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INLAND WATERWAYS IN THE DEVELOPMENT OF INLAND SHIPPING

Abstract

Inland shipping is one of the most environmentally friendly transport modes. Currently it amounts to 6.3% of the whole cargo transport of the EU-28. The low share of transport with the use of inland waterways in the European Union is, among others, the result of many bottlenecks in the inland waterways system. Investments which would improve the condition of the water routes of international significance are necessary to increase the significance of inland shipping, thus eliminating the infrastructural barriers which diminish the development of inland shipping. The goal of the article is to present the relations between the economisation of the inland waterways and the volume of goods transported on inland waterways.

Keywords: transport infrastructure, European Agreement AGN, inland shipping, inland waterways

Introduction

An increasing economic integration and a dynamic growth of trade exchange presents new challenges for transportation. Transport development depends on the condition of the infrastructure, which determines the development and competitiveness of different modes of transport. The road and railway transport have the most developed route network (EU Transport, 2017). These modes of transport are used to transport over 93% of all cargo (Eurostat, 2017a). Inland waterways transport has the least developed network, which only exists in 17 Member States. European inland waterways have significantly different parameters and the planned network requires an update in the light of new socio-economic challenges. The goal

of the article is to present the relations between the economisation of the inland waterways and the volume of inland waterways transport.

1. Investments on inland waterways

The share of inland shipping in total cargo transport for the EU-28 was 6.3% tonne-km in 2015 (Eurostat, 2017a). This relatively low share, in comparison to other modes of transport, results from a low quality of inland waterways. The specifics of the waterborne transport infrastructure, which depends on the natural network of rivers, means that it is moderately accessible (Wszelaczyński, 1990). Furthermore, the natural structure of rivers, characterised by constant change of the riverbed and shore, makes the development of inland shipping more difficult. Investments are necessary to provide a proper:

– depth;
– width;
– curve radius;
– parameters of the lock chamber: height, width, depth;
– height of the bridge clearance (Wojewódzka-Król, Rolbiecki, 2014).

The most common investment processes, carried out in order to improve the navigational conditions are:

– dredging which is the process of removing sediments from the riverbed, which prove difficult for navigation;
– regulation, which is the process of straightening and deepening the riverbed, removal of islands, construction of embankments, groynes and shore enforcements;
– canalisation which is the barraging of the riverbed where the water level decreases; construction of partitions across the riverbed to increase the water level at the channelled route; in case of significant water level differences, ramps and hoists are constructed;
– construction of reservoirs, in which water is collected when the water levels are high and released when the water levels are low; the reservoirs buffer large flow differences on inland waterways;
– construction of channels and navigation tunnels;
– construction of road, railway and channel bridges at waterway crossings (Wojewódzka-Król, Rolbiecki, 2014).

One of the investments mentioned above is the construction of channels which are artificial waterways (Figure 1). They supplement the existing natural network of routes thus improving their accessibility. Two types of channels are distinguished in the literature:

– merging channels – which are the extensions of existing waterways aimed at connecting two existing waterways or connecting an existing waterway with an urban, industrial territory or with another reservoir;
– lateral channels – constructed to bypass obstacles at natural waterways.

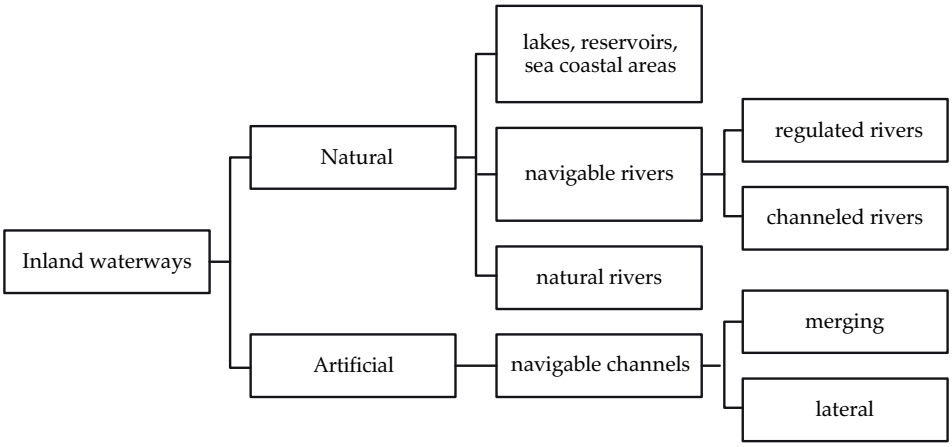

Figure 1. Typology of inland waterways
Source: (own elaboration based on data available at: Kulczyk, Winter, 2003)

The characteristics of the inland waterways result in the fact that the parameters achieved after the investment are the basis for the assessment of the maximal parameters of the fleet admitted to use the given waterway. If the fleet exceeds the technical parameters, its use at a given waterway is prohibited. A high diversification of the inland waterways parameters hinders and often prevents the inland waterways cargo transport. The development of the inland waterways transport will only be possible once the waterway parameters are unified and the size of the admitted units is increased, this increasing the throughput of the waterway and decreasing the unit costs (Wojewódzka-Król, Rolbiecki, 2014).

