, because it also includes the modernization of the border section of the Odra River, and carrying out only a part of renovations, may prove insufficient and lead to damage to the riverbed. The modernization plans do not include the modernization of bridges, which must be no lower than 5.25 m from the navigable water status, so that the river can apply for the Va class. The main investments that should be made with the prospect of 2030 are presented in **Table 1**.

Renovation of the E-40 road leading to Belarus envisages raising its paraments to the Va class. By 2020, it is necessary to prepare the necessary documentation and plans for the investment of the Lower Vistula River Kaskada. Another urgent investment is the construction of a new water level in the area of Włocławek, due to the instability of the existing one. By 2020, the plans also assume the promotion of inland waterway transport as a pro-ecological and advertising of renewable energy sources on the example of a hydroelectric power plant. The 2030 perspective with regard to the E-40 waterway includes the construction of further water stages, two major logistic centers and the development of the concept of the upper and middle connection of the Vistula.

The following years are also a vision of the construction of missing water connections between the Oder and the Danube, and between the Oder and the Vistula. Regardless of the location of the Odra-Danube intersection, the Polish authorities have already commissioned the development of possible variants of this route on our territory in 2002.

The length of the whole combined route (river-canal-tank) was supposed to amount to 54.3 km and run between Ostrava and Koźle. By 2020, project and reconciliation tasks are to be undertaken between the Polish and Czech parties regarding the connection to Ostrava-Koźle, and then the construction of this road is expected to be completed by 2030.

The connection between the Vistula and the Oder is to facilitate the Silesian Channel, thanks to which it will be possible to include the Polish inland road to the Central European Water Corridor. The ten-stage Silesian Channel is to be 93 km long and meet the operational requirements for class Vb. The construction will require reconstruction of the existing infrastructure, road bridges and modernization of hydrotechnical facilities along the whole section of the route. It is assumed that the Silesian Channel will be partially or completely ready by 2030, and the cost of its construction will amount to approximately 11.0 billion PLN [4].

The accession of Poland in 2017 to the AGN Agreement (European Agreement on Main Inland Waterways of the International Importance) opens the possibility of navigating the main waterways and entering them into the TEN-T network.

Greater use of inland waterways in Poland as part of the intermodal freight transport system, in the cross-border area of the Silesia and Opole Voivodeships, also assumes the European Grouping of Territorial Cooperation TRITIA. The basic objective of the strategy adopted by the group in the area of Transport and Infrastructure is: maximizing the geographical location of partner regions for their economic development supported by appropriate development of cross-border transport infrastructure and transport using the internal potential of cooperating regions, taking into account the needs of accessibility and safety while friendly treatment of the natural environment.

Table 1 Major investments on the Odra River with a prospect until 2030 [own study based on 4]

Investments on the River Odra, which should be completed by 2020	**Investments on the River Oder in the perspective of 2030**
Finish renovation works on the Gliwicki Canal	On the Gliwice Canal, implement a phased reconstruction of the channel's positions up to V class
Finish the construction of the Racibórz water reservoir	Finish the construction of the Odra-Danube Canal
Start planning the construction of the Odra-Danube Canal in agreement with the Czech Republic	Complete the construction of the cascade of sluices along with adapting the geometry of the channel to the requirements of Va class
Modernize the locks located on the sewered section of the Oder	On the canalization section of the Oder, complete the reconstruction of the other locks and reconstruct the riverbed
Modernize the existing ones and start construction of new slime stages on the Central Oder	
Perform necessary renovation works in the most limiting places in order to improve the navigational possibilities	

4. CONCLUSION

Inland waterway transport is one of the oldest ways of transporting goods between cities and countries. It is thanks to the systematic human work on the capacity and depth of waterways that it is possible to move more and more ships and barges. Every year, hundreds of tons of goods are transported across the whole of Europe through inland waterways. Inland navigation is a system that provides numerous benefits, such as: low noise emission, the use of natural resources of the transport network and the possibility of transporting large-size loads without causing major difficulties in land traffic. Currently in Poland, two main inland transport routes can be distinguished, along the Vistula and Odra rivers, which are not adapted to the standards and classes of navigability enabling their full use. Already in the times of the Polish People's Republic, changes were planned regarding inland water infrastructure, but due to the declining number of industrial plants, all plans to improve the quality of E40 and E30 routes have remained mainly in the plans. It is now known that the renovation of inland waterways in Poland and the combination of various transport systems may contribute to the opening of the Baltic-Adriatic transport corridor, which will enable safe transport of goods throughout Europe. Rivers are a natural line infrastructure whose potential in Poland remains unused. Prospects for activities undertaken in Poland assume the renovation of E30 and E40 transport routes, raising their navigability class to IVa and V class, construction of new water stages and channels enabling the flow of barges with high tonnage. The implementation of these perspectives would improve the quality of water routes in Poland, enable cheap transport of goods and enable Poland to co-create international transport routes.

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