2. European inland waterways

The European network of inland waterways is approximately 36 000 km long (Figure 2), out of which 29 000 km of the routes have an international significance (UN, 2017). As previously mentioned, only 17 Member States have access to inland waterways. The European inland waterways network is characterised by diversified natural and navigational conditions. In 1996, the Inland Water Transport Workgroup within the Internal Transport Committee of the UNECE, prepared the European Agreement on Main Inland Waterway of International Importance, which is often called the AGN Agreement in order to integrate the inland waterway network (UNECE, 1996). Four main transport routes were agreed upon and technical parameters of routes ranging from the Atlantic Ocean to Ural were established. In order to unify the whole network of the inland waterways in practice, the AGN agreements has to be ratified and introduced by all the countries, in which the network exists.

Figure 2. Map of the navigable European network
Source: (VNF, 2018)

According to the AGN Agreement, the international waterway network should have at least the IV navigation class, which is suitable for units which have a draught of at least 2.5 m, width of 9.5 m, length of 85 m and payload of 1000–1500 tonnes. According to the research from 2012 and 2016, these parameters are met at at least 83% on European inland waterways. At the rest of the routes there is a high diversity of the natural conditions (Table 1). In the years 2004–2016 the length of inland waterways covered by the AGN Agreement increased:

– in total by 1500 km;
– missing connections by 500 km;
– routes meeting the parameters of the international route by 2300 km.

Table 1. Structure of E waterways

	Length	Total	Missing links	Less than class IV	Class						
					IV	Va	Vb	VIa	VIb	VIc	VII
2004	(km)	27 711	1 489	4 286	3 969	3 270	5 051	667	5 766	1 592	1 621
	%	100	5.37	15.47	14.32	11.80	18.23	2.41	20.81	5.74	5.85
2012	(km)	29 131	2 328	2 580	4 963	4 558	4 625	524	3 532	4 724	1 747
	%	100	8.0	8.9	17.08	15.6	15.9	1.8	12.1	14.7	6.0
2016	(km)	29 238	1 988	2 968	4 775	4 646	4 566	630	3 578	4 341	1 746
	%	100	6.8	10.2	16.3	15.9	15.6	2.2	12.2	14.8	6.0

Source: (own elaboration based on data available at: UN, 2005, 2013, 2017)

The increase of the total length of the international inland waterways resulted in the change of the class structure of navigable routes. In 2012 and 2016 the IV class was the dominant class – respectively 17.8% and 16.3%, while the highest increase in comparison to 2004 was observed in class Vic – from 5.74% in 2004 to 14.8% in 2016. These data indicates a large scale of investments carried out in regards to the inland waterways and still significant development disproportions. Inland waterways require additional investments which would improve and unify their parameters. Countries which start implementing these investments can benefit from the investments implemented and presented in the report called "European best practices, a report for the inland waterways transport". The investments which were implemented are innovative and important for the competitiveness of the inland waterways transport.

Western European countries such as: Belgium, the Netherlands, Germany and France have the most developed network of inland waterways. The countries have an above average share of channels in the structure of inland waterways (Figure 3). The existing navigable channels supplement the network by connecting the European rivers, e.g.: the Rhine-Main-Danube Channel, Brussels Channel, Dortmund-Ems Channel, the Mitland Channel, the South Channel, the Central Channel. They also integrate cities and marine ports with the inland waterways network, e.g.: the North Sea Channel or the Kortrijk-Bossuit Channel.

Marine ports are an important demand source for the inland waterways. This is why, connecting them with socio-economic centres in the mainland is important. The specifics of inland waterways transport means that it is mostly applied to transportation of:

– large portions of bulk cargo between the place of departure and arrival located near water routes, including the handling of marine ports, mines, larger agglomerations and industrial plants placed near water routes;
– cargo, for which other modes of transport cannot be used, for example the sand from the riverbed;
– large-scale, heavy and fragile cargo.

An increasing demand for cargo transport and an increasing throughput of sea ports due to globalisation results in an increase of the demand for the transportation to and from marine ports (Figure 3).

The largest sea ports in Europe are located within the North Sea basin. The infrastructure in the hinterlands of these ports is composed of a well-developed network of road, railway and waterway routes. In the Rotterdam port 50% of the cargo is transported inland with the use of inland shipping (Port of Rotterdam, 2018). For Antwerp it's 37% (Port of Antwerp, 2017) and for Hamburg 11.5% (Port of Hamburg, 2017). Due to the high throughput of the sea ports, these values affect the transportation structure of the whole country. In the Netherlands, 43.1% of all the cargo is transport with the use of inland waterways, in Belgium it's 15.6% and in Germany 11.4% (Figure 4).

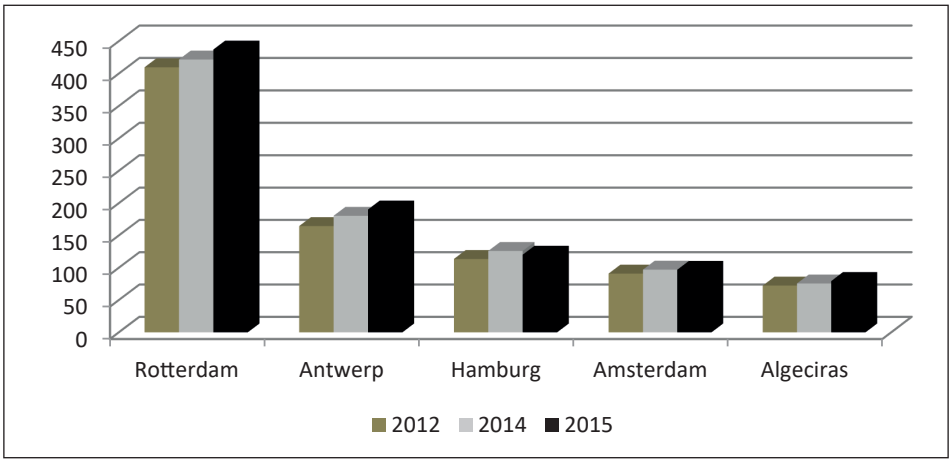

Figure 3. Top cargo sea ports of the European Union [million tones]
Source: (own elaboration based on data available at: GUS, 2017)

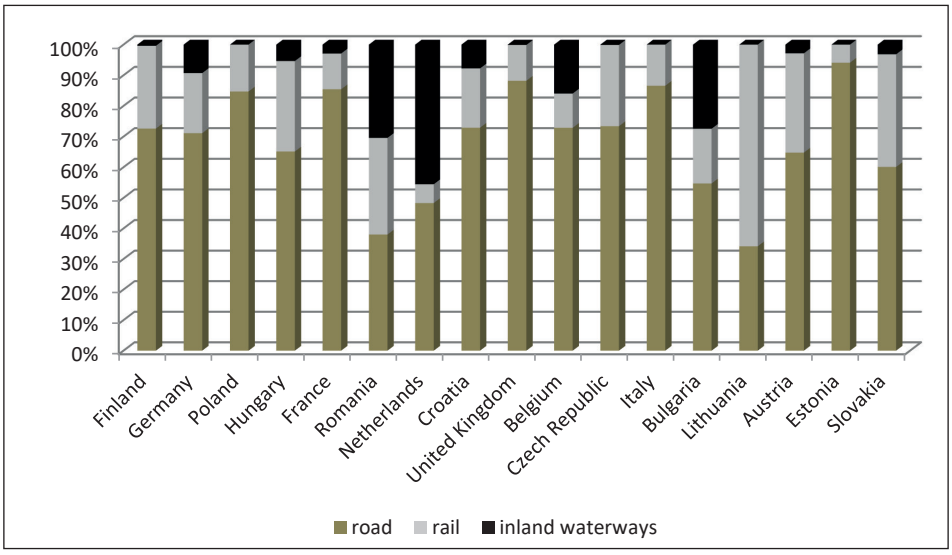

Figure 4. Modal split of freight transport on land 2015 [tkm in %]
Source: (own elaboration based on data available at: EU Transport, 2017)

A high share of the inland shipping is also noticeable in Romania (29.7%) and Bulgaria (26.6%). This relatively high share, in comparison to other EU Member States, results from the modernisation of the international Rhein-Main-Danube inland waterway.

Conclusions

An improvement of the navigational conditions on the inland waterways and the unification and adaptation of the parameters to the international waterway standard is an important factor for the development of the inland shipping and the growth of its share in the cargo transport. In countries, in which the waterway route network meets the international route conditions and is connected with the international network, thus connecting the industrial centres and marine ports, the share of inland waterways transport is much higher. This is the case of Bulgaria and Romania, for which this share is 4 times as high as it is in EU-28. Countries which abstain from the investments on inland waterways make it difficult to create a unified network and to develop the inland waterways transport system. Therefore, an improvement of the navigational conditions at the estuaries, where marine ports are located and in transit countries is especially important for the development of waterborne transport.

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